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For further correspondence, please see VOL. II.

RECORDS MANAGEMENT SECTION

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
TECHNICAL ADVISORY COMMITTEE
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PR 3/10.12

January 1976

To: Members of the Technical Advisory Committee
Members of the Consultative Group on International Agricultural Research

From: The Executive Secretary, TAC

Subject: 12th Meeting of the Technical Advisory Committee

The Twelfth Meeting of the Technical Advisory Committee will be held in the Ethiopia Room (C285) at FAO Headquarters, Rome, from 2-6 February 1976. The meeting will open at 0900 hours.

... Copies of the Provisional Agenda and the Draft Report of the Eleventh Meeting are enclosed herewith.

... Members will also find enclosed a copy of the first draft of the Report of the IRRI Review Mission which is currently being edited. Please note that present Chapter VII, the Impact of Research on Rice Production, will become Chapter II in the edited version.

Further documentation, including the revised report of the IRRI Review Mission, the Report of the TAC Vegetable Research Appraisal Mission, and the revised TAC Priorities Paper will be available at the meeting.

Members of the Consultative Group are reminded that they are welcome to send one observer to the "open" sessions of the Committee at their own expense.

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

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January, 1976

12th MEETING

FAO HEADQUARTERS, ROME, ITALY

2-6 February, 1976

REVISED AGENDA

	Monday, 2 February
0900-1300	Morning session OPEN
Item 1	Adoption of Agenda. Chairman welcomes new members.
Item 2	Adoption of Reports of 10th and 11th Meetings.
Item 3	Discussion of Report of IRRI Review Mission (Dr. Swaminathan).
1430-1800	Afternoon session OPEN
Item 4	Discussion of Report of Vegetable Appraisal Mission (Dr. Marcano).
	Tuesday, 3 February
0900-1300	Morning session OPEN
Item 5	Relations with advanced scientific institutes including the proposed International Agricultural Development Service (Dr. Wortman).
Item 6	Priorities for research. Discussion of revised TAC Priorities Paper. (Chairman)
1430-1800	Afternoon session OPEN
Item 6	continued.
Item 7	Evaluation of agricultural research programmes. Discussion of paper by Dr. Ruttan (Dr. Ruttan).

Wednesday, 4 February

0900-1300 Morning session OPEN

Item 8 Other business.

a) Arrangements for Water Buffalo Research Consultation March 1976 (Executive Secretary)
b) Arrangements for CIMMYT Review Mission, March/April 1976
c) Arrangements for 13th TAC Meeting, IRRI, May 1976
d) Arrangements for CIP Review Mission, Autumn 1976.
e) **Proposal for further discussion of CATIE request.**

Item 9 **Report of discussions and recommendations of the FAO Conference in respect of research (Executive Secretary).**

Item 10 Proposals for further action to establish an international soya bean research programme (Dr. Hopper).

1430-1800 Afternoon session CLOSED

Item 11 Formulation of recommendations on Item 3 - IRRI Review Mission.

Item 12 Formulation of recommendations on Item 4 - Vegetable Appraisal Mission.

Thursday, 5 February

0900-1300 Morning session CLOSED

Item 13 Formulation of recommendations on Item 6 - TAC Priorities Paper.

Item 14 Formulation of recommendations on Item 7 - Evaluation procedures.

1430-1800 Afternoon session CLOSED

Item 15 Formulation of recommendations on Item 8 - Other business.

Item 16 Formulation of recommendations on Item 9 - Relations with advanced scientific institutions/IADS.

Item 17 Formulation of recommendations on Item 10 - Soya beans.

Item 18 Discussion with Study Director of CGIAR Review Committee.

Friday, 6 February

0900-1300 Morning session OPEN

Item 19 Chairman's summing up.

Item 20 Time and place of next meeting.

Jan. 9, 1976 From: Rome INCOMING TELEX

F-2

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January, 1976

THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

Twelth Meeting, Rome, 2-6 February, 1976

REPORT OF THE TAC VEGETABLE RESEARCH APPRAISAL MISSION

(Agenda Item 4)

TAC SECRETARIAT

FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS

Rome, 1976

WS/H6414

TABLE OF CONTENTS

VEGETABLE RESEARCH APPRAISAL MISSION

I. INTRODUCTION

1. Although the Consultative Group on International Agricultural Research (CGIAR) has accorded first priority to research on cereals, grain legumes, roots, tubers and beef cattle, its Technical Advisory Committee (TAC) has maintained a continuing interest in the improvement of vegetable production and consumption in the tropics, and the role which vegetables play in the diets of its peoples. As the staple foods have been progressively covered by international research programmes the TAC has concluded that there is a need to look more closely into the case for reinforcement of research on vegetables in the tropics, and particularly to assess in more detail the priority species and their specific research needs as a means of determining the level of support, if any, that the TAC would wish to recommend to vegetables.

2. A number of alternative proposals for international action have been submitted for consideration by TAC. These included proposals for (a) the formation of an International Vegetable Research Institute for the Tropics (IVRIT), and (b) an Inter-country Vegetable Research network in Asia and the Far East. It was eventually decided that a mission should be organized and sent out to visit selected countries in Africa and Asia, with the terms of reference shown in Appendix II(a). The names and addresses of members of the mission are also given in Appendix II(b).

3. Members of the mission rendezvoused in FAO headquarters, Rome, from 11 to 13 November, during which period they were briefed by staff of the TAC Secretariat and the Research Development Centre, the Plant Production and Protection Division, the Horticultural Crops Group and the Food Policy and Nutrition Division, Food Consumption and Planning Group.

4. Thereafter, the mission departed Rome on 13 November to visit Senegal and Nigeria in Africa; India, Thailand and Indonesia in Asia and return to Rome on 11 December 1975. The itinerary is shown in Appendix II(c).

5. In each country, the mission visited several research institutions where vegetables formed all or part of their programmes of work. Often this necessitated travelling to different parts within the countries. The mission held discussions with research scientists, research administrators and policy makers. It is noteworthy that in each country the mission visited the centres of nutrition studies and also talked to the scientists there. A list of institutions visited and the people with whom the mission held discussions is given under each country report in Appendix I.

6. During the various discussions, the members of the mission tried at all times to get a clear picture of the overall status of vegetables in each country's agriculture, nutrition, economy and development programmes. The discussions were usually followed by field excursions during which members saw things for themselves. The mission tried at various stages to obtain concrete statistical data on the various aspects discussed. Unfortunately, quantitative data were not always readily available, and the mission did not have the time to search for this in libraries and other sources. Consequently, much of the findings are not supported by published quantitative data. The people with whom the mission discussed were, in general, very frank, and as far as members could judge gave the best information at their disposal. Although one cannot rule out personal interests and prejudices from the opinions expressed on certain topics, like the need for and type and organization of international research effort for tropical vegetables, certain clear general patterns emerged. The mission has highlighted these in the body of the report.

7. The fifth term of reference requested the mission, in the event that an international effort is considered justified, to recommend an organizational form and location(s) of any such effort. While the mission has found it possible to make definite recommendations on the organizational form, it decided that it did not have enough basis for concrete recommendations on a particular location. This is because the mission visited only a few countries, and, even then, did not have time to ascertain the necessary facts pertaining to the criteria for selecting an appropriate location.

8. The mission was aware, through the report of the Executive Secretary of TAC (DDDR:IAR/75/21, June 19 5), that Thailand has unofficially offered a site for such a centre near Bangkok, on the new campus of the Kasetsart University.

9. Having defined certain specifications for a prospective site, the mission recommends that a special mission be launched to choose a site, in the event that TAC and the Group decide to set up an international research centre for vegetables. The mission suggests that several sites should be explored for this purpose.

II. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

i) The Present State of Vegetable Research

10. Research on vegetables* in the countries visited ranges from a highly developed state at several locations in India to programmes which to a large extent have been initiated recently in Senegal, Nigeria, Thailand and Indonesia. In all these countries the research emphasis to date has been mainly on vegetables which are grown on a commercial scale for urban markets or export, with much less attention to native tropical vegetables eaten extensively by rural people Many of the latter vegetables have less prestige and lower market price but more nutritional value and better adaptability to the tropics.

ii) The Economic and Nutritional Contribution of Vegetables

1) The Economic Contribution

11. Due to the fact that the mission did not have much opportunity to locate data pertaining to economic aspects of vegetables in the countries visited, the conclusions have mainly been based on personal discussions and observations. The economic impact of vegetables can be shown in the following ways:

a) Policy-makers in all countries placed a high priority in supporting the expansion of vegetable production. In most countries, vegetable research and extension programmes have been included in their national economic development plans. However, it is noted that the consideration given to vegetables refers almost exclusively to the commercial vegetables, that are marketed in the cities or for export

b) The non-commercial crops, such as native leafy green vegetables, have been found to play a very important role as substitutes for the unavailable or the expensive foods at certain periods of the year for the rural people in all countries.

c) In all the countries, vegetable production and marketing were found to be labour intensive, and therefore have generated employment for many rural and urban people.

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* The term "vegetables" in this report does not in general include starchy roots and tubers or dry legume seeds. However, the leaves, sprouts, young pods, and immature seeds of such food plants are considered as vegetables in accordance with general usage.

d) Vegetable growers in all countries visited were found to be among the high income farmers. In Thailand, more and more rice farmers are going in for vegetable growing because this gives them as much as 4.75 times more income than that derived from growing paddy.

e) The demand for vegetables in these countries will continue to grow in line with growth of population, the increase of real disposable income, and the effort to solve the problems of the undernourished and malnourished people. This indicates the urgent need for serious attention to the accelerated expansion of vegetable production in the tropical countries.

f) In some countries the export of vegetables contributes to the earning of foreign currency.

2) The Nutritional Contribution

12. Nutritionists in all countries stressed the importance of vegetables in supplying vitamins (vitamin A in particular). Some nutritionists also mentioned vegetables as important in supplying minerals, calories, and protein, in providing a good balance of amino acids in diets low in animal protein, and in adding desirable bulk, variety and taste to the diet.

13. While vegetables have long been regarded as rich in vitamins and minerals, it has not been appreciated until recently that some of them, such as the leafy greens, are capable of producing protein and calories at rates equal to those of the most efficient staple crops. There is a growing awareness that vegetables should not be regarded as optional foods for most people in the tropics because they are the main source of some essential vitamins. Neither should they be regarded as luxury foods because many of them pay their way in terms of calories and protein production while providing a free supply of vitamins and minerals. The need for the nutrients supplied by vegetables is especially great among the poorer rural people in the tropics who can afford relatively little meat, but who in general consume grossly inadequate quantities of vegetables.

iii) Crop Species and Problems Needing Additional Research

14. Tomatoes rank at or near the top among the species for which additional research is needed. They were identified for first priority by nutritionists, horticulturists, and government policy-makers alike in every country visited. A scientific base for rapid improvement of the tomato is available because more is known of its genetics than of any other vegetable, large germplasm collections are available, and the main characteristics needed to improve tomatoes throughout the tropics are already known to exist, namely resistance to fusarium and bacterial wilts, nematode and virus resistance, and ability to set fruit at high temperatures. The results of combining these features into a single variety will improve tomato production at all levels from the home garden to large scale production for fresh market and for processing. Eggplant or brinjal (Solanum melongena) and peppers or chillies (Capsicum sp.)are also extremely important vegetables in the tropics and as members of the same family as tomatoes, they share some of its disease and insect problems. It is apparent, therefore, that these crops warrant attention along with the mainstream of research on tomatoes.

15. Leafy green vegetables of the tropics should have priority almost equal to tomatoes. Probably no other single group of crops, vegetable or otherwise, can equal their ability to produce high yields of calories, proteins, vitamins, and minerals simultaneously. Some of them can produce a marketable crop in as little time as three weeks or harvest can be deferred for some time while greater yields accumulate. Successive harvests may be made from the same planting. This flexibility in harvesting makes them well suited for intercropping and relay cropping. It is difficult to say which of the many species in this group should get attention but we suggest the amaranths for initial research because (1) they are eaten by the poor and rural people in every country visited,

(2) their protein percentage on a dry matter basis equals most of the grain legumes and is reported to be high in sulfur-containing amino acids, (3) they have a high content of minerals and vitamins especially vitamin A, (4) they have the more efficient C4 type of photosynthesis, (5) great genetic variation is available as a basis for improvement, (6) they have relatively few insect and disease problems, and (7) they grow readily in semi-wild and under rainy conditions. Ipomoea aquatica (variously known as kangkong, water convolvulus, or swamp cabbage) also seems worthy of attention. It is widely used, highly nutritious, and accorded more prestige than the amaranths in certain areas, but it has been the subject of little research so far.

16. A third priority group is the leguminous vegetables - the immature pods, the immature seeds, the sprouts, and occasionally the leaves of many legumes. As compared with leafy greens, these green pods and seeds have the advantage of less rapid deterioration after harvest and more commercial popularity. The plants also have the ability to fix nitrogen. As compared to the dry seeds of the same species, they have more vitamins, require less cooking, and have shorter duration of growth. We suggest that initial research should be concentrated on the Vigna species - cowpea, yardlong bean, and mungbean - because of their known adaptability to the tropics. Exploratory work is suggested for lima beans, winged beans, and Dolichos beans (now known as Lablab niger). All work on this group of vegetables should be closely coordinated with the work at existing International Centres on the same species grown as grain legumes.

It is difficult to go beyond these three groups in establishing priorities, but some research needs of other vegetables are discussed in the body of this report.

iv) The Needs for Additional Internationally-Supported Research

17. International research on vegetables in the tropics is needed for several reasons: (1) Although some research on vegetables is done in all the countries, it is grossly inadequate - in scope, depth and organization - to meet the colossal challenge of enhancing vegetable improvement and production to the extent most urgently required. (2) International programmes are in a better position than national programmes to do research on those vegetables which are atpresent of less commercial importance but of great nutritional value to the masses of people. (3) The large number of species used as vegetables makes it difficult for national programmes to get enough support to have effective programmes on most of them, whereas the combined area planted with a given species in the tropics as a whole can justify an international effort. (4) International research could help provide continuity of effort which is often lacking in national programmes by giving information and experimental materials to new and inexperienced people and by providing a planning framework for organizing programmes. (5) It is not economically feasible for most national programmes to assemble and evaluate the large germplasm collections needed for the improvement of each species. (6) Research on disease and insect resistance is more urgently needed in the tropics than elsewhere and yet this is where it is lagging because it is beyond the capabilities of most national programmes. The benefits of resistance to one pest are often not realized because several others may be nearly as serious. Only through coordinated international effort is the required multiple resistance likely to be attained.

v) The Organizational Form, Activities and Location of an International Effort

18. After considering carefully the advantages of a network approach, i.e. giving international support to vegetable research at existing centres, we conclude that this is unlikely to be successful unless it is used in combination with a new international centre. Due to the weakness of national programmes, a network among themselves would not succeed in giving a strong push to vegetable research. We therefore recommend the establishment of a new centre for research on vegetables in the tropics in combination with a network approach. We would recommend that grants and contracts be given to existing research centres for studies requiring environmental conditions, personnel, or facilities different from those at the main centre. For this reason we feel that the new centre could be of modest size.

19. Some of the advantages of the proposed centre over a more diverse effort include: (1) Efficiency in activities which relate to all the species which it undertakes to study. These include training, communications, collection and dissemination of germplasm, and research on such as economics, sociology, and nutrition which cuts across species. (2) The stimulating effect of having vegetables as the focus of thought and activity for the entire staff. (3) Clear rather than diffuse responsibility for considering programme changes, and flexibility in making changes in emphasis. (4) Convenience to workers in national programmes in having a single place to turn to with problems.

20. We recommend that a separate study be made to choose a location according to the following guidelines:

a) An Asian location because of the size and density of population and the very great importance of vegetables for the mass of the people.

b) A lowland tropical location with well-defined wet and dry seasons in order that responses under both humid and drought conditions can be determined.

c) Access to a range of altitudes to provide different temperature regimes.

d) A country with a tradition of good and diverse vegetable growing.

e) A location preferably near a good faculty of agriculture where cooperative programmes of graduate study might be developed.

In addition to these specific points, there are several generally accepted criteria for choosing a site for an international centre such as:

a) A country with a government interested in being host to a centre, willing to facilitate the entry of scientists and the supplies, equipment, and other resources, including seeds, that they require.

b) A location with schools, medical resources, and cultural activities adequate to attract qualified scientists.

c) Adequate communication and travel facilities.

vi) Supporting Action Required in Infrastructural Fields

21. The mission interprets "supporting action .... in infrastructural fields" as meaning action which would not be undertaken through international research in itself, but lack of which would reduce or nullify the effectiveness of research.

22. Seed production and distribution appears to be the main infrastructural field which might require supporting action to bring into use the results of international efforts in vegetable improvement. Lack of it was pointed out in every country as a limiting factor in the application of research results from national programmes. Other infrastructural needs such as availability of water for irrigation, marketing and extension vary from country to country. These are factors which seem appropriately handled by national or bilateral programmes.

III. DISCUSSION

a) Definition of Vegetables

23. No single concise definition of vegetables is universally accepted, but one can say that in general vegetables are parts of herbaceous plants, eaten raw or with simple kitchen preparation, usually as the principal supplement to foods which supply the major part of calories and proteins.

24. Stated in another way, nearly all vegetative and immature reproductive plant parts which are edible are considered as vegetables, whether they come from herbaceous or woody plants, the main exception being starchy roots and tubers. A number of mature fruits, such as tomatoes, peppers, okra, and many cucurbits, are also considered generally as vegetables, these being distinguished from horticultural fruits by coming from herbaceous rather than woody plants, by being seasoned with salt, and by being cooked frequently with other vegetables.

25. In this report the term vegetable does not include starchy roots and tubers nor grain legumes even though they are called vegetables in some places. However, certain plants in both groups produce leaves, immature pods, and immature seeds which are commonly eaten and always called vegetables.

b) The Main Vegetables of the Tropics

26. In this section the aim is to highlight the wide range of tropical vegetables through selected examples. Consequently, the compilation of a complete list will not be attempted. Attention will be directed to vegetables for tropical lowlands, in line with the mission's interpretation of its terms of reference. Furthermore, the use of starchy tubers for vegetables, such as the sweet potato, Irish potato and cassava, will not be considered in detail, partly because such usage is not general and partly because they are already the subject of research at existing international institutes. But the use of their young leaves as vegetables will be discussed.

27. Many temperate-zone vegetables (sometimes called European or exotic vegetables) have been introduced into the tropical region and have become well adapted to highlands and higher belts although less so to lowland conditions where they need intensive case. Such vegetables, e.g. lettuce, cabbage, cauliflower, radish, carrot, etc., are often grown mainly for the well-to-do urban population. Because of the high prices which they bring they are too expensive for the ordinary and rural people and have thus achieved a high social prestige. For easy distinction they will be called the "elite" vegetables in contra-distinction to those vegetables which are indigenous or "native" to the tropics and are consumed by the majority of the rural population.

28. For ease of description we may distinguish vegetables into:

(i) leafy vegetables, consisting of those plants in which the primary organs consumed are the tender leaves such as the amaranths;

(ii) fruity vegetables, in which the major organs consumed are the fruits and seeds, such as the chillies, tomatoes, eggplants, etc.;

(iii) sprouts, consisting of germinated seeds, principally legumes - lentils, mung beans, soy beans, etc.;

(iv) others, comprising a motley of plants of which one part or another is consumed, e.g. the root tubers of carrot, the bulbs of onions, the inflorescence of cauliflower, etc.

29. Among the ordinary people of West Africa the word "vegetables" is almost synonymous with the "leafy" vegetables. In this region there is a wide range of herbaceous plants whose leaves and young stems are cooked into stews, together with peppers, onions, tomatoes and other condiments. It is noteworthy that in this region most of the vegetables are eaten cooked - often after thorough cooking. This is in marked contrast to the manner in which the "elite" vegetables are eaten - fresh or after very minor cooking. In India, Thailand and Indonesia there are also leafy vegetables but their consumption is somewhat less popular because of the low social status which they have acquired in comparison with the more prestigous "elite" vegetables.

30. There is a dearth of information about the number of species in the leafy group which highlights the need for a programme of exploration and collection throughout the tropics. A few of these leafy vegetables are eaten in all the countries visited, such as amaranths, celosia, and the various spinaches. The water convolvulus (Ipomea aquatica) is also commonly eaten in the Philippines, Thailand and Indonesia.

31. Special attention needs to be called to the leaves of other plants which are eaten. Throughout the tropics, people eat the leaves of legumes, cassava, sweet potatoes and several solanaceous plants and cucurbits. The leaves of several tree and shrub species are also eaten, fresh or dried, such as Adansonia digitata, Tamarindus indica, Vernonia amygdalina, Poinsettia, Gnetum, Moringa. The great advantage of this last group of plants is that they are often uncultivated and, being perennial, provide leafy vegetables during the dry season when the production of the more herbaceous ones has terminated. In many parts of the tropics, the Sahel, India, Thailand, Indonesia, they are reportedly very important as a source of vegetables to the rural population at all times.

32. Tomato is the most commonly eaten fruity vegetable. It is eaten either fresh, as in salad, or cooked into soups or stews. It is truly better adapted to cooler growing conditions such as those on tropical highlands, but its popular usage has encouraged its production in lowlands, where it requires intensive cultural management. Very many varieties of it have been developed, making it possible to grow it under various conditions for various purposes. But in the lowlands its cultivation continues to be constrained by diseases, pests and poor fruit-set under rainy and high temperature conditions.

33. Throughout the tropics the young fruits of three main families of plants are eaten as vegetables. These are the Solanaceae (tomato has already been mentioned, eggplants, chillies), Cucurbitaceae (melons, gourds, squashes) and Leguminosae (peas, chickpeas, cowpeas, French beans). Perennial trees and shrubs also provide a source of vegetable fruits such as the Drumsticks (Moringa oleifera).

34. Two other vegetables that are commonly eaten throughout the tropics are onions and related species, and okra. Onions are eaten in practically every stew. In India, Thailand and Indonesia the production and consumption of onions, shallots and garlic is well known.

c) The Present State of Vegetable Research

35. In all the countries visited, vegetable research up to some years ago received limited and rather scattered attention in comparison to research on the staple cereals and on the major export crops. The relatively low priority in the past accorded to vegetable research is understandable, since most of the countries were faced with the large problem of finding enough basic food for their rapidly growing population and enough foreign exchange needed to import capital goods necessary for both agricultural and industrial development.

36. A growing awareness of the often widespread state of malnutrition and of the essential contribution of vegetables to a balanced and healthy diet, and an increasing interest in growing vegetables for export, have led the governments of the countries visited to pay, in recent times, more attention to the development of vegetable production and, as one of the prerequisites to this, to vegetable research.

37. This is shown, inter alia, by the following:

(a) In Senegal, the Government has established in 1973 a Centre for Horticultural Development, with research as one of its main activities. This Centre will primarily cater for the very large group of market gardeners, operating in the coastal zone and supplying the towns with fresh vegetables. They also produce some vegetables for export. The Government, through the Senegalese Institute for Agricultural Research, also initiated in 1974 some vegetable research in the irrigation projects along the Senegal river, and in a farm family settlement study in the Centre for Agricultural Research in Bambey. There are plans to coordinate these present rather diffuse research efforts.

(b) In Nigeria, the Government last year created the National Horticultural Research and Demonstration Centre, located in Ibadan (high rainfall area),with proposals for centres in areas with different ecological conditions. The Centre has already helped in stimulating the cooperation between the scattered individuals and institutes which hitherto did some vegetable research.

(c) In India, with already a rather longer tradition of vegetable research, but then rather dispersed over many institutions, a National Horticultural (including vegetable) Research Institute was established in Bangalore in 1968. It also started, in 1970, the All India Coordinated Vegetable Improvement Project. This project identifies research problems and their order of priority, and then delegates selected problems to participating institutions. The programme works on a large number of vegetable crops.

(d) In Thailand, where scattered vegetable research was done mainly by some staff members at the Katsetsart University in Bangkok*, a Vegetable Research Centre has been created this year. It is made up of research workers belonging to the Faculties of Agriculture, Arts and Science, and Economics and Business Administration. The Centre's programme for the first three years is focussed on the different aspects (e.g. agronomic, breeding, economic and storage) of tomatoes, cabbages, peppers and peas. The Centre's activities are at present still in an informal way coordinated with those of the two other Thai Universities and the Horticultural Division of the Ministry of Agriculture in the National Vegetable Research Group.

(e) In Indonesia, most of the research work on vegetables is done by the Horticultural Research Institute of the Ministry of Agriculture. The Government has attracted assistance from both the Netherlands' Government and the World Bank to considerably strengthen the research programme. Almost all efforts are directed toward highland vegetables (potatoes, white and Chinese cabbage, French beans, garlic and tomatoes).

38. Despite the progress in relation to vegetable research, illustrated by the above examples, much remains still to be done before the countries will have a research apparatus which can handle all the crops and their problems; most institutions are still small and many of their staff members still young and inexperienced.

39. The mission noted that the "native" vegetables received comparatively little attention (Table1,p.9). This is understandable from the economic point of view (many of these vegetables are not commercially grown but rather raised as a sideline on a home garden scale or collected from wild or semi-wild sources). From the point of view of nutrition and welfare for the rural masses, greater attention to this group of "neglected" crops seems to be justified.

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* Other Faculties of Agriculture are in the Universities of Khon-Kaen (Northeast Region) and Chiengmai (North Region).

Table 1. Analysis of research topics of 5 national vegetable research programmes (for explanation, see below)

	breeding*					Agronomy					Weed cont.					Pl. Prot.					Score
	S	N	I	T	RI	S	N	I	T	RI	S	N	I	T	RI	S	N	I	T	RI	
Tomato	X	X	X	X	X	0	X	X	X	X		X				X	X	X	X	X	15
Eggplants	X	X	X	0	0	0	X	X	0	0		0				X	X	X	0	0	8
Capsicum	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	15
Cauliflower	X	0	X	0	0	X	0	X	0	0						X	0	0	0	0	5
Cabbage	X	0	X	X	X	X	0	X	X	X						X	0	X	X	X	12
Chinese cabbage	0	0	0	0	X	0	0	0	0	X						0	0	0	0	X	3
Radish	0	0	X	0	0	0	0	0	0	0						0	0	0	0	0	1
Cucumber	0	0	0	0	X	0	0	0	0	0						0	0	0	0	X	1
Muskmelon	X	0	X	0	0	X	0	0	0	0						X	0	X	0	0	5
Watermelon	0	0	X	0	0	0	0	0	0	0						0	0	X	0	0	2
Pumpkins**	0	0	X	0	0	0	0	0	0	0						0	0	X	0	0	2
Courgette	0	0	0	0	0	0	0	0	0	0						X	0	0	0	0	1
Onions	X	0	X	0	0	X	0	X	0	0			X			0	0	0	0	0	6
Shallots	0	0	0	0	X	0	0	0	0	X						0	0	0	0	X	3
Garlic	0	0	0	0	X	0	0	0	0	X						0	0	0	0	X	3
Maize	0	0	0	0	X	0	0	0	0	0						0	0	0	0	0	1
Peas	0	0	X	X	0	0	0	0	X	0			X			0	0	X	X	0	6
French beans	X	0	0	0	X	X	0	0	0	X			0			X	0	0	0	X	6
Cowpeas	0	X	0	0	X	0	X	0	0	0		X	0			0	X	0	0	0	5
Wingbeans	0	X	0	0	0	0	X	0	0	0			0			0	0	0	0	0	2
Broad bean	0	0	0	0	X	0	0	0	0	0			0			0	0	0	0	0	1
Lettuce	X	0	0	0	X	X	0	0	0	0						0	0	0	0	0	3
Okra	0	X	X	0	0	0	X	X	0	0			X			0	X	X	0	0	7
Roselle	0	0	0	0	0	0	0	0	0	0						0	0	0	0	0	0
Carrot	0	0	0	0	0	0	0	0	0	0						0	0	0	0	0	0
Irish potato	X	0	0	0	X	X	0	0	0	X						X	0	0	0	X	6
Asparagus	X	0	0	0	0	X	0	0	0	0						0	0	0	0	0	2
Nat. leafy vegs	0	X	0	0	0	0	X	0	0	0		X				0	X	0	0	0	4

* Hybridizations, selection, variety trials
** Including various gourds and squashes

S = programme 1975-76 of the Hort.Dev.Centre, Cambarène, Sénégal
N = " " of Nat.Veg.Centres in Ibadan and Samaru, Nigeria
I = from progress report 1972-4, All India Vegetable Improvement Project, India
T = programme of the Vegetable Res.Centre, Katsetsart University, Thailand
RI = programme of the Hort.Research Institute, Republic of Indonesia

40. It should be pointed out that several species of wild, often protected trees, are valuable sources of vegetables either in their leaves and young shoots or in their flowers, pods and seeds. These species have been mentioned in III-b. Since, with the accelerated growth of the rural population and the intensive search for firewood the numbers of "wild" trees tend to be reduced considerably, it is important that more research be done on their productivity, and methods of management, under cultivation. This is obviously a long-term programme. Systematic planting will only yield results after several years. Therefore it is important to start now with the collection and planting of "wild" material. The mission noted this as a gap in research which it wishes to draw to the attention of the TAC.

d) The Economic and Nutritional Contribution of Vegetables

1) The economic contribution

41. Most of the comments in this section are based on data and information obtained from personal discussions with authorities concerned in all countries visited. This is because ofthe scarcity of economic data of vegetables in itself and also because the mission did not have much opportunity to locate such data. We, however, believe that the economic contribution of vegetables in the tropics is more than adequate to justify more international attention to its problems.

42. The economic impact of vegetables will be discussed in this section in terms of a) high priority crops, b) importance of native leafy green vegetables, c) generating employment, d) greater profitability, e) rising demand for vegetables, and f) export commodity.

High priority crop

43. The conventional vegetables, namely European-type vegetables, have drawn wide attention from both researchers and policy-makers of all countries. Those government authorities expressed their awareness of the importance of these vegetables, and also the interests and efforts they have put on the development of research programmes for them. Policy-makers in Senegal, India and Indonesia, for example, have included national research programmes on mostly European vegetables in their economic development plans. In short, there are indications from several sources that vegetables, especially the commercial ones, have been regarded as requiring research support.

Importance of native vegetables

44. There has been a consensus in all the countries visited that leafy green native vegetables, which are inexpensive and rich in vitamins, have been widely consumed by the majority of rural people. In some countries, they were even available for sale in the local markets for urban consumers. This group of vegetables is therefore considered as one of the important food items of the majority of people both at the present time and in the future.

Generating employment

45. In most cases, the vegetable growing is labour intensive. It needs special care and attention for some vegetables. This, coupled with growing two to four crops of vegetables per year,results in significantly increased labour demand from the rural area. Apart from this, vegetable marketing systems involvedmany intermediaries which creates employment in the urban area. The employment resulting from vegetable production and marketing will continue to grow in line with the expansion of this industry.

Greater profitability

46. The mission was told in all the countries visited that vegetable farmers earned higher incomes than most of the other types of farmer due to their intensive land use and their risk reduction through crop diversification. This partly explains why other types of

farmers become vegetable growers. Supanee found out about previous occupations of Bangwack vegetable growers in Thailand and 65 percent had been rice farmers, 26 percent orchard farmers, 5 percent upland crop growers, and only 4 percent had no previous farming experience of any type. It was also found that over a six-year period the vegetable farmers earned 4.75 times more income than that derived from their previous farming enterprises. This indicates that high income from vegetable farming contributes to the well-being of those who are involved in the vegetable industry in particular, and to the progress of the community as a whole.

Rising demand for vegetables

47. Apart from the fact that the demand for vegetables will increase in line with population growth, and the increase of real disposable income, there has been a strong belief in all countries visited that the government effort to solve malnutrition problems of the people will result in a sizeable increase in total demand for vegetables. It is noteworthy that in FAO's Indicative World Plan projected growth of demand for vegetables is considerably higher than that for the so-called food staples, averaging 4.0 per cent.

Export commodity

48. In some countries where certain conditions are in favour of the production of particular vegetables at very low costs, a vegetable export industry can be developed. Among the countries visited, Senegal and Indonesia had been engaged in vegetable export for about ten years. Table 2 provides an indication of the continuing progress of vegetable exports for both countries.

Table 2. Vegetable exports, Senegal and Indonesia, 1969-73

Country	1969	1970	1971	1972	1973
Senegal* (ton)	1,365.3	1,093.7	1,659.7	3,402.8	5,520.0
Indonesia** (US$)	238,954	752,790	1,264,593	1,200,139	1,895,250

Source: * Centre for Horticulture Development, Senegal.
** Central Bureau of Statistics, Jakarta, Indonesia.

2) The nutritional contribution

49. Vegetables are recognized as an important source of vitamins and minerals in diets throughout the world. We talked with at least one and sometimes several nutritionists in every country visited and they all expressed the opinion that vegetable consumption is far too low in the tropics. In terms of specific nutrients likely to be deficient, we were informed that the greatest needs among the vitamins and minerals are for vitamin A and for iron. Vitamin C is supplied by both fruits and vegetables and was only once reported as being deficient in certain seasons of the year. Vegetables contribute important amounts of B vitamins in diets that are low in animal products, but again deficiencies in this group are seldom mentioned. Therefore it appears that in the tropics emphasis should be placed on vegetables which supply vitamin A and iron. Massive annual doses of vitamin A are relatively inexpensive but all nutritionists we consulted prefer that in the long run this vitamin be obtained from vegetables because they supply other nutrients at the same time, including some whose requirements are not established and probably some that are still not identified.

50. Carrots are an excellent source of vitamin A in temperate regions, the darker orange varieties supplying as much as several thousand micrograms of carotene per 100 grams fresh weight. The carotene is converted to vitamin A in the body. In the lowland tropics,

where carrots do not grow so well, leafy green vegetables with comparable amounts of carotene can be grown abundantly. Tomatoes and green pods of legumes have several hundred micrograms of carotene per 100 grams fresh weight and are a good source of vitamin A because of the volume consumed when they are available. Sweet potatoes and the fruits of several cucurbits can be very high in carotene if varieties with dark orange flesh are used, but unfortunately many varieties used in the tropics have white or pale yellow flesh and do not supply much carotene.

51. Leafy vegetables as a group stand out above all other plant sources of food as having a high content of iron. However the iron contribution of foods is difficult to evaluate because there are differences in availability of the iron related to the presence of oxalates and phytins in the food and also to the iron status of the individual consuming it. An iron-deficient individual absorbs more iron from the same food than does one who is iron-sufficient. Until more is known about this matter, all we can say is that certain vegetables do contain good amounts of iron.

52. The next priority seems to be for more protein and calories. Vegetables are not usually regarded as being high in protein, partly because tables of composition report protein in vegetables on a fresh weight basis and of cereals and pulses on a dry weight basis which we believe to be misleading. With protein percentage made comparable on a dry weight basis, many vegetables are as high as legume seeds. Taking examples from the handbook "Nutritive Values of Indian Foods", and converting protein percentages to a dry weight basis, ten species of amaranth range from 17 to 30 percent protein per 100 grams with an average of 25 percent. For all 18 species of pulses and legumes listed, protein ranges from 19 to 46 percent with an average of 27 percent. Mustard leaves at 39 percent and radish leaves at 41 percent protein exceed all the pulses and legumes except soy beans. Table 3 -P.13. (data from the Philippines) bears on the same point by comparing boiled vegetables with boiled rice and pulses. It shows a number of vegetables with protein percentages close to the grain legumes and far ahead of rice.

53. Along with the percentage of protein in various crops it is equally important to consider the yield of protein per unit of time since this affects availability and cost. Kilograms of protein per hectare per day gives a basis for comparing crops with different durations of growth, which vary widely among vegetables from as little as three weeks to several months. Table 4 provides a standard for comparison, showing that among 14 crops listed the highest rate of protein production is by soy beans. For high state average yields in the U.S., protein is produced at the rate of 6.0 kg/ha/day. For record yields the rate is 20.4 kg/ha/day.

54. Wilson at IITA in Ibadan told us that in an experiment with an improved variety of Celosia, a member of the amaranth family, he obtained average fresh yields of 70 tons per hectare, which he considered to be 80 percent edible, in four harvests which ended 119 days after planting. Assuming 2 percent protein as given in the Indian Handbook, this amounts to 70,000 kg x .80 x .02 ÷ 119 = 9.4 kg. protein/ha/day which is in the range of soy beans. Deutsch in recent experiments in Taiwan reports protein yields as high as 10 kg/ha/day for amaranthus harvested 30 days after planting and up to 6 kg/ha/day 24 days after planting. Munger and Villareal in the Philippines found that mung beans harvested 6 times as edible pods gave 9.5 kg protein/ha/day in 67 days from planting. In the same experiment soy beans which matured in 80 days with a yield of 2.3 tons/ha produced 9.3 kg. protein/ha/day (Table 6 on P.15). In short, there are indications from several different experiments that some vegetables produce daily yields of protein as high as those of soy beans (Table 5 on P.14)

55. High yields of protein produced by vegetables can be accompanied by high yields of calories (usually expressed as dry matter, which is closely correlated with calories). The dry matter of the green mung bean pods whose protein yields are given above is compared with high yields of rice and sugar from cane under similar conditions in Table 7 on P.16. When reduced to edible dry matter per hectare per day, the three yields are very close, but it can be noted that the 40 kg. produced by the mung beans had nearly 25 percent protein while the 35 kg. produced by rice had about 10 percent protein, and the 35 kg. of sugar had none.

Table 3. Some cooked vegetables with higher protein percentages than cooked rice (2.2%)

Soybean, boiled (*Glycine max*)	12.8
Mung bean, boiled (*Phaseolus aureus*)	11.0
Pigeon pea, boiled (*Cajanus cajan*)	9.4
Chickpea, boiled (*Cicer arietinum*)	9.3
Papaya leaves (*Carica papaya*)	8.0
Bago leaves (*Gnetum gnemon*)	7.4
Lima beans, boiled (*Phaseolus lunatus*)	7.4
Cassava leaves, (*Manihot esculenta*)	7.2
Beans, boiled (*P. vulgaris*)	7.2
Garlic (*Allium sativum*)	7.0
Malunggay leaves, boiled (Horseradish tree) (*Moringa oleifera*)	6.5
Cashew nut, young leaves (*Anacardium occidentale*)	5.2
Ampalaya leaves, (*Momordica charantia*	5.0
Patola (Sponge gourd) tops (*Luffa cylindrica*)	4.6
Kulitis, boiled (Spineless amaranth) (*Amaranthus gracilis*)	4.4
Broccoli (*Brassica oleracea* var. *italica*)	3.5
Kangkong, boiled (Water Convolvulus) (*Ipomoea aquatica*)	3.4
Gabi leaves, boiled (Taro) (*Colocasia esculenta*)	3.3
New Zealand Spinach, boiled (*Tetragonia expansa*)	3.3
Cowpeas, edible pods, boiled (*Vigna sinensis*)	3.0
Sitao, edible pods, boiled, (*Vigna sinensis* var. *sesquipedalis*)	2.9
Winged beans, edible pods boiled, (*Psophocarpus tetragonolobus*)	2.9
Sweet pea, edible pods, boiled (*Pisum sativum*)	2.7
Sweet potato, boiled, (*Ipomoea batatas*)	2.6
Gabi (Taro) (*Colocasia esculenta*)	2.4

Except for broccoli, values are from Food Composition Table, Food and Nutrition Research Center. Handbook I. 4th Revision. Manila, 1968. A number of the values for boiled vegetables are for a single analysis but are not greatly different from those for the fresh vegetables based on more analyses.

Table 4. Production of protein per hectare per day in the U.S; based on FEDS Report 2.

Crop	High state average yields x % protein	Record yields x % protein
Soy bean	6.0 kg/ha	20.4 kg/ha
Beans	4.7	10.0
Peas	4.0	5.9
White potatoes	3.7	7.9
Corn	3.0	9.7
Sorghum	2.9	9.3
Peanuts	2.9	8.4
Spring wheat	2.4	10.3
Rice	2.2	3.0
Barley,	1.7	4.6
Oats	1.6	4.8
Sweet potatoes	1.1	3.9
Winter wheat	0.8	4.3
Rye	0.7	1.7

56. The Celosia experiment at Ibadan produced about 56 kg/ha/day edible dry matter if one applies the 12 percent value for dry matter from the Indian Handbook, and Deutsch obtained some yields of 48 kg/day from amaranthus in Taiwan. Schuphan working in Germany under very different conditions and with different crops has also shown (Table 8) that a vegetable or successive crops of vegetables can produce in a year more protein and calories than cereals while giving high yields of vitamins as well. The foregoing facts do not imply that vegetables should be proposed as the main source of calories and proteins; the concentration is too low to permit eating enough to meet daily requirements, and furthermore some of the most productive vegetables cannot be stored very long. However one can say that enough vegetables, judiciously chosen, can be grown to meet requirements for vitamins without sacrificing the calories and protein that could have been produced by planting staple crops on the same land instead.

Table 5. Rates of protein and dry matter produced by certain vegetables in comparison with soy beans

	Protein Kg/Ha/day	Edible Dry Matter Kg/Ha/day
Soybeans - high state yields in U.S.	6.0	—
Soybeans - experiment in Philippines	9.3	26
Celosia - experiment in Nigeria	9.4	56
Amaranthus - experiment in Taiwan	10.0	48
Mungbean pods - experiment in Philippines	9.5	40

Table 6. Yield and composition of legumes and seed potatoes grown at College, Laguna, Philippines during May/July 1969

Planted April 29 in rows 75 cm. apart and 4 meters long, 3 rows per plot, 4 replicates. Center row of each plot harvested in 3 segments, 1 meter at each of 3 maturity stages. Harvest mostly in rainy season. Phaseolus vulgaris (Contender and Sanilac) produced zero yields in this experiment. Lima bean (Habas) produced abundant pods but all rotted. Cowpeas were unharvestable as small plots because of excessive vines.

CROP	Stage of maturity at harvest	Days to last harvest	Fresh Wt.-Tons per ha.	Dry Matter			Protein (N x 6.25)		
				Ave. %	Tons per ha.	Kg./ha/ day	Ave. %	Kg./ ha.	Kg./ha/ day
Soybean 'Hsih-Hsih'	Edible pod	84	7.16	24.9	1.78	21.2	4.9	358	4.3
	Green shell	61	2.98	32.3	.94	16.4	11.0	326	5.6
	Dry	84	2.32	92.8	2.16	25.7	33.7	784	9.3
Mung Bean 'BPI MG50 -10A'	Edible pod	67	15.36	18.3	2.68	40.0	4.1	632	9.5
	Green shell	48	2.42	37.7	.91	19.1	10.6	257	5.3
	Dry	56	1.18	93.5	1.10	19.7	23.0	272	4.9
Bush Sitao 'Los Banos #1'	Edible pod	77	12.05	13.1	1.64	21.3	3.3	395	5.1
	Green Shell	56	2.16	37.0	.80	14.3	10.0	216	3.9
	Dry	56	1.05	91.9	.97	17.3	22.7	239	4.3

Table 7. Yields of edible dry matter and protein for three crops in the Philippines

	Days to harvest	Tons per hectare	Edible dry matter Kg./ha.	Edible dry matter Kg./ha/day	Protein Kg./ha.	Protein Kg./ha/day
Sugar Cane[1/]	365	12.65	12,650	34.7	0	0
Rice[2/]	105	5.75	3,622	34.5	332	3.26
Mungbean[3/] edible pods	67	15.36	2,680	40.0	632	9.50

1/ According to Dr. C. Jesena, UP College of Agriculture, 200 piculs of sugar per hectare is a high yield for irrigated sugar cane but one obtained occasionally under commerical conditions.
200 x 63.25 kg./picul = 12,650 kg./ha.

2/ According to Dr. D. S. Athwal, IRRI, an early May planting of IR8 rice on good land at College Laguna should produce 5 1/2 - 6 tons/ha. of rice of which 70% would be edible after milling.
5750 kg. x .7 x .9 dry matter = 3622 kg./ha.

3/ Yield from experiment in Vegetable Crops Section, UPCA, May-July 1969. Pods with seeds starting to develope were picked 6 times. 67 days from planting to last harvest.

Table 8. The production of protein, calories and vitamin C by various animal and plant sources

Source	Protein kg./ha./yr.	Calories mill./ha./yr.	Vitamin C kg./ha./yr.
Pigs	48	1.6	--
Dairy cows	107	2.2	--
Maize (corn)	301	11.6	0.06
Winter wheat	329	10.8	0.06
Sugar beet	132	24.1	--
Green kale	600	10.0	25.25
Early carrot/green kale	752	18.4	25.34
Early potato/green kale	720	24.6	26.53
Spinach/early kohlrabi/ lettuce/spinach	1251	22.8	45.09
Lettuce, early kohlrabi, tomatoes	612	32.9	28.25

From Schuphan: Nutritional Values in Crop and Plants. 1965.

e) Crop Species and Problems Needing Additional Research

1) Tomatoes and related solanaceous crops

57. We recommend that tomatoes be given high priority in internationally supported vegetable research because in nearly every tropical country we have visited as a group and individually, this is the vegetable most commonly mentioned as needing research to improve the quantity, quality and seasonal availability. From a nutritional standpoint, tomatoes are an important source of vitamins A and C (the former being frequently deficient in the tropics) but they may be even more important in improving the palatability and thereby increasing the intake of nutrients from other foods with which they are cooked. With the possible exception of onions, it would be hard to name another food plant which is so universally liked by people in all cultures and climates. In the tropics the tomatoes in markets are usually pitifully small in quantity and high in price as well as poor in shape and color. Conditions are favorable for tomato production only during a limited part of the year with the result that there may be over-production for a short time and few or no tomatoes the rest of the year.

58. Tomatoes are grown in home gardens, in small-scale commercial plantings for local markets, on a larger scale for shipment to more distant urban markets, and in several tropical countries they are the first vegetable considered for canning for the local and export market. Most improvements made through research would be applicable to all these uses without great modification, and similar problems are found throughout the tropics. Four main problems are failure to set fruit at high temperatures, bacterial wilt, nematodes and another virus disease which is called by various names but which is insect rather than mechanically transmitted. Breeding is probably the best solution to all these problems and some useful germ plasm is known for each one. However, these are difficult characteristics with which to work, and no single national programme had had the resources to combine them in one variety along with the many other characteristics that are needed.

59. More is known about the genetics of tomatoes than of any other vegetable, large collections of germ plasm are available, and horticulturally desirable varieties with multiple disease resistance bred in temperate regions could be adapted to the tropics by adding the required heat tolerance and additional disease resistance. These resources remain largely unexploited in the tropics, but their availability means that rapid progress should be possible if concentrated effort is applied.

60. Aside from improving the quantity of tomatoes, two quality improvements would be especially valuable in the tropics. A single gene that can be added easily to any variety of tomato increases its vitamin A value 10-fold at the expense of red pigment, giving a tomato of orange-red colour. This may have potential for correcting the prevalent vitamin A deficiency. Both appearance and palatability could also be improved by breeding varieties resistant to "hard-wall" or "blotchy ripening" which commonly leaves part of the outer wall hard and green when the rest of the tomato is ripe.

61. A complete revolution in tomato production in developed countries was triggered by improved varieties followed by appropriate changes in cultural practices. With this experience as a basis, similar progress in a shorter time should be possible if concerted effort is made in the tropics.

62. Eggplant or brinjal (Solanum melongena) and peppers or chillies (Capsicum sp.) belong to the same family as tomatoes and have some problems in common with them. Eggplant is subject to bacterial wilt and peppers to some of the same virus diseases. Both of these species seem better adapted to the tropics and less work on them is required than on tomatoes even though they are presently grown on much larger areas in some of the countries visited. Because of the efficiency related to working on the same disease with more than one crop, and because of the great importance of these two crops, we suggest that consideration be given to a limited amount of work on these species related to the tomato.

Table 9: Composition of Some Species of Amaranthus (from Nutritive value of India Foods)

	% H20	% Prot.	Protein/ 100g dry	Ca mg/100g	Fe	Carotene mg/100g	Vit C mg/100g
A. spinosus	85.0	3.0	20	300	23	3564	33
A. gangeticus	85.7	4.0	28	397	25	5520	99
A. tristis	87.0	2.8	22	364	38	—	—
A. sp.	80.6	4.5	23	321	18	—	—
A. sp.	88.0	2.8	23	292	2	—	—
A. viridis	81.8	5.2	29	330	19	—	178
A. caudatus	90.0	3.0	30	200	—	—	—
A. paniculatus	78.6	5.9	28	530	18	14,190	81
Celosia argentia	88.0	2.0	17	323	—	—	—
A. polygonoides	90.0	2.8	28	251	27	—	—

2) Leafy Green Vegetables

63. The case for giving research priority to the leafy green vegetables has been largely presented in the section on the nutritional contribution of vegetables. The leafy greens may well represent the greatest unexploited food resource of the world and as such would deserve first priority for research were it not for the universal demand for more and better tomatoes. There are so many species of tropical leafy green vegetables and so little is known about the potential of most of them that we recommend considerable exploratory research to determine what species should receive attention in depth. Initially, however, there is justification for some concentration on the amaranths (i.e., celosia and various species of genus Amaranthus). They were cited as important in every country visited especially for poor and rural people. Their protein percentage on a dry matter basis equals the grain legumes and is reported to be high in sulfur-containing amino acids. Feeding experiments in India showed that adding amaranthus to a cereal and pulse diet improved the protein quality almost to the level of milk. Table 9 shows that they have a high content of vitamins and minerals. They have the more efficient P4 type of photosynthesis, a rarity among dicotyledonous plants. Great genetic variability is apparently present in the genus judging from the range of values in Table 6 as well as from observations. High content of oxalates is sometimes regarded as an objection and could probably be reduced by breeding. They have relatively few disease and insect problems, grow readily in semi-wild or under rainy conditions, and are especially valuable in hot weather when many other species cannot be grown.

64. Ipomoea aquatica (known as kangkong, water convolvulus, or swamp cabbage), also seems deserving of some initial attention. It is widely used in Asia and in certain areas is considered more desirable than the amaranths. It grows well in marshes, ditches or other places too wet for amaranthus or most other vegetables, to some extent utilizing land that would otherwise be wasted.

65. The leaves of certain trees are commonly eaten in the tropics and are unusually high in protein. The drumstick tree (Moringa oleifera) has leaves with 6.7 percent protein (28 percent of dry weight), papaya leaves have about 8 percent, and tamarind about 6 percent. These have advantages in greater availability in the dry season than annual plants, in utilizing land where cultivating a crop is difficult, and of being less subject to loss from domestic animals, a serious problem in many home gardens. No information has been found on the level of nutrient production by such species or about the genetic variability present in them. A modest amount of exploratory work might give a large return in a short time.

3) Leguminous Vegetables

66. Although there has been a gratifying increase in research on the grain legumes or pulses in recent years, the parts of these plants used as vegetables are still receiving relatively little attention. The green pods and immature seeds are popular throughout the tropics. They share some of the nutritional advantages of the leafy green vegetables but are easier to market because they deteriorate more slowly. In addition some legume leaves are eaten and have a high food value. The plants also can fix nitrogen. As compared to dry seeds of the same species, the vegetable parts have more vitamins, require less cooking and have shorter duration of growth to first harvest. This last feature makes them especially useful in fitting into a cropping systems pattern.

67. Some of the leguminous vegetables give their maximum yield when harvested several times as successive flushes of pods reach suitable size while others do not as shown in Table 3. More research is needed to determine when to pick the more important legumes to get maximum nutrient production. It is clear that the varieties bred for dry seed production will frequently not be the best for vegetable use so that breeding for vegetable use will be needed.

68. We suggest that initial research in this group should be concentrated on the Vigna species - cowpea, yardlong bean, and mung bean - because of their known adaptability to high temperatures and their widespread use in the tropics. Exploratory work is suggested

for lima beans, winged beans and Dolichos beans (now known as Lablab niger). Some of these legumes are under study as dry seeds at existing International Centres. Full advantage should be taken of their germ plasm collections and knowledge already obtained, and future work should be closely coordinated with them.

4) Other Crops needing Additional Research Effort

There are a number of other vegetables deserving additional research effort, but we feel that more study is needed to establish priorities beyond the three already discussed. We suggest that consideration be given to three additional crops or groups of crops which we discuss briefly here without attaching priorities.

(a) Onions, garlic and related species. The amounts used and the composition of these vegetables is such that they probably do not in themselves contribute many nutrients. Nevertheless they are used everywhere in cookery and make their contribution to the diet by increasing the palatability of the foods with which they are combined. When they are scarce, onions become front-page news as we saw in India. One of the main problems is storability to have a steady supply throughout the year. Because they are sensitive to photoperiod, storage types from temperate zones cannot be used and most tropical varieties do not keep well. Germ plasm almost certainly exists that could be used for rapid improvement, little having been done so far.

Chinese chives (Allium tuberosum) are grown throughout the year on a very large scale in China but we saw few of them in the countries visited. They are probably more nutritious than onions since the green parts are eaten, and they may deserve some study and promotion.

(b) Cucurbits. A wide range of cucurbits is grown in every country visited and some are extremely popular. Unfortunately many of them such as cucumber, immature squashes or vegetable marrow (Cucurbita papo), chayote (Sechium edule), and most of the edible gourds of the genera Benincasa, Momordica, Lagenaria, Luffa, and Trichosanthes have little food value - less than 1 percent protein and low vitamin content. The winter squashes (Cucurbita moschta and C.maxima) have varieties with much more dry matter and carotene and the same is true for melons (Cucumis melo). Perhaps similar improvement could be made in the other genera, but in any event, work should be concentrated on species which produce carotene.

These crops are relatively resistant to drought and some of them have fruits which can be stored for several months to provide food in a dry part of the year. In addition, the vine tips are eaten to some extent and are more nutritious than the fruit in most cases.

Because of their present importance, large potential for improvement, and availability in dry seasons, this group deserves consideration for additional research.

(c) Cabbage. This is a crop which is notably adapted to cool growing conditions. Its desirability as a vegetable is indicated by continued attempts to grow it in the tropics, which have recently been rewarded by remarkable improvements in adaptability. Certain hybrid varieties from Japan and perhaps some from Denmark also can even be grown well in the lowland tropics. This might suggest that further research is not needed, but the hybrid nature of the seed presents a problem. New seed must be imported for each crop at a considerable cost in foreign exchange, and this seed is often not readily available to small farmers. It should certainly be possible to develop open-pollinated varieties with heat tolerance and for which seed can be produced within a country.

Furthermore, insect control on cabbage is extremely difficult in the tropics. Resistance to certain insects has been found recently and may be especially valuable in the tropics.

Cabbage produces large amounts of vitamins A and C as well as respectable amounts of protein.

f) The Need for Additional Internationally Supported Research

70. As indicated in Chapter III c, rather limited efforts have until recently been devoted to vegetable research in all the countries visited, except perhaps India. Past efforts have also suffered from a lack of continuity, in common with agricultural research in general. An important reason underlying this appears to be insufficient remuneration of research workers leading to a high turnover of professional staff, so that research programmes have not produced the results anticipated. This in turn has made governments wary of investing more money in research.

71. Of the limited effort which has been devoted to vegetable research a high proportion has been directed to the improvement of temperate type vegetables. Very little attention has been paid to native vegetables even though they are widely consumed and nutritionists have recognized their important contribution to the diet. Reasons for this neglect of native vegetables are probably (a) their relatively low economic value at present because they are not widely marketed, and in some cases difficult to market, and (b) the fact that as a group they are made up of a large number of species, each of which is grown on a relatively small area if considered on a country by country basis.

72. The mission recognizes the important contribution which AVRDC has been making to the improvement of vegetable production in developing countries, but even in its programme, the native vegetables have largely been omitted. Moreover, it is not located in the true tropics and the doubts concerning its future as an international research and training centre for vegetables, are well-known to the TAC.

73. The mission therefore sees an urgent need to reinforce vegetable research in the tropics, which it considers to be critically weak at present, and to this end, recommends additional internationally supported research.

74. The main arguments for establishing such a programme, which the mission recommends should involve both the creation of an International Vegetable Research Centre, and the reinforcement of national institutions to participate in a research network (see Chapter III g) - are the following:

(i) While on a national basis many individual vegetable species are relatively unimportant in comparison to the staple food crops, and a large research investment on them is therefore not easy to justify, they occupy a much larger area in aggregate on a world-wide basis. International efforts can therefore be defended more easily. This particularly applies to the native vegetables, and international research directed to these species, followed by recommendations about their use made by scientists of authority, would help to raise them from their present status of a Cinderella to the place of importance they deserve.

(ii) The available germ plasm of many vegetable species is scattered over many countries. An international effort to bring together this germ plasm and to evaluate its potentialities by multi-local testing is likely to yield quicker results, in the interest of national research programmes, than if individual nations were to attempt to undertake this work. This is of particular importance in the case of breeding for resistance to insect pests and diseases, so urgently needed in view of the rising costs and ecological disadvantages of relying mainly on chemical pest control.

(iii) An international effort generally commands more continuity and stability. Any interruption in breeding efforts on a national basis can be bridged over by an international centre supplying breeding material.

(iv) International research effort concentrated on selected species of vegetables should help to accelerate the generation of results from research on those species within national programmes. Hopefully this would induce national governments to give further

support to expanded vegetable research activities.

75. The need for an international programme is exemplified by the tomato, which is discussed in more detail in another part of this report. Improving its ability to set fruit under high temperatures and its resistance to bacterial wilt, nematodes, and virus diseases, are all problems which require an adequate scientific effort with strong financial backing. However, the importance of tomatoes in any individual tropical country is unlikely to justify it receiving a high priority in national research whereas the importance of tomatoes in the tropics in general does merit an international research programme.

Similarly the production of leafy vegetables during the dry season in the tropical countries that have a relatively long dry season, or at least the extension for a few weeks of the period of growth of leafy vegetables, is of great importance for all the countries concerned, and justifies an international effort to tackle that rather difficult problem. However, this effort would probably be out of consideration for any single country.

g) The Organizational Form of an International Effort

76. Once the mission was convinced that additional international support to vegetable research was required, a great deal of time and discussion was spent on determining the form that this support should take. The following possibilities were considered:

(a) the strengthening of individual national programmes;
(b) the establishment of a network amongst the existing national programmes;
(c) the use of existing International Centres;
(d) the setting up of a Centre fully dedicated to vegetable research.

77. The inadequacy of most national programmes and their orientation principally to research on the commercial vegetables are a main reason for ruling out alternative (a). It is difficult to visualize how the reinforcement of these programmes could produce the short-term results needed to transform the production of vegetables in the respective countries, and even more difficult to visualize how this could influence other countries' production.

78. In respect of option (b) the mission feels that a cooperative programme amongst existing national institutions would be unlikely to succeed unless a central institution, international in character, is established to give the network the required orientation, to contribute substantially to the knowledge of vegetables indicated as priorities for the cooperative research effort, and to train national research workers to participate in the network. Because of the weakness of existing national programmes, the latter is considered to be particularly crucial.

79. The possibility that research in vegetables considered as deserving high priority could be undertaken by existing International Centres was also eliminated. Theoretically, such an arrangement could be more economical but each of the International Centres has a well-defined mandate to which it is already heavily committed. In the light of the financial and administrative constraints on continuing programme expansion it seems unlikely that they would be interested in taking on new responsibilities, or if they were to agree to do so, there would be a risk that those responsibilities would be given only second degree attention. Alternatively their on-going research activities could be jeopardized.

80. The mission therefore considers that only the formation of a new International Centre specifically established to resolve the problems of vegetable production in the tropics will be an adequate response to the needs foreseen, if solutions are to be found in the relatively short-term able to make an important impact on the production and consumption of vegetables.

81. The mission recommends that the proposed Centre should conduct its activities mainly in the tropics of Asia and Africa, but does not exclude that its findings could be applied in other tropical areas of the world.

82. The Centre should give first and major attention to the solution of problems limiting the production of the priority species selected (see the mission's recommendations, paras 14-16), with the objective of producing knowledge and information that will permit national institutions to better appreciate the advantages of those crops and the contribution that they can make to the nutrition of their respective nations, particularly by providing good quality food at prices accessible to the lowest income groups of the population.

83. The development of varieties of high yielding, high nutritive value, resistant to pests and diseases, and to environmental limitations such as drought and excess of moisture, should be an important part of the responsibilities of the new Centre.

84. The various aspects of preservation of vegetable products after harvest and the economics of their production, marketing and consumption should also be considered as essential elements of its programme.

85. A primary responsibility of the Centre must be the training of national personnel to different scientific levels. This should encompass not only the training of vegetable research workers, but also of production specialists able to further train national staffs in managing production, demonstration, and extension campaigns.

86. As soon as the Centre is created, contacts should be established with the national research organizations interested in vegetable crops to create a cooperative programme that will not only permit the formal movement of information and materials, but also provide a basis for efficient testing of the materials produced in many locations at the same time, and to seek the participation of the national institutions in the activities of the network.

87. Through this network it is also visualized that certain of the national programmes will take responsibility for the conduct of those aspects of the research that require environmental conditions, personnel, or facilities different from those of the main Centre.

88. The proposed Centre must also work in close cooperation with the other International Centres, particularly IITA, CIAT and ICRISAT, which have a major responsibility for cowpea, field bean, chick pea and pigeon pea breeding. These Centres should provide information and materials to the Vegetable Centre for testing for the production of green (pod) peas and beans. As the work of the proposed Vegetable Centre progresses and other crops are included in its programme, further associated programmes can be developed. For example, if the Vegetable Centre at a given time undertakes studies of cassava or sweet potatoes as producers of green leafy vegetables, this work should be conducted in association with IITA and CIAT.

89. In respect of the initial programme of the proposed Vegetable Centre the mission considers that the main effort should be concentrated on the three groups of crops mentioned as primary priorities in paras 14-16. However, some exploratory work should also be considered on the other vegetables that are felt to have a promising potential, such as solanaceous fruits (egg-plant, peppers, and other related species). A more general evaluation should also be made of other leafy green vegetables listed elsewhere in this report (see tables 3 and 9 and Country Reports).

90. Bearing in mind the relatively narrow range of priorities recommended and the fact that the Vegetable Centre must work in close cooperation with other International and national Centres, it is suggested that the total staff be around 15 senior scientists with the required assistants and supporting personnel. It is also suggested that the investment in buildings and other facilities be kept at a minimum. For purposes of calculations, it can be estimated that the new institute will not be bigger in staff or facilities than the AVRDC. The mission considers it desirable to locate the Centre near a reasonably large city, both because of the facilities this might provide (see paras 92 and 93) and because it would permit the staff to live in the city and thus eliminate the need to build houses for them.

91. It is considered that the Centre should be located in a hot, lowland tropical area with clear-cut rainy and dry seasons. The reason for this is that the tropical belt is the area that the Centre will be expected to serve. A location with a clear-cut dry and wet season would permit the Centre to obtain information not only for the humid zone, but also for the semi-arid and seasonally dry areas of which there are many in the tropics.

92. It is also desirable that the chosen location permit of easy access to areas of high altitude where trials can also be carried out by the Centre staff or associated national stations under more temperate conditions.

93. The mission recommends that the Centre be located in Asia, not only because of the size and density of the population, but also because of the notable tradition of vegetable growing in that continent.

94. The other conditions that are desirable for a location are those that apply to all the International Centres, i.e. that the government of the country concerned is interested in hosting the Centre and is also prepared to facilitate the entry and movement of scientists, students, seeds and propagated materials. A location near a university that will permit an association with a college of agriculture where a cooperative programme of graduate studies might be developed is also desirable.

95. Other requirements are adequate medical facilities, schools and cultural activities, communications and a general environment that will be attractive to scientists from different parts of the world.

h) Supporting Action Required in Infrastructural Fields

96. Despite on-going and planned efforts in all the countries visited, much remains to be done to improve the infrastructure required for the efficient production of agricultural commodities including vegetables. Apart from research, which has been discussed separately, more attention needs to be given to:

(a) roads and/or railways connecting producing and consuming areas (markets for fresh produce and processing factories);
(b) the supply of inputs (fertilizers, pesticides, seeds, etc.);
(c) irrigation and drainage facilities;
(d) storage and marketing facilities;
(e) credit;
(f) the organization of production and marketing;
(g) education and extension activities.

97. The mission felt that many of these requirements need action primarily by national governmental and private institutions. However, an international vegetable research institute could assist them in this task by making available information on, e.g. the irrigation requirements of vegetables; available equipment for drip irrigation; required conditions, methods and equipment for vegetable seed production; storage of vegetables, etc. Of these items, vegetable seed production seems to be the one with which the International Vegetable Centre should be particularly concerned. This is because the Centre's activities in developing new vegetable varieties will remain without practical application if the follow-up of seed multiplication is lacking.

98. Which of the infrastructural components mentioned above will form an essential complement to the research of the proposed International Centre depends upon the prevailing state of vegetable production and marketing in the individual countries. In some, extension may be the bottleneck, in others roads, in others irrigation facilities, etc. No general rule can at present be given. In the opinion of the mission, a survey should be

made to detect, country by country, the main bottlenecks. This should be taken up by the national institutions with the help of the proposed Vegetable Research Centre; perhaps with the cooperation of international organizations, or through bilateral arrangements.

99. In the last decennia, FAO has been very active in assisting national institutions in developing the infrastructure for vegetable production. The proposed new International Centre should therefore seek close cooperation with available FAO expertise, and vice versa.

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A C K N O W L E D G E M E N T S

The mission would like to express its sincere thanks to all the people in the countries visited who gave much of their time in supplying the required information and guiding the mission in its visits to projects.

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APPENDIX I

COUNTRY REPORT - SENEGAL

1. Some Background Information

1.1 Geographical position

Senegal is a small (196 722 km^2) country situated on the west coast of Africa between 12°30' and 16°30' latitude north and 11°30' and 17°30' eastern longitude.

Its capital Dakar with an air and seaport is strategically situated between Europe and South America. Dakar is nearer to West Europe than any other port in a wholly tropical country.

1.2 Climate

This is characterized by one long, dry season (7 months in the south to 10 months in the north) and a short rainy season (5 to 2 months). The average yearly precipitation decreases from 1500 mm in the south to 400 mm in the north. Rainfall distribution from year to year and within the season shows wide fluctuations, making rainfed agriculture an uncertain business. Sunshine in the dry season is abundant; even in the rainy season sunny periods are not uncommon. Temperatures are high throughout the year, in particular in the month preceding the onset of the rainy season. During the dry season, there is a strong influx of dry air from the Sahara. Along the coast the heat and dryness are tempered by more moist and cool air coming from the sea.

1.3 Population

About 75 per cent of the population, which is about 4 million, live in rural areas and also derive their living from agriculture. The other 25 per cent live, for the larger part in the towns and are engaged in trade, industry or services.

Three-quarters of the population is concentrated in the western part of Senegal. Here all the cities are situated and also the densely populated rural areas. The eastern part is sparsely populated, except for a small band along the Senegal river.

Half of the population is in the working age group (15- 59years), 40 per cent younger and 10 per cent older than that.

There is a strong tendency towards abandoning the countryside and seeking a livelihood in the urban centres.

Available labour is plentiful but often unskilled.

1.4 Agriculture

Except for relatively small areas where water is available for irrigation in the dry season, agriculture is of the seasonal rainfed type. Predominant upland crops for food are sorghum and pearl millet as subsistence crops and, if surpluses are available, as cash crops, and groundnuts as the main cash crop. Rice is grown mainly as an upland crop or as swamp rice. Other food crops frequently cultivated are maize, cowpea and cassava. Cotton is an important non-food crop.

Apart from soil preparation for which animal traction is used frequently, most agricultural operations are done by hand. Family labour is common. Crops are often grown in mixtures. Soil fertility is poorly maintained by a system of bush fallow alternated

with cropping. The use of fertilizers, however, is becoming increasingly popular.

Mixed farming, i.e. the integration of livestock keeping with crop growing, is not yet practised widely. The cattle population is largely in the hands of pastoral nomads who are not involved in crop growing.

2. Aspects of the Vegetable Business in Senegal

2.1 Consumption and supply of vegetables

2.1.1 General picture

The majority of the people in Senegal are said to have accepted vegetables as an essential part of their diet (which is based upon a cereal - rice, sorghum or pearl millet - as the staple), and they will consume them if they can get them. In the rural areas fresh vegetables are generally available only in the rainy season, when they are grown for home consumption mixed with the main food crops; some are also obtained from the spontaneous vegetation. In the dry season, one has to make use of (a) small quantities of home preserved (mainly dried) vegetables, obtained from the excess production in the rainy season; (b) leaves and other material collected from the wild vegetation, or (c) produce bought.

In the towns fresh vegetables are generally available throughout the year. They mostly come from surrounding rural areas, where they are often produced by specialist, small-scale growers for a large part of the year in places where water is available for irrigation. During the rainy season, a deficiency in production due to incidences of pests and diseases mainly is made up by the importation of vegetables from abroad. Besides fresh vegetables, tomato puree is consumed currently in relatively large quantities.

2.1.2 Consumption figures

The annual per caput consumption of vegetables was estimated in 1972 to amount to: 10-20 kg for the rural people, 50-70 kg for the average urban consumer, 100-230 kg for the rich urban consumers. There is a tendency towards an increasing consumption of "European" vegetables, in particular in the urban areas.

2.1.3 Imports

Senegal imports every year about 24,000 tons of fresh (non-processed) vegetables 90 percent of which consist of only two commodities, i.e. potatoes and onions. Besides these, 7,000 tons of tomato concentrates are imported.

2.1.4 Exports

As from about 1965, Senegal has become an exporter of fresh vegetables to Europe in the winter season. From the 1966-67 season till the 1974-75 season, the quantity exported rose from 538 tons to 6,345 tons.

In the first years, French beans, produced by the small grower under contract with a dozen or so rather small exporters, were the main export item. With BUD-Senegal coming into production in 1972, a more diversified export package developed, including also melons, eggplants, tomatoes, lettuce, peppers, strawberries and others. Because of insufficient marketability some crops were later deleted from the export programme.

2.2 Production aspects

2.2.1 Species produced

Senegal produces a large number of vegetables. See Table (i) on p. iii.

Table (i)

MAIN VEGETABLES GROWN IN SENEGAL

I. Cultivated vegetables:

Allium cepa	Onions
Brassica oleracea	Head cabbage
Brassica olerocea Botrytis	Cauliflower
Capsicum frutescens	Hot pepper
Capsicum annuum	Sweet pepper
Cucumis sativus	Cucumber
Cucumis melo	Melon
Cucurbita pepo	Gourd
Daucus carota	Carrot
Hibiscus esculentus	Okra
Hibiscus sabdariffa	Roselle
Lycopersicum esculentum	Tomato
Phaseolus vulgaris	French bean
Solanum aethiopicum	Native eggplant
Solanum melongena	Eggplant

II. Leaves collected from spontaneous vegetation or from crops grown mainly for other purposes:

Adansonia digitata (tree)	Baobab
Amaranthus hibridus (herb)	Amaranth
Amaranthus lividus (herb)	"
Amaranthus spinosus (herb)	"
Archis hypogea (herb)	Groundnut
Bauhinia reticulata (shrub)	
Cassia tora (herbac. shrub)	
Ceratotheca sesamoides (herb)	
Corchorus olitorius (herb)	Jute
Cratoeva adansonii	
Cucurbita pepo (herb)	Squash
Ficus gnaphalocarpa (tree)	
Gynandropsis pentaphylla (herb)	
Hibiscus sabdarriffa (herb)	Roselle
Ipomea catatas (herb)	Sweet potato
Leptadenia lancifolla	
Manihot utilissima (woody herb)	Cassava
Moringa pterygos-Perma (tree)	Drumstick
Solanum aethiopicum (herb)	Bitter tomato
Talinum triangulare (herb)	
Trianthema portulagastrum (herb)	
Urena lobata (herb)	
Vigna unguiculata (herb)	Cowpea

Source: Toury, J., et all, Aliments de l'Ouest Africain. ORANA, Dakar, ca. 1965.

2.2.2 Types of production

Several types of production can be distinguished:

a) that for home consumption or sale locally side by side with the main food crops in the rainy season*;
b) that on a small scale for sale in the towns. Production in the rainy season and, near places with a high water table permitting hand-watering also in the dry season**;
c) that for export during the European off-season:

(i) on a small scale. Often practised by the same growers as of (b).
(ii) on a large scale. Practised by a large company named BUD-Senegal.

d) that for processing. Mainly practised in an irrigation project along the Senegal river by a group of farmers under contract to a canning factory.

2.2.3 Government support to production

Both direct and indirect support are important. In the period of the 3rd four-year plan (1969-72), the Government has been able to attract assistance from UNDP for the establishment of the Centre for Horticultural Development (CHD), from BUD-Senegal for initiating the large-scale production of vegetables for export, and from SOCAS for the production of concentrates derived from contract-produced tomatoes.

In the current 4th Plan period (1973-77) the above projects are receiving further financial support from the Government.

The small-scale producers will be supported by an agricultural credit scheme, by helping them to form cooperatives, by increased extension work through well-trained horticulturalists, and by a subsidy on water rates. It is hoped that by 1977 these producers are able to cover the total needs of Senegal for fresh vegetables. BUD-Senegal will receive further support to increase exports.

Various projects aiming to produce a total of 1300 ha of industrial tomatoes will also receive support from the Government.

3. Vegetable-Oriented Research in Senegal

(1) Before the CHD was established, some selection work was done on onions, tomatoes, eggplants and some native vegetables at the Centre for Agricultural Research (CRA) in Bambey. The results helped the small-scale producers, mainly.

(2) In preparation for their large-scale production project, BUD-Senegal initiated research on vegetable varieties, irrigation and agronomic practices on their own farm in 1969. This work is being continued. Results are applied on their own farm and are also available, where applicable, to, amongst others, a group of 22 families settled as "supervised outgrowers" nearby.

(3) The Centre for Horticultural Development, a UNDP/FAO Senegal Project became operational in 1972. It caters mainly for the small growers. It consists of four sections, dealing with:

(a) experimentation on varieties and agronomic practices;
(b) study of plant pests and diseases and their control;
(c) extension and economic studies;
(d) marketing studies and assistance.

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* This type is likely to be practised by a very large number of growers. No data are available on the amount of produce grown.

** There are an estimated 5,100 ha in this category. With an average size of the individual garden of 0.4 ha, one arrives at a figure of some 12,750 market gardeners. Since several labourers are employed per garden, the total contribution of this sector to employment is considerable.

CHD cooperates with the well-developed Division of Nematology of ORSTOM in Dakar in the study of nematode pests and their control. The senior professional staff of CHD at present consists of five expatriate FAO experts (one as project leader and the others on, respectively, agronomy, plant pathology, marketing and extension), three associate experts, and five Senegalese experts (counterparts to the FAO staff).

The 1975-76 research programme mentions work on: tomatoes, eggplants, capsicums, cauliflower, cabbage, mush-melons, squashes, onions, French beans, lettuce, Irish potatoes, asparagus, and strawberries; the economics of vegetable growing; the use of small farm implements; collecting species and varieties of "African" vegetables and exploratory observations on their growth, productivity, and diseases and pests. This collecting, etc., will be done in collaboration with the ITA and the Institut Fondamental de l'Afrique Noire (IFAN).

(4) A Chinese technical assistance mission does a small amount of practical research on vegetable growing. Details are not available.

(5) The Institute of Alimentary Technology (ITA) in Dakar has done work on the preservation of vegetables by drying and canning.

(6) The Organization for Research on Foodstuffs and Nutrition in Africa, based in Dakar, does surveys on food consumption and has analysed the nutritional value of a large number of indigenous vegetable sources.

(7) The Agricultural Research Institute in Senegal (ISRA) has stationed two agronomists in the Dagana Basin Project (part of the projects of irrigated agriculture along the Senegal River) to work on varieties and agronomy of vegetables to be grown in the project. Much attention is given to producing tomatoes for canning.

(8) CRA in Bambey experiment on setting up family-size farms using groundwater for irrigation. Vegetables form part of the rotation. Special attention is given to drip irrigation.

4. Needs for an Increase in Vegetable Production

Senegal has to increase vegetable production for the following reasons:
(1) The consumption of vegetables in especially the rural areas is far below the recommended requirements. This may partly be the cause of deficiencies in protein, vitamin A and Fe which are said to be widespread in Senegal especially amongst the vulnerable groups of the population, i.e. the young children and the pregnant and lactating mothers.

(2) The urban population in Senegal is growing fast. The present trend of a growing demand for vegetables by urban dwellers is likely to continue, hence vegetable supplies need to grow considerably.

(3) Senegal imports yearly a large quantity of potatoes, onions and tomato concentrates. In order to save foreign currency the local production* of these commodities needs to be stepped up.

(4) In order to diversify the exports (which now are dominated by groundnuts), Senegal should use the opportunities for exporting fresh vegetables to Europe in the off-season. Both its climate and geographical position are well suited for this purpose.

5. Requirements for Increasing Vegetable Production and Availability

A summary description of the requirements is as follows:

(a) land - Senegal possesses large areas of unutilized land suitable for vegetable growing;

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* to be coupled with improved storage for potatoes and onions.

(b) water - there are still large untapped sources of surface water (the rivers Senegal and Casamance) and of underground water;
(c) proper planting material - a number of suitable varieties is already available, but more research is needed to improve them;
(d) proper growing techniques - much remains to be found out about seedling production, field sowing or transplanting techniques, optimal spacing, water and fertilizer requirements, appropriate pest control measures, harvesting techniques etc.;
(e) proper post-harvest handling and storage - hardly any data on this are available;
(f) an infrastructure of roads, irrigation facilities, sales points for inputs, markets and stores;
(g) a sufficient number of people with the right managerial and technical knowledge and skills;
(h) a system to keep these people's knowledge and skill up to date.
(i) sufficient remuneration to attract people to vegetable growing.

6. Ways to increase Vegetable Production and Availability

(1) By the expansion of the acreage. As stated above, Senegal still has large areas which can be used for vegetable production. To satisfy the local demands, these areas must be able to produce crops both in the rainy season and the dry season. To satisfy the demands of the European market, these areas must be able to produce crops especially in the dry season, being the season which coincides with the winter season in Europe.

To realize production in the rainy it is necessary to deal eventually both with excess water (sometimes over only a rather small number of days during the season) and with a water shortage (again sometimes only for limited periods).

To obtain production in the dry season, one has to deal only with a water shortage.

(2) By higher yields per hectare. Yields of vegetables often remain below standard because of pests, diseases, low soil fertility, lack of water, and unskillful handling of the crop. Appropriate measures to take away the limiting factors are necessary.

(3) By reducing post-harvest losses. Losses due to deficiencies in on-the-farm storage, transportation and on-the-market storage, are often very high. (No quantitative data were available).

7. The Need for Vegetable Research

R Repeatedly in many countries research has been found to be essential in providing vegetable growers with good varieties, the right growing techniques, the best post-harvest handling techniques, etc. Research is also needed to guide growers in the economic and social (nutritional) aspects of vegetable production. Finally, research is needed to provide the planners and managers of infra-structural development projects with advice on how best to proceed with these projects.

8. Actual Versus Needed Vegetable Research

The mission considers orientation of present vegetable research in Senegal in general to be adequate. The mission was not in a position to judge whether the distribution of research time and funds over the different crops and problems studied was in accordance with their present importance.

COUNTRY REPORT: NIGERIA

1. Some Background Information

1.1 Geographical position and climate

Nigeria, a large-sized country (912,000 sq. km) in West Africa, extends from 4°25' to almost 14° latitude north and from 2°30' to 14°40' longitude east. Its tropical climate ranges from humid in the southwest to semi-arid in the north.

1.2 Agriculture

The majority of the population is engaged in agriculture, predominantly in the production of basic food crops for home consumption and for the national market: maize, sorghum, millet, rice, cassava, yams and others. The production of food and industrial crops for export is also important: groundnuts, oilpalm products, rubber, cotton, cocoa and others. Agricultural techniques used are mostly rather simple.

Farm holdings generally are small due more to the limitations of hand labour in handling a larger area than to a shortage of land resources. However, in certain areas almost all the available land has been taken into cultivation.

Farm productivity often is low due to low soil fertility, the limited use of manures and fertilizers, low-yielding varieties, the low level of phytosanitary measures, and the absence of mechanization. Drought and excessive rainfall also contribute to low farm productivity.

2. Places visited

In Nigeria the mission visited the following institutes:

a) The Department of Animal Sciences (DAS), University of Ibadan Ibadan ;
b) The Department of Applied Nutrition (DAN), University of Ibadan , Ibadan;
c) The National Fruit and Vegetable Research and Demonstration Centre (NFVRDC), Ibadan;
d) The Institute for Agricultural Research and Training (IART), University of Ife, Ibadan ; and
e) The International Institute for Tropical Agriculture (IITA), Ibadan.

Two members of the mission also visited the Kano River Irrigation Project in Kadawa.

Verbal and written information was received from several members of the institutions mentioned and also from the Institute for Agricultural Research of the Ahmadu Bello University, Samaru.

3. Vegetable Research, Production and Consumption

From the information obtained, the following conclusions could be drawn:

a) very small efforts have been given to research in vegetables on the agricultural aspects or otherwise, although some information has been accumulated particularly on the chemical composition and nutritional properties of vegetables;

b) a great deal of interest has developed in recent years. This is reflected in the creation of the NFVRDC and also in the organization of tomato and other vegetable sections at the IART in Ibadan;

c) in two interdisciplinary groups of the IART, some ten scientists provide a good basis to develop an important programme not only for research but also for teaching. The NFVRDC when fully operating, will have a total of 14 foreign experts and a similar number of Nigerians. In the field of nutrition, the two Departments at the University of Ibadan, mentioned above, can also provide good support for an important programme;

d) it seems that a more adequate mechanism for coordination of the national effort will give Nigeria a splendid basis for the development of required research and teaching to increase the production of vegetables;

e) all the persons consulted agreed that in Nigeria the contribution of vegetables to the diet is extremely important, not only with regard to minerals and vitamins, but also for the amount of protein and carbohydrates they provide;

f) the major interest of growing vegetables in Nigeria is for the consumption of the population, although export is also envisaged;

g) it is obvious that a large diversity of physical environments exists in Nigeria. These differing environments require the cultivation of numerous species of vegetables, and research in all the needed species will be practically impossible to promote immediately. To make a very simple and arbitrary division, it can be said that the northern part of the country, with a long dry season, is best adapted to grow species such as tomatoes and onions under irrigation, not only for local consumption but also for internal trading and for export. In the southern part of the country, where rains provide water for a longer part of the year, the cultivation of leafy and other native vegetables assumes much greater importance. The most common vegetables are several species of amaranthus and okra;

h) the consumption of leaves of cassava and sweet potatoes constitutes an important addition to the diet in the zones where these plants are grown - mainly in the south;

i) the leaves of certain trees that remain green for the largest part of the year are known to be used as vegetables and therefore increase the amount of food available particularly in the more dry areas during the dry season. It is not possible to determine, with the information available, just how important the leaves of these trees can be as part of the diet. However, all the persons consulted, with a knowledge of the subject, agreed that the contribution of the "tree vegetables" is very important and deserves more attention;

j) one of the limitations to research and development in vegetables is the small number of Nigerians with adequate training for these functions. This is not only true for scientists at all levels, but also there is a scarcity of people who are efficient in the art of horticulture;

k) the availability of native vegetables is plentiful during the rainy season. It declines thereafter, and during the extremely dry months virtually no vegetables are available. This indicates the need for research into the preservation of vegetables. Some attempts have been made to preserve the leafy vegetables by desiccation and it seems that adequate techniques can be developed that will be a substantial contribution to the provision of food during the dry season.

4. Details about the Places visited

4.1 Department of Animal Science, University of Ibadan

This Department, basically devoted to problems of animal nutrition, has extended itself to the area of human nutrition. Research analysis of many vegetables has been carried out and evidence found of the important contribution that vegetables can make to the diet, not only in minerals and vitamins, but also in protein and particularly in some of the essential amino-acids.

At least three senior scientists have devoted some time to studies of human nutrition and graduate students are accepted in the Department for MS and PhD degrees in nutrition. A paper recently presented at a national seminar on fruit and vegetables summarizes much of the work done in this field.

4.2 Department of Food Science and Applied Nutrition, University of Ibadan

This Department focusses on nutrition more from the medicinal point of view. It has information on some of the problems of malnutrition present in Nigeria. Cases of deficiency of vitamin A causing blindness have been reported. Professor Omolohi, Head of the Department, considers that in the case of vegetables a certain amount of the production is not consumed by the people because it deteriorates before it reaches the consumers.

Some figures obtained show that in recent years, as a result of the increase in the population, the consumption of rice has increased. However, the total consumption of vegetables remains the same. So, even though the situation changes, more problems due to the lack of vitamins and minerals are to be expected.

4.3 National Fruit and Vegetable Research and Demonstration Centre, Ibadan

This Centre was created in February 1974 with financial support from UNDP and the Federal Government of Nigeria. Staff is being recruited and very soon the construction of additional laboratories and other facilities will start on the land which has already been acquired. The total expenditure in construction, equipment, consultants and training for the first five years will be in the order of US$ 18 million. An additional amount will be provided to cover the cost of national staff and operational costs.

In addition to the headquarters in Ibadan, two sub-stations will be established; one in the north at Tiga, near to the Kano River Irrigation Project, and the other in Mbato Okigwe, in the East Central State in the south.

The professional staff at the Centre will be formed of 14 experts from FAO and several more national scientists and a secretarial group of nationals, some of whom are already working in Ibadan.

4.4 Institute of Agricultural Research and Training, University of IFE, Moor Plantation, Ibadan

This Institute has for some years been active in research and teaching, and has an important group of scientists dedicated to vegetable research: a total of about ten scientists of which four are involved in tomato research and the others to other vegetables. The group includes plant breeders, soils and chemistry specialists, plant protection specialists and nutrition specialists as well as horticulturalists.

The Institute has obtained much information on the native leafy vegetables, as well as the eggplant and related species also on the tomato. Some information has also been obtained on the diseases and insect pests of vegetables and their control.

In a preliminary report of the experimental work in progress, some figures are given of yields of Corchorus olitorius (a leafy vegetable), 1,186 kg/ha dry matter 857.5 kg/ha leaf dry matter (the consumable part), and 7.97 metric tons/ha fresh (marketable) weight.

For Amaranthus spp, the highest marketable yield of 33.82 mt/ha was obtained when 10 mt/ha of poultry manure was used.

4.5 Kano River Irrigation Project

This project is already in operation and expanding slowly. Vegetables are considered an important part of the rotation, and tomatoes are already planted on a large scale. The plans are that a total of 1,500 ha. of tomatoes will be planted in the future and this will be accelerated with the development of a processing plant.

In the area of the project, the sub-station of the National Fruit and Vegetable Research and Demonstration Centre will be located.

There is close association of this project with the Institute for Agricultural Research of Ahmadu Bello University at Samaru, and the scarce information concerning the growth of vegetables used up to now in the project comes from that Institute.

COUNTRY REPORT: INDIA

1. Some Background Information

1.1 Geographical position and regions

India, the second most populous nation of the world with some 600 million inhabitants, extends from 8° to 37° north latitude and from 68° to 97° east longitude. Of its total land area of 3.26 million square kilometres about half lies within the tropics.

Geographically, India can roughly be divided into three areas:

1. the north : the Himalayas, an area of high mountains;
2. the middle: the Ganges plain, rather flat;
3. the peninsula: forming the southern part, a plateau of varying height (300–1,000 m) bordered by mountain ranges.

Part of the Ganges plain and all of the peninsula lie in the tropical zone.

1.2 Climate

The climate of India is of the monsoon type, characterized by a dry and a wet season. In general, the dry season extends from November to April; this is the period of clear skies, low relative humidity, warm days and cool nights. April and May are the transition period, with increasing temperatures during both day and night, increasing relative humidity, and occasional rain storms. The rainy season lasts from June until October, and is both hot and moist. Geographical position and relief may cause variants in the above picture.

The onset, frequency and intensity of rainfall in the rainy season may show strong fluctuations from year to year. Late or low rainfall may result in crop failure in areas of rainfed agriculture.

1.3 Agriculture

Agriculture is the most important sector of India's economy. It employs 70 percent of the active population and contributes about half of the Gross National Product. About 150 million ha, i.e. 45 percent of India's land area, are devoted to agriculture. At present four-fifths of this area is only rainfed. The Government gives high priority to the increasing development of irrigation (so important both for reducing crop failure in the rainy season and making cropping possible in the dry season), but even with all the available water used for this purpose, there will still remain 90 million ha of rainfed land. These figures illustrate the importance of studies on both irrigation and "dry land" cropping.

Main food crops for subsistence and cash are rice, wheat, sorghum and several millets, and pulses. Oilseeds, cotton, tobacco, jute, tea, coffee, rubber and spices are important cash crops.

A large proportion of the farming population has smallholdings or is landless. Agricultural techniques are often simple and productivity is low. With the application of modern technology (which requires knowledge, skill, capital, and a massive input of energy, fertilizers and pesticides), India's agriculture is considered to be capable of reaching much higher levels of productivity.

2. Aspects of the Vegetable Business

2.1 The main vegetables

India is blessed with a wide range of vegetables. It had a very rich germplasm collection of vegetables from within and outside the country, under the supervision of well-established institutions. It is not easy to distinguish between indigenous and exotic vegetables, because many of the varieties were reportedly imported very many years ago and have adapted very well into the Indian environment, farming systems and diet. But it is estimated that out of the 45 or so vegetables grown commercially in India, most of them are introduced. The following are most probably indigenous: eggplant, the bitter gourds (Lageneria and Luffa spp.), and Dolichos lablab.

Most of the cultivated vegetables are the "fruity" types, of which the primary organs consumed are the fruits, such as the tomatoes, chillies and eggplant, melons and gourds, legumes (peas, pigeon pea, chick peas, French beans, cowpea, Dolichos) and okra. "Leafy" vegetables of various types are also very common, such as lettuce, cabbage, spinach, spinach beet and the amaranths. Cauliflower, onions, radish and carrot are also produced and consumed.

A host of other plants, especially trees and shrubs, which grow wild, semi-wild or "protected" for their edible value, provide additional sources of vegetables such as the drumsticks (Moringa oleifera), Agathi (Sesbania grandiflora) and bamboo. The sprouted seeds of some legumes (e.g. mung bean, soya beans) are consumed as vegetables.

2.2 The pattern of consumption

Although there is a dearth of published statistical information on this matter, the information available from the Indian National Institute of Nutrition 1/ and from discussions shows very interesting patterns.

It is estimated that the average per capita daily consumption requirements for vegetables is 235 g (leafy vegetables 110 g, other vegetables 125 g). But as of 1966-67 only 53 g was available for consumption per capita from national production. Apparently India imports some vegetables to supplement its requirements. The All India average per capita daily consumption is estimated at 92 g (leafy vegetables 21 g, others 71 g). Two facts stand out very clearly. Firstly, India produces much less vegetables than it needs. Secondly, the Indian people consume much less vegetables than they require.

Other features of the consumption pattern are noteworthy. Firstly, in any given location or social group there is very little difference in the amount of vegetables consumed in the vegetarian and non-vegetarian diet, both of which appear to be predominantly based on cereals, pulses and dairy products, with a sprinkling of vegetables. Secondly, much more vegetables are consumed by the metropolitan and urban than the rural population. Thirdly the types and quantities of vegetables consumed in India vary markedly from place to place and among different social groups.

The fact that the urban population eats more vegetables per capita than the rural population was repeated over and over again during discussions, and supported by two survey data of the Indian National Institute of Nutrition, e.g. in areas around Maharastra and Hyderabad. (Table (i) on p. xiii).

1/ "Diet Atlas of India", National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 1971.

Table 1.

Pattern of Vegetable Consumption in Rural, Urban and Metropolitan Areas in two Areas of India (g/capita)

Area		Metropolitan	Urban	Rural
Maharashtra 1		60	39	20
Hyderabad	Leafy	-	31	6
	Others	-	147	79

However, there were other opinions which contested the veracity of this pattern. The main basis of argument was that most of the people in the rural areas do not eat what may be termed the "elite" vegetables, such as the melons, gourds, lettuce, cabbages, etc., upon which the survey data may have been collected. It was pointed out that such "elite" vegetables are produced principally for the urban populations, whereas the rural people eat mostly what may be termed the "native" vegetables, many of which are collected from young leaves, flowers and fruits of wild, semi-wild and cultivated plants whose existence and consumption are largely ignored in surveys. The team was not in a position to verify the above. But in view of the fact that the same pattern was reported in Thailand and Indonesia, it would appear reasonable to maintain that more vegetables are eaten per capita by the urban than by the rural population.

It was further explained that in the rural areas people subsist mainly on the local breads eaten with cooked onions, chillies and salt. This is due partly to the fact that traditionally most farmers do not produce vegetables on their small farms and partly because they do not have the means to purchase available vegetables.

However, many are able to supplement their diet with vegetables collected from volunteer plants during the rainy season. But during the subsequent dry season, which may endure from upwards of six months, they do entirely without fresh vegetables. Some eat dried and otherwise preserved vegetables, or if and where available, pick the leaves, fruits and other edible parts of perennial trees and shrubs.

Thus, we see that there is a marked difference in the types and sources of vegetables eaten by the urban and rural population. However in both groups of the population vegetable consumption per capita is inadequate, range from zero to high depending on the state and socio-economic group.

Nutritionists stressed the important role which vegetables could be made to play in the diet of the rural masses. However, there is a general deficiency, especially Vitamin A, and also of Iron. As a short-term measure the Government is promoting the intake of large doses of concentrated vitamin A to 1-5 year old children. This is stored in the liver from where it is released to the body as needed during a period of 6-8 months. The dose is repeated every six months until the children are 5 years old.

Leafy vegetables could alleviate these deficiencies if consumed and this is seen as the long-term solution. For instance, although the intake of iron from other food sources is large, the availability to the body is low because of the combining phytates in the cereal diet. Vitamin C intake, which enhances the absorption of iron, is low. Unfortunately the rural population does not like to eat the leafy vegetables because of the low social value accorded to them. To achieve the desired long-term solution to the problems, much social work is required to popularise the consumption of leafy vegetables. It was suggested that first the people should be educated about their nutritional importance, followed by the dissociation of the low, social prestige value. Thereafter, the vegetable should be made available cheaply , (or in other words, let the people produce it).

2.3 The pattern of production

In all parts of India, most of the vegetables are produced by a myriad of small farmers. For convenience, we may distinguish three categories of farmers, namely, the principal producers, the more minor producers and those who do not traditionally produce vegetables in their farming systems.

In most parts the principal vegetable growers are congregated around the outskirts of the cities and the more immediate hinterland. From this position, they direct all their efforts to supplying vegetables to the urban population. It is also reported that from them supplies also filter through to the rural population further afield. Being oriented to the urban markets, the farmers produce mostly those vegetables that are commercially popular, such as the solanaceous plants, the cucurbits and legumes, and other vegetables that have acquired some social status of prestige - like lettuce and cabbages. Consequently, they pay little attention to the formal production of what may be described as the "native" vegetables that command low social and economic values - even though they may be more nutritive than the "elite" vegetables and are consumed by most of the rural population.

In general, most of the rural farmers further away from the urban centres produce little or no vegetables, partly because of inadequate land, transport and marketing facilities. By sheer force of circumstances and priority, they are compelled to grow only their staple food crops on their limited, smallholdings. In some cases, they grow vegetables on a small part of their land (home gardens) or as part of tested traditional farming systems, either mixed with the staple crops or as relays to them. This appears to be especially true for the solanaceous plants, the cucurbits and legumes. Traditionally, the native leafy vegetables are usually not grown as field crops, but where possible, are produced within the home garden systems. It is partly for this reason that international organizations like UNICEF are cooperating in MINIKIT promotion for home gardens.

Climate and soil constrain the production of vegetables to certain seasons and areas. Around Bangalore,for example with equable climate throughout the year, vegetables are produced more or less continuously but on the Deccan plateau vegetable production, like other crop production is very seasonal except in areas where the watershed has been properly managed (e.g. around Hyderabad) to conserve water in tanks (ponds) or where the rivers are available to provide water for irrigation. Generally water is scarce, especially in the interior and non-availability of water for irrigation places a big constraint on the continuous production of vegetables.

India produces much less vegetables than it needs. The estimated daily consumption requirements per capita of 235 gr are obviously not met by the internal production which made available only 53 gr in 1966-67 and 46 gr in 1970. The fact that the All India average per capita consumption is 92 gr indicates quite clearly that India must import much vegetables although this fact has not been verified. The production for 1966-67 was 1.98 million tons. The estimated requirements for 1975 were 53 million tons and the national target was to produce 12 million tons. This target posed a colossal challenge of increasing production six-fold in under ten years. Even if this target were to be achieved, India would still be producing less than one-quarter of its requirements. It is quite clear, therefore, that any national drive to promote vegetable consumption would be gravely constrained by availability, unless the miracle of green revolution occurs in India's vegetable production.

3. The Status of Vegetable Research

Research on tropical vegetables is organized in a number of institutions in India. The principal among these are (1) Indian Agricultural Research Institute (IARI), New Delhi; (2) Indian Institute of Horticultural Research (IIHR), Bangalore; and (3) several agricultural universities. In addition to the separate projects conducted by the above institutions, there exists an All India Coordinated Vegetable Improvement Project in which research is done

through a network of seven main centres and 17 other establishments, with the coordination cell located in the Division of Vegetable Crops and Floriculture, IARI, New Delhi.

In three institutions in Hyderabad, namely, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the Soil Conservation and Dry Farming Research Centre, and the Regional Centre of IARI, vegetables per se are not included in their research programmes, but some of their work on farming systems involves the use - and hence the partial study - of vegetable producing plants like chickpeas, pigeon peas, peppers and tomatoes.

Research work at the main centres such as IARI and IIHR is organized on a multi-disciplinary structure. In all cases, the objectives are to do comprehensive research on selected vegetables, with the usual aims of crop improvement through breeding, management and related activities. In this regard, important facts are noteworthy. Firstly, all research effort appears to be concentrated on those"elite"vegetables required for the urban population. Thus, the programmes are characterized by intensive work on the solanaceous plants (especially tomato and egg plant) and cucurbits. Less intensive,but still appreciable,work is done on cabbage, cauliflower, okra and some legumes especially cowpea and pea (Pisum). The "native" vegetables eaten by the rural masses are given scant attention.

Secondly, there is a generous pool of trained scientists which makes the staffing of individual projects easy, and concerted, multi-disciplinary effort possible in each selected crop. For instance, during the last five years, the All India Coordinated Vegetable Improvement Project involved 160 scientists. This has resulted in several achievements culminating in the development and release of some improved and disease resistant varieties of vegetables. Also considerable training programmes and facilities for advanced students exist in the various agricultural universities and at the IARI.

More specifically, research on diseases and pest control receives special attention along two lines namely, breeding for resistance and crop protection. More attention seems to be given to crop protection. Tomato, egg plant and okra receive special attention. The most common and serious tomato disease is the curly leaf virus, against which some resistant lines have now been developed. The yellow-vein mosaic virus of okra is very common, and the tolerance of varieties previously developed is breaking down. In egg plant Phomopsis blight and leaf curl ravage the crops and some resistant lines have also been developed.

The seed production industry is well organized in India through the National Seed Corporation and a network of certified seed growers. India produces all the vegetable seeds it requires - both tropical and temperate types. It does not import seeds and is itself reportedly trying to export some.

4. Places Visited.

In India the mission visited the following places:

a) Office of the Indian Council of Agricultural Research, New Delhi;

b) Indian Agricultural Research Institute (IARI), Pusa, New Delhi;

c) Regional Centre for the IARI, Hyderabad;

d) ICRISAT, Hyderabad;

e) Institute of Applied Nutrition, Hyderabad;

f) All India Coordinated Project for Dryland Agriculture at the Soil Conservation and Dry-farming Research Centre, Hyderabad;

g) Andra Pradesh University, Department of Horticulture, Hyderabad;

h) Indian Institute for Horticultural Research, Bangalore.

COUNTRY REPORT: THAILAND

1. Background Information

1.1 Situation and climate

Thailand, a country of 514,000 square km, lies to the north of the equator between 5°4' and 20° 30' latitude, and extends from 97° 30' to 105° 45' east longitude. The three seasons in Thailand are the hot dry season (February-April), the hot rainy season (May-October) and the cool semi-wet season (November-January). Thailand has a tropical humid climate influenced by the monsoon. Average annual rainfalls for the central, north, northeast and southern regions are 1,500, 1,300, 900, and 2,375 mm respectively.

1.2 Population

Thailand has a population of 41 million in 1975 of which 65 percent are engaged in farming. Its population density is approximately 80 persons per sq km.

1.3 Agriculture

The distribution of agricultural enterprises in Thailand can be shown by figures in Table i Paddy farming constitutes about two-thirds of arable land. Upland crop farming and fruit tree plantations rank second and third, in terms of area occupied. Only one percent of arable land is used for commercial vegetable growing, and no estimation has been made on the area for vegetable home gardening. Thailand's main agricultural exports are rice, rubber, maize and sugar.

2. Aspects of the Vegetable Business

2.1 Production and consumption

Like all the countries visited, vegetable production in Thailand falls into two main types - commercial growing and home gardening. Both types are popular and very well developed in the areas of adequate water supply. It was estimated that about two-fifths of total vegetables consumed in urban areas of Thailand are from the all-the-year-round vegetable producing farms. Thai people produce leafy green native vegetables in a considerable quantity but there is no way to quantify it. Main vegetables in Thailand, in order of importance are onions, garlic, cabbage, pepper, tomato, chinese kale and sugar pea. The total vegetable production for the country, expressed in terms of index numbers, for the years 1969, 1970, 1971, 1972 and 1973 is 100, 109, 120, 132 and 160 respectively.

Table ii illustrates percentages of both the quantity of vegetables consumed, and the amount of money spent for vegetables by the Thai people in 1963. These percentage figures are getting bigger and bigger for Thai people because they tend to consume more vegetables as prices of other food items continue to rise relatively higher than the vegetable prices. However, the present level of vegetable consumption for Thai people which is about 100 gr/day for Bangkok dwellers, and 55 gr/day for rural people is still far below the recommended daily requirement level.

Apparently rural Thai people consume native leafy vegetables to supplement their diets mainly in lieu of meat and other expensive food items.

2.2 Production techniques and marketing aspects

Production techniques of vegetables used in Thailand are traditional. Most of the work is done manually. However, in some commercial vegetable growing areas, highly developed techniques in water management, fertilizer application, insecticide and herbicide application, and harvesting are normally practiced. The vegetable marketing problems in Thailand are regarded as one of the constraints of the vegetable industry. Vegetable growers have to rely heavily on local dealers in marketing of their products. Most of the produce is handled on a fixed rate or fee basis. Dealers usually do not incur any losses. If prices go down, farmers have to take the losses. Growers are well aware of the advantages of group marketing of their produce but they are adverse to this because past experience has revealed serious faults due to the inefficient operation and poor management.

2.3 Vegetable species cultivated

These are listed in Table iii on page xx.

3. The Present State of Vegetable Research

In Thailand research on vegetables was started only recently. It is being done separately by three different parties, namely the Horticulture Division of the Ministry of Agriculture and Cooperatives, three agricultural universities and private seed companies.

The Horticulture Division of the Ministry of Agriculture and Cooperatives has confined vegetable research work to the following areas: 1) variety improvement, which is mainly dealing with breeding and selection; 2) regional trials on its 10 experimental stations located in different parts of the country; 3) stock seed production for supplying them to the Department of Agricultural Extension for further seed production and sale; 4) cultural practices; and 5) seed technology. Vegetables of their interest now include cucumber, tomato, pea (Pisum), chili, lettuce and chinese radish.

The university vegetable research work has been done by three agricultural universities, namely Kasetsart, Chiangmai, and KhonKaen. Every year, researchers from all three universities hold a meeting for discussion of the research work done, and for planning of future research effort. Out of this group, Kasetsart University has been involved in several vegetable research projects in the integrated form. Their main components are seed production and technology, breeding, cultural practices, soil fertility, plant pathology, entomology, toxicology, quality analysis and utilization and economics. Their integrated research programme is only two years old and for the first three years they have been concentrating on tomatoes, peppers, lettuce and peas.

Little work on vegetable research has been done by Chiangmai and KhonKaen University groups due to their limited research personnel and funds.

Vegetable research done by private seed companies is primarily concerned with seed production and little information is revealed to the public.

4. The Need for expanding Vegetable Production

It is realized that there is a need for expanding vegetable production in Thailand to be able to keep up with the increased demand resulting from growth of population, higher real disposable income, and the relative increase in prices of other food items such as pork, beef, chicken and fish. The vegetable production expansion could be in both types of vegetables namely, the introduced, and the native vegetables.

5. The Need for More Research on Vegetables

Presently the extent of research work on vegetables in Thailand is very small compared with that on other crops such as rice and maize. This situation has arisen due to the small number of scientists engaged in, and the limited budget in support of, vegetable research. Clearly there exist areas of vegetable research to be urgently dealt with and these include breeding, seed production and multiplication, cultural practices, and cropping systems. In short more attention should be paid to initiating and supporting the research work on vegetables so that the country can move ahead with the plan for expanding vegetable production.

6. Concluding Remarks

Although Thailand is one of the tropical countries which has favourable conditions for vegetable growing, research on these crops has received little attention from the Government and authorities concerned. It is only recently that vegetable researchers all over the country got together and organized themselves as a group to help develop the vegetable industry. The success of the group and the future of Thailand's vegetable industry will depend upon the appropriate planning and support by all parties concerned.

Persons Consulted

1. Director of the Horticulture Division, and Head of Vegetable Branch, Department of Agriculture, Ministry of Agriculture and Cooperatives.
2. Rector, Vice-Rector for Academic Affairs, Assistant Vice-Rector for Academic Affairs, Dean, Faculty of Agriculture, Dean, Faculty of Economics and Business Administration, and Director of Research, Kasetsart University.
3. Administrators and researchers at Kasetsart University Vegetable Research Centre.
4. Director and Assistant Director, Institute of Food Research and Product Development, Kasetsart University.
5. Drs. D.L. Umali, Sala Dasananda, D.H. Parish, Bhakdi Lusanandana, and S.D. Chaudhuri, all of the FAO Regional Office for Asia and the Far East.
6. Dr. G. Schütz, SAA/FAO Country Representative in Thailand and Mr. Thomas F. Power Jr., UNDP Regional Representative.
7. Agriculture officers and researchers of Maejo Agricultural Experiment Station, Chiangmai.
8. Dean, Faculty of Agriculture, Drs. Vichian Pusavang, Manu Sitisarn, Earl Kellogg and Dawson of Chiangmai University.
9. Mr. Sawaeng Tadtiang, a vegetable farmer in Chiangmai.
10. M.R. Chaktong Tongyai, President, the Thai Agricultural Science Association, under the King's patronage.
11. Dr. F. Haworth, Coordinator of Plant Production Research in Thailand (UNDP/FAO).

Table i.: Utilization of Arable Land of Thailand by Region, 1971
(unit: 1 000 ha)

Region	Total Arable Land	Land Use						
		Housing area	Paddy land	Upland crops	Fruit trees	Vegetable and flower	Wood land	Others
Northern	2 878	115	1 971	620	72	29	55	14
Northeastern	6 856	170	5 383	754	80	48	34	78
Central	1 289	31	977	197	39	13	6	25
Eastern	1 131	27	661	130	200	9	36	69
Western	1 180	39	705	154	118	52	68	42
Southern	1 889	42	682	35	999	9	57	65
Total	15 223	425	10 380	1 890	1 508	160	565	294
Percent	100	2.8	68.2	12.4	9.9	1.0	3.7	1.9

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Bangkok

Tableii: Percentage of Average Quantity and Average Expenditures of Selected Food Consumed Per Capita in a 7-day Period, Thailand, 1963

Item	Quantity		Expenditure	
	Town	Village	Town	Village
Rice, cereals and flour products	61.5	73.9	27.7	35.7
Meats	7.6	3.0	20.9	17.6
Poultry	1.6	1.0	2.9	0.1
Fish and sea food	5.9	4.2	15.3	14.1
Vegetables	14.0	7.8	11.3	11.1
Fresh fruits	6.5	6.6	6.9	5.6
Eggs, milk, fats, oils, sugar, spices	2.9	3.5	15.0	15.8
Total	100	100	100	100

Source: Household Expenditure Survey B.E. 2506, National Statistical Office, Bangkok, 1963.

Table iii: Types of Vegetable Crops commercially grown in Thailand

1. Perennial Crops

Asparagus : (*Asparagus officinalis*)

2. Potherbs or Greens

Spinach : Chinese type (*Spinacia oleracea*)
Basil : (*Ocimum basilicum*; *O. sanctum*; *O. canum*)
Coriander : (*Coriandrum sativum*)
Summer Chrysanthemum : (*Chrysanthemum coronarium*)

3. Salad Crops

Celery : Chinese and European type (*Apium graveolens*)
Lettuce : (*Lactuca sativa*)
Corn : Sweet corn (*Zea mays*)
Parsley : (*Petroselinum hortense*)

4. Cole Crops

Cabbage : (*Brassica oleracea* var. *capitata*)
Cauliflower : (*B. oleracea* var. *botrytis*)
Broccoli : (*B. oleracea* var. *italica*)
Brussel Sprout : (*B. oleracea* var. *gemmifera*)
Kohlrabi : (*B. caulo-rapa*)
Chinese Cabbage : (*B. pekinensis*, *B. chinensis*)
Leaf Mustard : (*B. juncea*)
Headed Mustard : (*B. juncea* var. *rugosa*)
Kale : Chinese type (*B. albograba*)

5. Root Crops

Radish : (*Raphanus sativus* var. *longipinnatus*) : Chinese and Japanese type
Carrot : (*Daucus carota*)
Ginger : (*Zingiber officinale*)
Colocasia : (*Colocasia antiquorum esculentum*)
White Potato : (*Solanum tuberosum*)
Sweet Potato : (*Ipomoea batatas*)

6. Bulb Crops

Onion : (*Allium cepa*)
Shallot : (*A. ascalonicum*)
Garlic : (*A. sativum*)
Chive : Chinese chive (*A. tuberosum*)

7. Peas and Beans

Sugar Pea and Edible-podded Pea : (*Pisum sativum*)
Yard Long Bean : (*Vigna sesquipedalis*)
Snap Bean : (*Phaseolus vulgaris*)
Cow Pea : (*Vigna sinensis*)
Wing Bean : (*Psophocarpus tetragonolobus*)

8. Solanaceous Fruits

Tomato : (Lycopersicum esculentum)
Egg Plant : (Solanum melongena) and many native varieties
Chili - Peppers : (Capsicum frutescens : C. annuum) and many native varieties

9. The Cucurbits

Cucumber : (Cucumis sativus)
Musk Melon : (C. melo)
Water Melon : (Citrullus vulgaris)
Pumpkin : (Cucurbita pepo)
Squash : (Cucurbita maxima)
Luffa : (Luffa cylindrica; L. acutangula)
Bitter Gourd : (Momordica charantia)
Coccinia : (Coccinia indica)

10. Miscellaneous Crops

Okra : (Abelmoschus esculentus)
Roselle : (Hibiscus sabdariffa)
Water Convolvulus : (Ipomoea reptans)
Nymphea : (Nymphea lotus)
Acasia : (Acasia insuvis)
Spices : vanilla, ginger, cardamom, cumin, coriander, cloves, black pepper, mints, basil
Bambo Shoot
Mushroom
Neptunia : (Neptunia oleracea)
Manchurian rice : (Zizania latifolia)

is much smaller,& although no exact data on this number are available, one can estimate it to be 1 to 2 million, in view of the generally small size (often less than 0.5 ha) of the growers' enterprise. Vegetable plantations are very rare.

Commercial production is geared towards sale of non-processed vegetables in nearby towns. The inter-island or export trade of such vegetables is as yet relatively unimportant. Production for processing purposes is very limited. The main processed product is dried peppers. The most important centres of commercial vegetable production are found in Java. The hills supply the highland vegetables (notably potatoes, cabbage, Chinese cabbage, garlic and French beans), the plains around the cities the bulk of the lowland vegetables (the green leafy ones, several species of beans, most cucurbits, shallots and capsicums).

2.2 Production and marketing patterns

These are generally rather simple but they may give produce of a good quality. As with other forms of food farming, the cultivation of vegetables is generally done by hand from soil preparation to harvesting. This is due to an abundance of available labour at low prices. (The daily wage of unskilled farm labourers is often less than half a U.S. dollar). Farmers appreciate the value of proper varieties, good seed, care in growing, fertilizers, irrigation and chemical pest control.

Marketing techniques do not involve sophisticated equipment, except for motor vehicles for long distance transport . The marketing channels range from a direct link between producer and consumer to a system involving several intermediaries

2.3 Vegetable species cultivated

Besides the species named already in Table i , many other species are cultivated, albeit on a smaller scale. Some of these are: Amaranthus spp.,and Celosia argentea, Basella spp., red beets, lettuce, sweet potatoes (used both for their roots and tops), cassava (for its leaves), cauliflower, a dozen cucurbits (mainly for their fleshy fruits), several Dioscorea yam species (for their roots), bamboo species (young sprouts) and water convolvulus.

The group of "other beans" in Table i includes lima beans, Dolichos beans, sword beans, and various types of cowpeas. A number of vegetables is obtained from the leaves, fruits and seeds of trees: e.g. the papaya (young fruits), Moringa oleifera (pods and leaves), Parkia speciosa (pods), and Tamarindus indicus (pods).

A list of all the species used as a source of vegetables would include several hundred items. It can be said in conclusion that Indonesia is able to produce a very rich diversity of vegetables.

4. Present State of Vegetable Research

Apart from small contributions made by university departments of horticulture and and by some growers, all vegetable research is carried out by the "Lembage Penelitian Hortikultura" (LPH), the Horticultural Research Institute of Indonesia. The Institute, formerly under the Directorate-General of Food Crop Agriculture in the Ministry of Agriculture, now comes under the Agency for Agricultural Research, an institution within the same Ministry now supervising all aspects of research within the Ministry, i.e. pertaining not only to crops, but also to livestock, fisheries and forestry.

The LPH works on three branches of horticulture, viz. , on fruit crops, vegetables and ornamentals. For its work the LPH has a head office in Pasarminggu and several branches and field stations in West Java, East Java and North Sumatra.

Most of the present vegetable research work is devoted to Irish potatoes, white cabbage, tomatoes, hot peppers and French beans with variety testing, spacing and fertilizer trials and chemical pest control, the main research topics. Some attention is paid to Chinese cabbage, garlic, shallots, leaf onions, cucumbers, cowpeas, lettuce and maize. The important lowland vegetables, including amaranthus, water convolvulus, various gourds and different beans are at present left out of consideration. The LPH is aware that the latter crops need more attention; a shortage of staff is said to be the limiting factor.

4. The Need for an Expansion of Vegetable Production

The Government of Indonesia considers the expansion of vegetable production as one of the goals to be realized in the present, second five-year plan (1974-8). The aim of expanding the production of vegetables is fourfold:

a) to increase the income of the vegetable growers;
b) to increase the amount of employment;
c) to improve the nutrition of the people;
d) to increase exports.

The mission had insufficient time to discuss all these aims in their quantitative aspect with Government planners. From limited discussions held, the following points emerged clearly: nutritionists and nutrition improvement planners repeatedly stressed that cases of protein-calorie malnutrition (PCM), vitamin A deficiency and iron deficiency are widespread. Part of these cases are due to ignorance or reluctance with regard to the use of available food sources, including vegetables. An important part however is due to the non-availability of these food sources.

On a short-term basis, Fe and vitamin A deficiencies will be attacked by governmental salt fortification and high dose intake programmes, respectively. The long-term solution must come from increasing the availability of foods high in Fe and vitamin A. In this respect, vegetables, in particular the dark green leaves and the fruits and tubers rich in carotenes (such as tomatoes and yellow sweet potatoes) will be promoted.

As to PCM, much emphasis is placed on increasing the production of crops typically rich in calories and proteins, i.e. the cereals and pulses. It is realized however that leafy vegetables especially constitute an important source of supplementary protein.

The economists stressed that vegetables in several areas of Indonesia are the main cash earners and the main sources of employment. Crops like garlic and shallots were particularly large absorbers of hand labour. They also stressed that there is a demand for certain types of vegetables such as cabbage, shallots and peppers in foreign countries.

The mission found agreement with the several arguments raised in favour of an expansion of vegetable production.

5. The Need for More Research Work on Vegetables

The required expansion of vegetable production must come either from increased yields per ha or an expansion of area or a combination of both. The expansion should go hand in hand with raising the net profit to be made on vegetable growing so as to attract growers to this business, and with lowering the retail price of vegetables so as to make them available to more consumers. It was generally realized in Indonesia that,at least in already heavily populated Java, preference should be given to increasing yields per ha.

Much emphasis was rightly put on the important role of research in improving present production techniques, including the use of improved varieties. Besides research, attention was also given to extension, the provision of inputs, and improved marketing.

The need for more vegetable research is being met by an expansion of the research staff and facilities in West Java with the assistance of the World Bank. Most of this assistance will go to research on highland vegetable crops.

Notwithstanding this advance the mission felt that the important factor of lowland vegetable crops, to which belong many nutritionally important crops like green leafy vegetables and beans, as well as the important cash earners, peppers and shallots, should not be neglected.

6. Concluding Remarks

Indonesia and in particular Java has a rich variety of ecological conditions favouring the production of a wide range of vegetables. Labour is plentiful and cheap, at least in Java. There is a good tradition of vegetable production, both on the home and the commercial scale. With the favourable prospects for economic development, incomes are likely to rise in the forthcoming years and more people will be able to afford to buy vegetables. Stimulated by an educational campaign, vegetable consumption is likely to rise.

Research is needed to improve the yields and the economic return on vegetables, both necessary for a growth in the vegetable supply. While highland vegetables already get research attention, lowland vegetables are, until now, a neglected field. As far as conditions in Indonesia are concerned, international research should fill in part of this gap.

Persons Consulted

1. Staff members of the highland vegetable breeding, pathology and agronomy stations of the LPH in Cipanas, Segunung and Margahaya.

2. The Director and some staff members, LPH, Pasarminggu.

Table i Area of Commercialized Vegetables (in 10^3 ha) in Indonesia in 1973

	All Indonesia	Java	Sumatra
Shallots	39.0	26.9	4.3
Red peppers	110.9	90.9	14.8
Cucumber	30.1	23.7	4.3
Egg plant	118.5	85.1	25.0
Other lowland vegetables	384.3	320.0	20.4
Potato	21.8	16.2	4.2
Cabbage	19.3	15.4	3.1
Chinese cabbage	12.4	7.1	3.7
Tomato	13.1	7.4	4.1
White radish	3.2	2.1	0.9
French bean	6.1	3.3	2.2
Leaf onion	7.7	5.5	0.9
Carrots	3.4	2.3	0.9
Garlic	5.9	3.0	0.8
Other beans*	222.7	194.2	6.7
Other highland vegetables	54.3	42.3	3.4

* Whether this refers to beans grown as a dry pulse or for their green pods or seeds still needs to be established.

Table ii Production of Commercial Vegetables (in 10^3 ha) in 1973

Shallots	173.8	117.5	22.0
Red peppers	302.1	254.5	35.7
Cucumber	174.6	123.3	26.0
Egg plant	118.5	85.1	25.0
Other lowland vegetables	348.3	320.0	20.3
Potato	173.1	131.6	37.9
Cabbage	224.7	157.2	61.3
Chinese cabbage	85.3	38.3	40.0
Tomato	60.4	23.0	32.2
White radish	18.7	10.1	8.0
French bean	22.6	14.1	7.0
Leaf onion	30.3	19.7	4.6
Carrots	27.2	16.9	9.3
Garlic	20.4	12.1	0.9
Other beans	308.4	278.0	16.4
Other highland vegetables	206.4	174.8	9.4

COUNTRY REPORT - KENYA

The terms of reference of the mission did not include Kenya, but taking advantage of a stopover in this country, some brief interviews were held. The information obtained can be summarized as follows:

1. In Kenya vegetables are of great importance for export and also for national consumption.

2. A special programme has been set up, i.e. The Horticultural Crops Production and Marketing Project, financed by UNDP, FAO and the national Government, to help the already existing Horticultural Crop Development Authority (HCDA) to promote the production of vegetables, fruits and flowers.

3. There is only one small experiment station in the country dedicated partly to vegetable research. A project has been submitted to UNDP to reinforce this station, but no final decision has been reached in this respect.

4. The consumption of vegetables for the nationals is expected to grow as fast as the increase in the growth of population. The production for export is also expected to grow mainly because of the increasing demand in Europe and the existence in Kenya of the climatic conditions which enable them to grow the vegetables required in Europe. Finally there is a growing demand for processing vegetables by the several factories which have been set up in recent years.

5. Very little attention has been given to native vegetables, but it is recognized that they make an important contribution to the nutrition of the people of lower incomes.

* * * * *

APPENDIX II

DETAILS OF THE MISSION

Terms of Reference

The objective of the mission is to review and evaluate the present situation of tropical vegetable research in selected countries of Asia and Africa from the economic, nutritional and social points of view, as a basis for determining the needs for, and likely benefits from, further internationally sponsored strengthening and coordination of research, either through the establishment of an international centre, a network or networks, or any other mechanism which, in the opinion of the mission, would serve to achieve the desired results.

In particular the mission will:

i) Review the present state of vegetable research in the countries and regions visited;

ii) Evaluate the economic and nutritional contribution of vegetables to those countries;

iii) Identify the principal crop species and problems to which additional research effort needs to be directed, and from which most rapid benefits might be expected as a guide to priorities;

iv) On the basis of the above findings to decide on the needs for additional internationally supported research;

v) In the event that an international effort is considered justified on technical, economic and social grounds, to recommend the organizational form and location(s) of any such effort; bearing in mind the location and mandates of other internationally supported research institutions, including the AVRDC;

vi) To recommend what supporting action might be required in infrastructural fields such as extension, marketing, price policies, etc., and whether other external assistance in those fields would be an essential complement to the research proposed.

On completion of its enquiries the mission will report to the Chairman of the TAC. It is understood that the mission shall make no commitments on behalf of its sponsors, the Technical Advisory Committee, or the Consultative Group on International Agricultural Research.

Members of the Mission

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Professor Chamnien Boonma
Department of Agricultural Economics
Kasetsart University
Bangkok, Thailand

Itinerary

11.11.75	Mission arrived in Rome
13.11.75	Mission departed Rome and arrived Dakar, Senegal
19.11.75	Mission departed Dakar and arrived Lagos, Nigeria
23.11.75	Mission departed Lagos and arrived Nairobi, Kenya (overnight stop)
24.11.75	Mission departed Nairobi and arrived Bombay, India
28.11.75	Mission departed Madras and arrived Bangkok, Thailand
06.12.75	Mission departed Bangkok and arrived Djakarta, Indonesia
10.12.75	Mission departed Djakarta and arrived Singapore en route to Rome

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THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

of

THE THIRTEENTH MEETING OF THE TECHNICAL ADVISORY COMMITTEE

TAC SECRETARIAT
FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS

Rome, 1976

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I N D E X

NOTE

The following summary incorporates the summing up made by the Vice-Chairman, Dr. M. S. Swaminathan, at the close of the 13th TAC Meeting. Part I was presented in draft to the members of the TAC and has been amended to reflect their comments. Part II has been prepared by the Secretariat on the basis of the summing up and the closed session discussions on the Centres' programmes.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Part I. New and Continuing Items

CIMMYT Quinquennial Review (Agenda Item 3)

1. The preliminary draft report of the Quinquennial Review of CIMMYT indicates that the Review Panel has by and large extended support to the basic research strategies and approach of CIMMYT. The accomplishments of CIMMYT in the improvement of bread wheat, durum wheat, Triticale, maize and barley are indeed impressive. The programmes are dynamic and and production-oriented. CIMMYT has devoted its attention with single-minded devotion to the improvement of the production of wheat and maize. It has developed the world's largest programme in Triticale and the Panel has recommended that the Triticale programme should become a part of the core activity of CIMMYT. Also, the IBPGR should recognize CIMMYT as the repository of germplasm of Triticale. TAC supports these suggestions.

2. The Panel has recommended that the barley work of CIMMYT should continue and that close linkage should be established with ICARDA after the new institute becomes operational. CIMMYT, however, is not in agreement with the view of the Panel that it should restrict its responsibility as regards barley mainly for the highlands of Latin America, once ICARDA is established. TAC felt that practical ad hoc cooperative arrangements should be negotiated in due course between CIMMYT and ICARDA similar to those already established by CIMMYT with other centres.

3. The Panel did not entirely agree with the major stress laid on breeding cereal varieties for general adaptation in contrast to adaptation to specific agro-ecological conditions. TAC feels, however, that CIMMYT's operational procedures permit national programmes to breed varieties for specific as well as general adaptation. Hence, the differences in viewpoint seem to be more apparent than real. The Panel also considers it desirable that CIMMYT should further intensify research on breeding lines of durum wheat, barley and maize for cultivation under marginal conditions of management.

4. The Panel has suggested the more intense use of trainer's training programmes and the use of postdoctoral fellowships for training research leaders from cooperating countries. TAC is in agreement with these suggestions.

5. Members of TAC desired that the Panel in its final report should give more information on the following aspects:

a) the recent research contributions and overall policy of CIMMYT, and in addition, the findings of past review missions;

b) the nature of constraints, if any;

c) quarantine arrangements made to ensure that the extensive seed exchange undertaken by CIMMYT does not lead to the unconscious dispersal of seed-borne pathogens;

d) its judgement on the adequacy of physiological and socio-economic research;

e) the relations among international centres such as those between CIMMYT and IITA/CIAT, as well as with national research centres should be spelt out in more detail. CIMMYT and IRRI could develop collaborative arrangements on breeding suitable lines for the rice-wheat rotation which is becoming important in South Asia. The extension tasks of CIMMYT should be described and the degree to which CIMMYT is involved in developmental projects should be indicated.

f) the conclusions of the report should include the specific recommendations made in the main body of the report in order to leave no ambiguities regarding the views of the Panel.

6. TAC viewed with concern the hardship caused to CIMMYT due to inadequate cash flow. It will again stress upon CGIAR the necessity for ensuring orderly cash flow according to approved budgets so that the Director-General and senior staff of the institute can concentrate on implementing the research and training programmes of the institute effectively.

7. The Panel also supports the principle of CIMMYT's regional services programme. There has, in the past, been some misunderstanding on the purposes and extent of this programme which has, as its principal thrust, the strengthening of CIMMYT's own research and as an important by-product building up national research capacities in collaborating countries. If possible, the TAC would like the Chairman and one or two members of the Review Panel, including the Secretary, to visit one of these programmes in North Africa or in the Middle East to gain firsthand knowledge and to report more fully to the Committee on how these regional services are being planned and implemented.

8. TAC members were invited to send to the TAC Secretariat written comments on the preliminary draft before 30th May.

Water Buffalo Research (Agenda Item 4)

9. It was recalled that two countries of Asia, Philippines and Pakistan, had both proposed to the TAC, and had offered to host, an international centre for water buffalo research. A UNDP/FAO Asian Regional Survey had further confirmed the needs and interests of the countries of the region in this field and had proposed an international cooperative buffalo research programme. TAC had then decided to call an expert consultation on the subject in order to reach some conclusions on research needs and ways in which these could be met.

10. The consultation, held in March, 1976, recommended that an international effort be made to strengthen water buffalo research through the establishment of a cooperative network of national programmes. Within this network, some participating national institutions with relatively advanced expertise could be assigned regional responsibilities for leading the joint research efforts in specific programme areas. The network could be guided either by an international board or a steering committee, including representatives of the national and international institutions involved. A coordinating unit and a documentation centre would service the network. It was proposed a locate the coordinating unit in Bangkok, Thailand and the documentation centre in SEARCA, Los Baños, Philippines.

11. The consultation recommended that the project be executed through FAO, and further suggested that FAO consider making full use of the mechanisms provided under its Regional Animal Production & Health Commission for Asia, Far East and Southwest Pacific of the proposed international board of the network, the participating national institutions could ensure that the international network programme would respond to their needs for buffalo research and development.

12. While confirming the need for an international effort for water buffalo research, TAC made the following specific comments on the proposal:

1) The scope of the international effort could be viewed either as that of an international coordinating unit servicing a research network of national programmes or that of a decentralized institute. For the time being, TAC proposed a step-by-step approach starting with a preparatory phase for one year during which time the detailed plans for wider scale operations will be proposed. The preparatory phase would also permit the Committee to strengthen or adjust its viewpoint on future operations.

2) The type of research carried out through the network should be production-oriented and should take due account of the actual capabilities and development needs of the national institutions involved.

3) Close coordination should be ensured both within the network and outside it, in particular with several international centres, particularly ILCA, and with programmes such as the Agricultural Information Bank of Asia operated by SEARCA in liaison with the AGRIS Programme of FAO.

4) Concern was expressed about the possible risk of dispersion of activities in a cooperative network involving several national institutions. The proposed scheme would, however, have the advantage of maintaining close links between research and national development programmes, providing that the development plans of the countries concerned, and especially their objectives, were further examined during the elaboration of the cooperative programme, by a Programme Committee. TAC felt that this would be a more appropriate mechanism than an international board.

5) Donors might wish, in a second phase, to provide direct bilateral assistance to the national programmes involved, as part of the larger support needed. The budget for the second phase is thus purely indicative.

13. TAC recommends to the CGIAR that an International Cooperative Buffalo Research Project (ICBRP) be established as follows:

(1) The proposed ICBRP would be as described in the project document.

(2) The Project would initially involve seven countries (Egypt, India, Indonesia, Pakistan, Philippines, Sri Lanka, and Thailand) which collectively have some 70 percent of the world's buffalo population. However, as the Project developed additional countries may be brought into the programme of cooperation.

(3) The International Coordinating Unit would be located in Bangkok, Thailand.

(4) In preparing the Plan of Operations of the Project, the International Coordinating Unit should be assisted by a Programme Committee consisting of 4 members to be nominated by the Chairman of TAC and by FAO.

(5) The International Buffalo Documentation Centre would be integrated with the Agricultural Information Bank of Asia (AIBA) which is operated by SEARCA (Los Baños, Philippines) and which is currently linked up with the AGRIS network of FAO.

(6) FAO should be approached regarding its willingness to act as Executing Agency in respect of the Project. It is further suggested that FAO be asked to consider making full use of the mechanism provided by its Regional Animal Production and Health Commission for Asia, the Far East, and the Southwest Pacific (RAPHCAP) in the implementation of the Project.

(7) It is proposed that the support to the IGBRP be phased as follows: a preparatory phase in year 1, and an establishment phase in years 2 and 3. It should be stressed that the proposed budget for the establishment phase is purely indicative and would be prepared in more detail during the preparatory phase. In year 3, a review mission should be mounted to take stock of the progress made and to develop concrete plans of action on a longer-term basis.

(8) The proposed budget for year 1 amounts to $232,400 and its breakdown is shown in Appendix A, and indicative figures for years 2 and 3 are shown in Appendix B to the project document **attached hereto as Annex I.**

Priorities for Research (Agenda Item 5)

14. The revised Priorities paper was generally endorsed by TAC members and was commended for clearly enunciating the views on priorities developed at previous TAC meetings.

In developing its statement on priorities, TAC has kept the following basic considerations in view:

(1) The highest priority should be accorded to the improvement of food production and availability in the developing countries;

(2) Priority should be given to research which can increase the purchasing power of landless peasants and marginal and small farmers so that they will be in a position to buy the needed quantities of food;

(3) Since the funds available for supporting international agricultural research will not be unlimited, TAC's exercise in developing priorities cannot just be a compilation of major research gaps but should be one which is capable of contributing most towards achieving the two objectives listed above within the funds available.

15. Seen in the above context, TAC reiterates that its first priority will go to the improvement of crops and animals which provide most of the calories and proteins in developing countries. For this purpose, cereals, food legumes, and crops giving starchy products like potatoes, cassava, and other tubers should continue to receive priority attention. TAC notes that among legumes, satisfactory arrangements for organizing international agricultural research have been made for all crops except soybean. Similarly, in major starchy products, a crop which may deserve international attention is plantain (banana).

16. Among farm animals, ruminant livestock has received specific attention from TAC, leading to the establishment of ILCA and ILRAD in Africa. TAC has been interested in stimulating research on water buffalo and is now ready to make a specific recommendation to CGIAR. One other farm animal which may deserve closer examination is the goat. Goats are used extensively by poorer people in many developing countries as a source of milk, meat, and fur.

17. Aquaculture technology, leading to increased production of fishes, has also been considered by TAC as a priority area of research. A TAC-sponsored Working Group had given useful recommendations resulting in support being extended to a few projects by some bilateral donors, e.g. IDRC.

18. TAC hopes to make further concrete recommendations to CG at its next meeting.

19. Among future priorities, TAC considers that research on climate-soil-water-plant relationships is important since such research would be essential for promoting the scientific intensification of farming. Another area which will need increasing attention is post-harvest technology, particularly aspects such as drying, storage, and marketing of farm produce by small farmers. Rodent control and other allied aspects of safe storage of grains in rural homes will also have to receive increasing attention, since a match

between production and post-harvest technologies is essential for farmers to derive full benefit from increased production.

20. Among second order priorities, vegetables , tropical fruits, oil seeds, and cotton deserve consideration. Among oil seeds, coconut in particular deserves attention since it is a very important crop both from the food and income points of view in several countries and is at present suffering from some serious disease problems. Farm forestry is also an important area but has not been assigned by TAC a high priority for international research since success in this area will depend to a great extent on the public policies of national governments and the amount of community effort generated for the planting and saving of trees. TAC, however, considers that the collection and conservation of the germplasm of tropical forest tree species is an urgent task and should receive attention.

21. TAC believes that socio-economic research, in particular the analysis of constraints and consequences relating to new technology is an exceedingly important adjunct of biological and technological research. Similarly, research on applied nutrition, mico-analysis of agro-ecological problems, and a study of individual factors of production will be important. This is why TAC has supported the establishment of the International Fertilizer Development Centre and the International Food Policy Research Institute and has been urging the optimum use of the expertise developed at the International Centre for Insect Physiology and Ecology.

22. Another instance where factor-oriented research may be necessary is the improvement of the efficiency of managing irrigation or rainfall water on the farmer's field. Recent studies in soil-plant-water relations suggest that significant water savings can be made (in crop production) through carefully controlled applications of water to the root zone of the plants. Such findings may have great implications for the future development of a highly productive agriculture throughout the world. The TAC has given careful attention in the past to the research needs of improved crop water management. The TAC's earlier reviews pointed to large gains in water use efficiency that can be made by appropriate development investments in the improvement of major and minor national irrigation systems, gains that did not require additional research, merely the application of known technologies. However, the TAC is aware that limitation of crop moisture is often the major factor holding farm yields at low levels. For this reason, it is concerned with worldwide research activities on water as an input to crop production. The Committee pays particular attention to the impact these activities might usefully have for the work of the international centres and the CGIAR. Should the Committee find that new research opens opportunities for further investigations, either at existing international centres or through other institutions, it will not hesitate to commend such work to the CGIAR. For the present, the TAC has urged all international centres to accord water management an important place in their research programmes.

23. One other aspect of factor-oriented research that has received little consideration in the past is the matter of pre-harvest crop losses from large pests such as locusts, birds and rodents. The TAC is aware of the magnitude of these losses, but it has not yet given consideration as to how these losses might be reduced as a consequence of appropriate research. For the time being, IARD's are encouraged to investigate protection from the depredations of pests as part of their general work on plant protection. But such work is often inadequate in relation to the magnitude of the problem. The TAC recognizes that more specific research may have to be undertaken at the international centres or through separate arrangements with specialized institutions such as the International Centre for Insect Physiology and Ecology (ICIPE) in Kenya. In the course of its future work, the TAC will examine this problem in greater depth.

24. While international centres may not themselves undertake basic research, it is important that they stimulate basic research relevant to applied field problems. Also, some proportion of research investment should be devoted to the creation of new technologies for the future. In this respect, research relating to all aspects of production physiology, nitrogen fixation, phosphorus recycling, and non-conventional sources of animal nutrition will have to receive high priority. For this purpose, international centres could stimulate appropriate studies in universities and national research institutions and collaborate with suitable institutions located in both developed and developing countries.

25. While TAC has been concentrating mainly on areas of research which lend themselves to international effort, it is conscious that in order to derive full benefit from international agricultural research, there have to be strong national research and development programmes. TAC hopes that the CGIAR Review Committee would discuss this matter with the CGFPI and develop suitable mechanisms for promoting and supporting national research.

26. Members of TAC suggested the following specific amendments to the Priorities paper:

(1) The financial annex should be omitted since such projections tend to become out of date very quickly;

(2) The water management aspect should be expanded within the chapter on factor-oriented research;

(3) Instead of using the term "lower priorities", "other areas of concern" may be used;[1/]

(4) Cotton is important but should not be given a high priority. The paragraph related to cotton research should be suitably reworded.

1/ As the term "other areas of concern" might lead to some confusion with the subsequent chapter heading vi) "Important fields of research not assigned specific priorities," the term "other priority areas" has been employed by the Secretariat instead, in the first version of the document.

Immediate Tasks for TAC Arising from the Priorities Paper

27. TAC concluded that with the above amendments, the Priorities paper may be sent to CGIAR for distribution at the Centres Week to be held in July. Also arising from TAC's Priorities paper, TAC itself should, either from its own budget or with funds from a suitable bilateral donor, organize Working Groups in the following areas:

(1) Coconut research with particular reference to the current state of knowledge on major diseases such as "cadang-cadang" and root wilt. (Advantage could be taken of a meeting being held in India early next year by providing an appropriate TAC input).

(2) Research on plantain (banana). This may possibly be done in collaboration with the New Guinea Foundation.

(3) Goat research for the production of milk, meat and fur.

(4) A critical discussion on the role of the international centres in farming systems research. (At present IITA, IRRI and ICRISAT spend 38, 21, and 18 percent of their respective core budgets on farming systems research).

28. These Expert Consultations are primarily for the purpose of informing TAC of the current status of research in these areas. They may or may not lead to concrete recommendations by TAC or projects for CGIAR funding.

IRRI Quinquennial Review (Agenda Item 6)

29. Referring to the report of the TAC's Quinquennial Review mission which he had led, the Chairman recorded his gratification that the Committee had unanimously endorsed the final report and had recommended that it be transmitted to the Consultative Group, and given as wide a circulation as may be deemed appropriate.

30. At the twelfth meeting of the Committee, when the report was presented in draft, members had the opportunity to discuss freely the findings of the mission and to record their comments. Reminding members that changes in the substance of the report were the prerogative of mission members, the Chairman pointed out that nevertheless members' comments and requests for clarification of certain points of obscurity and ambiguity could be utilized to advantage in refining the draft. Their comments would be recorded and incorporated in the report of the Committee which would itself of course also be presented to the Consultative Group.

31. Members had made some constructive suggestions for improvement of the test and these had been reviewed by four members of the mission who were fortunately all present

the the last TA meeting. Agreement had been reached by this group on the changes to be made, most of them relatively minor; one of some substance, was the need to assign a priority rating to the recommendation for staff increases and improved facilities. This had been done.

32. The revised draft was then submitted to the mission members for approval and further comments, with a deadline date. Comments and corrections had been received from four members and these, together with those of the TAC members and the Chairman, had been incorporated in the final version.

33. The unanimity with which members recommended the adoption of the report, was praise enough in itself. The Chairman recorded his thanks, as leader of the mission, to the members of the Committee, both for their constructive comments on its redrafting and for their kind remarks in its quality.

Vegetable Research (Agenda Item 7)

34. At its last meeting TAC reached the conclusion, on the basis of the report of its Vegetable Research Appraisal Mission, that some form of international research effort was necessary on vegetables used for home consumption by the poor. As a basis for further discussion the TAC Secretariat was asked to prepare a paper giving alternative methods of organizing such research and indicating priorities in the choice of vegetables. After discussions of this paper at this meeting, TAC felt that vegetable research fits into its priorities for improving human nutrition. Hence, TAC recommends the initiation of an International Vegetable Research Project based on the following principles:

1) Vegetables normally eaten by the masses of people in Southeast Asia and Africa (tropical lowlands) contribute greatly to their diet and nutrition and there is little doubt that research and appropriate training can make an important addition to the production and consumption of these vegetables.

2) Taking into consideration the recommendations made by the Vegetable Appraisal Mission, TAC decided to support the general idea to undertake a serious effort but felt that not enough information was on hand at present to enable it to make a final recommendation as to the organizational form, specific activities, definitive location and other important aspects for a permanent programme. TAC, however, was ready to consider supporting a short-term or pilot research project covering a period of from 3 to 5 years which would provide the information that was now lacking.

3) It was agreed that the preparation of the project be given to a special mission which would work for a period of 3 to 4 months and subsequently report to TAC by early 1977 with a concrete proposal or alternative proposals. **(See Annex II).**

4) The pilot project to be proposed should contain the following elements:

a) should be a plan for not more than 5 years;

b) the preliminary action should be organized as one coordinated effort although actual work could be conducted in two locations, one in Asia and another in Africa;

c) should be considered as an international project, financed by CG but possibly based in one or more existing institutions, either international, regional or national, able to provide the project with the necessary technical and logistic backstopping.

d) in the period of the pilot project, work should be initiated on the genetic evaluation and utilization of the main species of vegetable crops chosen for priority attention. Also, appropriate training programmes should be organized. Another purpose of this research project would be the compilation of all available information on vegetable research.

35. TAC expected that by the end of the project, concrete proposals for long-term action would emerge. In addition, it believed that the proposed International Vegetable Research Project would help to extend to other countries the results of work of the Asian Vegetable Research and Development Centre, Taiwan.

Grain Legumes and Plant Nutrition (Agenda Item 8)

36. In view of the importance attached by TAC to this subject, it had constituted a Subcommittee to review the progress of international research in improving the productivity of grain legumes and in harnessing all forms of plant nutrients. Arising from the recommendations of the Subcommittee, research programmes were now in progress in nearly all major grain legumes at international centres. Soybean research alone remains to be organized on international lines under the CGIAR system. The TAC Working Group on the Biology of Yield in Grain Legumes, which met in New Delhi in October 1974, had made valuable recommendations on the strategies useful for improving the yield potential of grain legumes and for achieving more efficient biological nitrogen fixation in the soil. TAC had also considered from time to time different aspects of fertilizer technology including the proposal for the formation of the International Fertilizer Development Centre.

37. Conscious of the need for enriching the organic matter content of tropical soils and for conserving all organic wastes for use as manure, TAC had asked its Subcommittee on Plant Nutrition to meet ahead of the 13th meeting of TAC at Los Baños to discuss and make concrete recommendations on the processing, management, and use of organic wastes. Based on the recommendations of the Subcommittee, TAC suggests the following additional steps:

a) International agricultural research centres may, where this is not already being done, intensify their research on soil organic matter and introduce organic recycling principles and integrated systems of nutrient supply in improving the fertility status of soils.

b) FAO, in collaboration with other appropriate international agencies, should consider organizing an information service on the technological and economic aspects of organic recycling which could become a means of collecting and disseminating information on methods of processing and use of organic refuse, including human wastes, from urban and rural areas.

c) TAC was informed of a programme for promoting the use of organic matters as fertilizers, prepared by FAO for support from the United Nations Environment Programme (UNEP). It hopes that this FAO programme will be implemented.

Other Business (Agenda Item 9)

i. CGIAR Review

38. The Committee was informed by Dr. Mosher of CGIAR Review Team of the methodology adopted by the Team and the progress made to date. It was noted that the Team members were visiting the IARC's and donors in turn to obtain data for a number of questionnaires which had been prepared. One of these questionnaires had been copied to TAC members who were requested to make their replies available, if they so wished, to a meeting of the Review Team on 20 June in Uppsala, Sweden.

39. It was anticipated that following this meeting the preliminary findings of the Team would be prepared for discussion at a Review Committee Meeting, to be held immediately prior to Centres' Week, in the third week of July.

40. The final report of the Review Committee was anticipated to be ready before the October meeting of CGIAR and might thus be available to assist the TAC in its anticipated deliberations on inter-se priorities at its own October meeting.

ii. Soybeans

41. An updated account of the work of INTSOY was tabled for the information of members and the representative of FAO gave some details of the Organization's activities in connection with this crop.

42. Time did not permit a major discussion and it was agreed that in-depth consideration, aimed at reaching some conclusions on the alternative proposals discussed at the 12th Meeting of the Committee, would be given during the October meeting of TAC.

43. The Secretariat was requested to seek the assistance of appropriate units in FAO in the preparation of a detailed background paper, including information on national research and development programmes on soybean. Meanwhile the joint arrangements between IITA and INTSOY were commended as an encouraging step towards the establishment of soybean research programmes in the true tropics.

iii. Aquaculture

44. Members were supplied with an up-to-date report and recommendations for aquaculture research prepared on behalf of IDRC and with an FAO document prepared for a forthcoming World Conference on Aquaculture.

45. The Committee noted that FAO was planning to seek UNDP support for a number of regional aquaculture centres whose research activities would be based on the needs of member countries of the regions. Research priorities noted to date were very much in line with those originally proposed to TAC by its sub-committee on aquaculture research.

46. The Chairman requested that members be supplied with the earlier TAC documentation on aquaculture prior to the October meeting at which it would figure as a major agenda item. The outcome and recommendations of the forthcoming FAO World Conference could also be expected to provide a major input to the deliberations of the Committee on this occasion.

iv. TAC Quinquennial Review of CIP

47. The Chairman reported that an opportunity had been taken to discuss with Dr. Sawyer, Director of CIP, the Terms of Reference and possible composition of the CIP Review Mission. Agreed Terms of Reference were tabled, and approved by the Committee, and the Secretariat was requested to go ahead with preparations for the Mission, planned for the second and third weeks of December.

Joint Meeting with Centres' Directors (Agenda Item 10)

48. Centres' Directors and TAC members discussed at length mechanisms for promoting linkages among:

a) centres themselves,

b) centres, universities and advanced research institutions in developed and developing countries,

c) centres and donors, and

d) centres and national programmes.

The following were the major conclusions arising from this discussion:

1) Mutually beneficial relationships are growing among the international centres and between international centres and national programmes. These bonds should continue to be nurtured and strengthened;

2) IARC's should continue to develop collaborative research projects with national research systems in developing countries; in particular, a more effective use of "hot spot" locations for major pest and disease screening could be developed in this manner;

3) CGIAR should encourage bilateral donors to provide funds directly to advanced research institutions in developing countries for collaborative research and not channel the funds through IARC's;

4) IARC's should not assume the role of grant-giving agencies so that they do not lose their essential character of research institutions;

5) Communication between IARC's and research institutions in developing countries should not be confined only to a few major institutions but should extend to the many small and active centres found in those countries;

6) Training programmes need to be expanded for providing developing countries with more research leaders. While at their headquarters IARC's could concentrate on organizing trainer's training programmes, they could organize other training programmes jointly with national institutions to enlarge the training base. In this respect, the training programmes organized by CIMMYT, jointly with national research systems and bilateral donors on the control of wheat diseases is a good example. TAC was also informed that financial support for training doctoral and postdoctoral candidates is tending to decline. This trend needs to be arrested since the lack of trained manpower is a major obstacle to the development of effective national research systems in several countries.

7) IARC's could help bilateral donors in identifying suitable national research institutions which, if given appropriate support, could make a substantial contribution to the improvement of food productivity;

8) Centre Directors made the following suggestions concerning Centre-TAC interactions:

   a) The centres welcome the quinquennial reviews undertaken by TAC but would suggest more advanced planning of the programme of the Review Panels, joint selection of Panel members, and an opportunity to examine the draft report before it is finalized. TAC clarified that it does not look upon the quinquennial review report as an inspection report but more as a joint exercise with centres on reviewing past work and developing broad guidelines for further growth;

   b) The centres welcome TAC meetings' being held in different centres. This would help to promote better understanding between TAC members and centre personnel. While the 14th meeting of TAC is scheduled to be held at ICRISAT, Hyderabad, India in October 1976, Centre Directors would suggest that the 15th meeting of TAC be held at CIAT, Cali, Colombia towards the end of May 1977 or early June 1977.

The U.S. National Research Council World Food and Nutrition Study - Interim Report
(Agenda Item 12)

49. TAC fully recognized the importance of this special study of the U.S. National Research Council on the mobilization of the scientific capacity of the United States towards improving the capabilities of all countries to increase food production to combat malnutrition and its effects.

50. TAC members individually provided a wide range of comments valuable to the study steering committee in its further deliberations.

51. They particularly stressed the importance of improving the capability of research personnel in developing countries through providing the proper incentives for the more highly trained scientists and technicians to remain in their country and devote their attention more to specific problems in the agricultural development of their country.

52. Notwithstanding these needs of national research, other members felt that the main gap was in the application of research findings, that is, in the intermediate technology, and consequently there was an urgent need for the technical training of teachers to be sent to the field to train extension officers.

53. Another specific subject which TAC members thought needed more attention was the socio-economic problems related to increasing food production.

54. TAC believed the United States' science and technology was able to make a major contribution to the world food problem through, for example, the application of satellite imagery to global early warning system and for integrated resource surveys, extension of knowledge of the use of solar and wind energy, the provision of more assistance from specialized institutions, the application of the Land Grant College model, and expertise on quarantine procedures and techniques.

Part II. The International Centres

Review of the International Centres' Programmes (Agenda Item 11)

55. According to the budget proposals provided by the Centres to TAC,[1] the total requirement for 1977 comes to $63.8 million for core operating funds and $25.5 million for capital expenditure. The details are as follows:

INSTITUTE	Budget/$millions			
	1976		1977	
	Core	Capital	Core Operating	Capital
CIAT	6.5	1.0	8.6	1.4
CIMMYT	10.7	0.5	11.2	1.6
CIP	3.2	0.9	4.9	1.2
IITA	8.3	2.5	10.0	1.4
IRRI	7.3	1.3	8.7	3.6
ICRISAT	4.9	3.7	5.9	6.5
ILCA	4.1	1.6	6.3	3.4/(5.4*)
ILRAD	2.1	2.8	2.6	3.0
WARDA	0.8	-	1.1	0.3
IBPGR	1.1	-	1.2	0.07
ICARDA	-	-	3.3	3.0
TOTAL			63.8	25.5

56. TAC was informed by the CG Secretariat that according to current indications, the likely availability of funds for 1977 will be about $80 million, thus leaving a gap of $9 million.[1] Due to the late receipt of Centres' programmes and budgets, TAC could not go into inter-se priorities and is therefore not in a position at this meeting to assign specific priorities to the new initiatives and proposals for 1977. TAC would therefore suggest the following procedure:

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* Working capital + capital for cooperative programmes

1/ It is understood that these figures may be subject to adjustment, prior to the Centres' Week meeting, following further discussion with the CGIAR Secretariat.

1) The CG Secretariat could ensure that Centres would have available during 1977 adequate budgets to cover the cost of current operations together with the amount needed to offset inflation;

2) The Centre Directors may themselves undertake a detailed exercise on priorities with reference to new proposals for additional funds and make the result of this exercise available to the TAC Secretariat by July 1976;

3) New international centres, which do not have even basic infrastructure for fulfilling their research mandate, should preferably be accorded priority in meeting their capital budget requirements;

4) On the basis of a clearer understanding of the availability of funds and the views of CGIAR Review Committee on the determination of inter-se priorities, TAC would be in a position to make concrete recommendations to CGIAR on allocation of funds for each centre at its October meeting.

57. Although it was not possible, as indicated above, for the Committee to assess inter-se priorities among the Centres' programmes, individual programmes were discussed following their presentation by the Directors. The highlights of the ensuing discussions and the Committee's conclusions are presented below.

i. International Rice Research Institute (IRRI)

58. Since IRRI's programme of work for 1977 was by and large in accordance with the recommendations of the Quinquennial Review Mission the only matter discussed in detail was the request for three regional representatives, one at CIAT for Latin America, one in Indonesia for S. Asia and another in the Indian sub-continent. Some members had wondered why this new proposal of IRRI had not been brought explicitly to the notice of the Quinquennial Review Panel. One of TAC's main concerns had been with regard to the security of tenure of the outreach staff of centres; the explanation given by the Director that this concern would be met by the new proposal proved acceptable to TAC and, in terms of IRRI's needs, compatible with the Review Report proposal for three core funded posts for outreach staff.

59. It was recalled that TAC had fully discussed regional services at its 1975 October meeting and had firmly recommended that there should be some regional research staff to ensure feedback to the centre's research programmes. Since it was not feasible to have a centre representative in every country of outreach activity the scientists involved, therefore, had to have regional responsibility.

60. With respect to the rice programme staff at CIAT the question was raised as to whether they should be regarded as CIAT staff members working on rice, or as IRRI staff members. The respective directors had indicated that either arrangement would be satisfactory but in TAC's view it was more pertinent that they be considered IRRI staff members

and therefore should be included in the IRRI budget since they provided the direct linkage with IRRI. TAC welcomed as a first step the two centres' proposal to enter a formal agreement in respect of one IRRI staff member of the CIAT rice team, which it was expected to finalize during the current week.

61. It was generally felt that there was a need for further clarification of the problems related to staff at one centre manifestly engaged in the research programme or research in a commodity of another centre. The Chairman felt that in these circumstances a definition of the mandate of each institute could help to decide what items should be included in one or the other centre's budget. Although the review missions, having only time to make a rapid assessment of the overall situation, had not been in a very good position to make recommendations on this aspect of a centre's outreach programme, future review teams should be urged to consider this point as closely as possible. It was agreed that TAC should thoroughly discuss the matter again and that this should form an item on the agenda of the October meeting.

62. The Chairman recorded the Committee's agreement to IRRI's proposal to establish in 1977 three regional services at an estimated cost of $ 250,000 noting that the Director of IRRI had indicated that this was only the start and that the Centre would be requesting an additional three regional services in following years. These proposals would be examined as they arose.

ii. International Institute of Tropical Agriculture (IITA)

63. The Chairman remarked that TAC had noted with satisfaction that the farming systems research programme, the relative expenditure on which had been a controversial subject in past discussions between TAC and the IITA management, accounting for nearly 40 percent of the 1977 budget, was anticipated to yield beneficial results. TAC hoped that this would have a desirable impact on improving farming systems and increasing agricultural production in other parts of the humid tropics which was the Institute's basic mandate; for this reason TAC accepted the programme proposals.

64. Significant developments at IITA which had reached the stage of field application through the use of kits and mini-kits were the production of (1) cassava clone resistant to the mosaic disease and bacterial blight, and which was being tested in production trials both in Nigeria and Zaire; (ii) a composite maize variety from typical Nigerian varieties; and (iii) varieties of cowpea which have resistance to some of the major insect pests and are now being tested for their nutritional value.

65. Other developments which met with TAC's approval were the land development work in the humid tropical zone station, which was more suitable than Ibadan for truly tropical research, and the collaborative programmes with INTSOY in the case of soybeans and with ICIPE on pest control research. The proposed agreement between IITA, IRRI and WARDA for

collaboration in rice research was welcomed and it was hoped this would soon be finalized. TAC also hoped that the informal linkages that had evolved between IITA and CIAT would be strengthened, particularly towards a closer collaboration in research on cassava and beans, and preferably through the establishment of a formal agreement as with other centres.

66. The Chairman referred to the concern felt by some TAC members about the situation regarding virus diseases. There was a good virus research programme at the national research intitute in Ibadan but since virus diseases were very important in the crops handled by IITA the Institute had considered strengthening virus research by the addition of a virus unit as a Special Project. The TAC felt that, at first this should be limited to a virologist in the core programme, if necessary financed through re-alignment of other priorities. It did not consider Special Project financing to be satisfactory for long-term virus work.

67. He referred also to the concern expressed about the expansion of the agricultural engineering sub-programme of the farming systems research programme, since TAC had seen other engineering activities develop into full programmes from special projects. TAC suggests therefore that IITA should not envisage any further expansion after 1977 and that the 1977 level of the programme be regarded as a ceiling.

68. Finally, with regard to the request for $970,000 of capital, for the provision of eight houses, the Chairman noted that the CG Secretariat was reviewing the entire capital programme and while TAC generally supported IITA's request for this additional staff accommodation in 1977, it would not make any specific recommendations beyond that.

iii. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

69. TAC was pleased with the progress made in the last four years in respect of the programmes approved by the ICRISAT Board. The Director had indicated that the capital development programme would be completed by the end of 1977, all the necessary building materials having now been assembled on the site. TAC had also been informed that staffing of ICRISAT was proceeding vigorously and that cooperative research programmes with other International Centres and national research institutions, particularly in Africa, were developing well. It was noted that there were some problems of accommodation for staff of the cooperative programme and TAC recommended that bilateral donors might be sought to meet these needs so that they did not form a major impediment towards accomplishment of the research programmes.

70. TAC viewed favourably the development of the cooperative research programmes on legumes of ICRISAT with IITA and some laboratories of Indian universities. It was also pleased with the progress made in research on groundnuts and acknowledged the help rendered by the North Carolina University in the provision of groundnut germplasm. However, recognizing the possibly very serious consequences of the groundnut rosette disease and Striga on sorghum and millets in Africa, TAC recommended that these problems should receive priority attention when ICRISAT's groundnut, sorghum, and millets programmes had become fully operational.

71. TAC fully endorsed the budget proposal by the ICRISAT Board noting that the Centre anticipated completing its first four-year programme within the budget ceiling set by the CGIAR.

iv. The International Potato Centre (CIP)

72. The Chairman noted that the Committee had again commented favourably on the innovative approach of CIP to core research through contracts, which currently accounted for half a million dollars of the core budget.

73. Only one new item was included in the 1977 budget proposals. This resulted from the transfer to core funding of the former Special Project funded research into village level processing. This was fully supported by the Committee, which also noted with satisfaction that the potato storage project was getting under way. Both projects should have a high priority in view of the disappointingly rapid post-harvest deterioration of tubers in some localities, to which TAC had earlier called attention.

74. The heavy regional programme of CIP which imposed a sizeable travel component in the budget, was to a large extent obligatory in view of the need to produce virus-free seed on a regional basis. In this connection the Committee viewed with satisfaction the work on tissue culture transfer which should eventually permit the storage of a large (15,000 entries) collection, and also facilitate clonal dissemination.

75. A further consequence of the regional programmes was the heavy schedule of workshops and seminars which was questioned by some members. It was pointed out that these were necessary in order to establish adequate local contacts at the national level, aimed at the building up of complementary programmes. The concern of the Committee at the amount of staff time tied-up in these activities was reiterated however, and it was decided to ask the forthcoming review team to examine this question and the total role of regional research staff in relation to the main scientific programme and objectives of the Centre.

76. With the above comments the Programme and Budget for 1977 were approved. Future projections, which appeared rather high, would be referred to the Quinquennial Review Mission for comment.

v. West Africa Rice Development Association (WARDA)

77. TAC members expressed their pleasure at the way in which WARDA was developing in view of its uniqueness as an inter-governmental organization associated with the CG system. In its research in relation to rice production and development in West Africa, WARDA was establishing links with both IITA and IRRI. TAC welcomed the progress being made and expressed the hope that agreements would soon be finalized and implemented.

78. The main point for comment in the WARDA Programme and Budget was the estimated expenditure of $240,000 for the decentralization of the research and development activities,

a decision taken by the Board of WARDA based on the recommendations of Dr. Chandler, consultant to WARDA. This would lead to four sub-regions with capital provision to strengthen and improve the facilities, including housing and laboratories at some cooperating national stations.

79. Although TAC members were in agreement with this new approach by WARDA, concern was again expressed about the continuing need for adequate technical supervision of the rice trials. It was pointed out, however, that Dr. Chandler had recorded in his report reasonable satisfaction with the improved standard of this work. In this connection TAC expressed its satisfaction with progress made in the training programme of WARDA particularly in relation to the needs for good supervisory staff. It felt some further concern, however, that the decentralization process might not necessarily lead to the lightening of the administrative superstructure which it had so long recommended. It noted, however, that the Advisory Committee had been abolished.

80. TAC agreed in principle to these developments although it felt handicapped by not having the benefit of the Chandler Report to give an in-depth appraisal. It was requested that this be made available for further discussion at the October meeting.

81. With the above comments TAC endorsed the request of WARDA for $1.5 million for 1977, noting that the provision for germplasm storage related only to breeders' working collections of rice germplasm.

vi. International Livestock Centre for Africa (ILCA)

82. Whilst commending the Director for the very rapid progress made in the establishment of ILCA's documentation programme and the cooperative programme in Mali, the Committee expressed considerable concern over the apparent escalation of the total budget in 1977 to $26 million, well beyond the $11 million foreseen in the foundation document. The headquarters operations had expanded to a cost of some $7 million and capital costs were already approaching the foreseen limit. Part of this high cost could no doubt be ascribed to an acknowledged need to employ expatriate support staff at international levels of salary. The Committee felt, however, that other costs, both for capital and recurrent expenditures should be re-examined.

83. The documentation programme, with its facility for production of micro-fiches had been a recognized first priority which had been ably tackled. Reference was made to the possible utilization in due course of some of the programmes' material on an information exchange basis with the proposed Buffalo Research Programme's documentation centre at SEARCA.

84. Whilst recognizing that the cooperative programmes formed part of the core activities of ILCA, members questioned the expansion of this programme from $0.2 million to

$1.7 million, and the need to virtually establish a rather substantial sub-station in Mali with laboratory and housing facilities.

85. The Committee felt that the attention of the ILCA Board and the CGIAR Secretariat should be called to its reservations about the budget, especially the costings which it found confusing. The Board should be requested to scrutinize the budget more carefully, with a view to its re-presentation.

86. Whilst the programme, as distinct from the budget was found generally acceptable, the members were not satisfied with the progress made towards the build-up of inter-disciplinary teams, finding a top heavy emphasis being given to breeding work, and insufficient to animal health. In the latter context the importance of attention to wild animals was stressed.

87. The Committee recognized that the CGIAR Secretariat was appraised of the need to seek means of paring the ILCA budget and anticipated that this would be properly effected.

vii. International Laboratory for Research on Animal Diseases (ILRAD)

88. TAC was satisfied with the progress achieved by ILRAD since its establishment. It noted that the work on the diseases Trypanosomiasis and Theileriosis, involving the use of vectors (tsetse fly and ticks) had started, and that cooperative research programmes had been established with the East African Veterinary Research Organization, the Washington State University, and the University of Glasgow, and were being developed with a number of other institutions and organizations including ILCA and ICIPE.

89. Following discussions with the Director, Dr. Henson, TAC was satisfied that a supply of tsetse flies in sufficient numbers and of the right type and quality which were needed for the research programme, could not be satisfactorialy obtained from any other source as and when required. It therefore strongly supported the request for $214,800 in the Revised 1976 Capital Budget, for the immediate establishment of a tsetse fly vector facility at ILRAD, and the request for $75,264 for a tick facility, to be used primarily as a tick maintenance and breeding area where cattle could be infected with Theileria.

viii. Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT)

90. On the opportunity of the 10th anniversary of CIMMYT, TAC was pleased to learn that CIMMYT-related varieties of wheat were now grown on more than 25 million hectares. This has resulted in an estimated 125 percent increase in yields for those areas. CIMMYT was confident that these trends could be maintained for the five years to come by further advances in the stabilization of yields and local adaptation, along with other necessary improvements in wheat production. TAC had also noted with satisfaction that the maize programme was now expected to have a substantial impact on production similar to that experienced from 1962 in wheat and since 1965 in rice, by the large-scale introduction of high yielding varieties.

91. CIMMYT considered that there was no major new development or change in its programme for 1977 as compared to that of 1976. TAC had therefore concentrated its discussions on some issues which had been raised before by the Committee and, more recently, by the Quinquennial Review Panel, and also commented on the new format which had been adopted by CIMMYT for the presentation of its Programme and Budget.

92. TAC had some difficulty in assessing the present and future size CIMMYT's regional programmes from this new presentation. Some regional activities were financed from special grants while others were incorporated in the core programme and budget. The Committee understood that, since these programmes had just started, it was difficult for CIMMYT to predict their optimum size, although, on average, it was not expected to rise above two persons per region. CIMMYT anticipated, however, from its present experience in East Africa, that some of the regional teams might also require the services of an economist in the future, wherever the size of the programme and its dependence on local socio-economic policies would warrant it. TAC was also informed that CIMMYT's involvement in national programmes was expected to stabilize at its present level. TAC had requested a report on the outreach programmes of CIMMYT as a supplement to the Quinquennial Review for consideration at its October meeting.

93. The Committee had noted with satisfaction that the Quinquennial Review Panel had, by and large, endorsed the other aspects of the programme of CIMMYT. TAC shared the views of CIMMYT that the conclusions and recommendations of the Review Panel did not call for significant monetary changes in the programme and budget of the Centre for 1977, but rather expressed slight differences of approaches or differences of emphasis to be further considered by CIMMYT in the implementation of its future programmes. Among the questions raised were the need to increase trainers' training activities; to maintain existing links with basic research; to further involve CIMMYT's economists in forward planning of the programme; to ascertain future strategies in plant pathology and, for maize, in raising protein content; to further extend the cooperation with IITA beyond existing collaboration in West Africa, and to review the role and place of postdoctorate fellows in the programme.

94. TAC had requested additional information on these issues, as indicated in its discussions of the Quinquennial Review Report, and did not wish to recommend at this stage any change in the proposed programme for 1977, noting that the Report of the Quinquennial Review would be completed for formal presentation and final discussion of its conclusions at its next session in October.

ix. Centro Internacional de Agricultura Tropicál (CIAT)

95. No major changes or new developments were anticipated for 1977 in the ongoing programmes of CIAT in cassava, beans, swine, or rice in cooperation with IRRI, and maize in

cooperation with CIMMYT. TAC was pleased to note the significant progress made in 1976 and gave its general support to these programmes as proposed by CIAT for 1977.

96. The Committee also commended the efforts made by CIAT for a concentration and streamlining of its beef programme. TAC gave its full support to the priority given by CIAT to the areas of the Llanos Orientales and similar acid savannah lands in Latin America and, within these areas, to the problems of animal nutrition as the main limiting factor to raising animal production. It noted with approval that the proposed programme for improvement of forage plants would follow a similar pattern to that already well established by CIAT for other crops, and should bring further advances in the utilization not only of Stylosanthes germplasm but also of other fodder plants. TAC was assured that the beef programme would continue to maintain a sufficient level of expertise in the other disciplines of animal nutrition, herd management, health control and economics in order not to lose sight of the other interrelated problems of production while concentrating on pasture improvement. TAC was informed that, due to the difficulty of communication between its Palmira headquarters and the areas concerned in the beef programme (e.g. Carimagua), CIAT would utilize, on an experimental basis, a new site near Palmira as a relay station where acid soil conditions would permit preliminary screening and testing of forage plants. TAC agreed that CIAT should report in 1977 on the adequacy of this arrangement in the context of other possibly more costly alternatives to establish better linkages with the Llanos and also with other areas of South America concerned in the programme.

97. TAC approved the proposed establishment of a germplasm unit in CIAT which would service the several crop programmes of the Centre, and the modification of the meat laboratory into a germplasm storage facility. While recognizing that the meat laboratory at Palmira was of limited use to the beef programme, TAC stressed the need for CIAT to secure other arrangements for assessing meat quality in the context of its beef programme. As to the phytosanitary problems involved in germplasm distribution, TAC was assured by CIAT that all possible measures would continue to be taken to avoid spreading diseases. In this context CIAT was also considering the possibilities offered by tissue culture techniques and TAC supported this approach which had already proved feasible in other areas.

98. TAC was informed that the economists of CIAT would now each work as an integral part of the multidisciplinary teams established for each commodity programme. In discussing the comparative advantages of this arrangement versus that of a pool of economists, TAC was assured that cooperation would be maintained among economists assigned to the commodity programmes, in particular with respect to the development of a common data base and methodology. Other general economic studies would be carried out through a special project under the Assistant Director. Confirmation was also given to TAC that such special projects would be established on an ad hoc basis with a limited scope and duration and not as a replacement for the small farming systems programme which had been discontinued.

99. Taking into account the above considerations, TAC approved the proposed programme of CIAT, noting that CIAT would have to make a special effort in filling existing and future vacancies in time for the full implementation of the proposed activities.

x. International Centre for Agricultural Research in the Dry Areas (ICARDA)

100. TAC was pleased to learn that in the last few months significant progress had been made towards the establishment of the new Centre of the CGIAR system. Sites for the Centre in Iran, Syria and Lebanon had been selected and as soon as the memoranda of understanding had been signed steps would be taken for the acquisition and preparation of the land by the respective governments. TAC had been informed that the Executing Agency (IDRC) was rather optimistic that they would be able to sign agreements with at least Iran and Syria before Centres' Week. It was considered that donors would agree that, in view of the present circumstances in Lebanon, the signatures of two of the three host countries would be adequate in order to proceed with the actual creation of the Centre.

101. TAC was informed that the Charter of ICARDA had been signed by the three co-sponsoring agencies of the CGIAR and that the inaugural Board of Trustees had met formally for the first time in January of this year. Dr. Obaid, Deputy Minister of Agriculture, Saudi Arabia, had been elected as its Chairman. The Board had established a Search Committee responsible for selecting the first Director-General for ICARDA. Meanwhile, an Acting Director-General (Project Development Officer) had been chosen and he would assume responsibilities in August for one year for the planning and development of the ICARDA sites and other essential facilities, pending the appointment of another person as Director-General.

102. TAC approved the programme and budget of ICARDA for 1977, noting that the major portion of the Arid Lands Agricultural Development (ALAD) Regional Network Programme is now being funded under the ICARDA mechanism to maintain on-going research until the Centre is operational.

xi. International Board for Plant Genetic Resources (IBPGR)

103. In the absence of a representative of IBPGR to provide details not given in the Summary of the Draft Programme and Budget proposals for 1977 tabled at the meeting, TAC felt it had not sufficient information to allow adequate discussion on which to form conclusions and recommendations. It therefore requested that the Priority Statement and other relevant documentation, as well as reports of the Crop Advisory Committees of the IBPGR be made available for its October meeting. TAC had been instrumental in the creation of the IBPGR and was naturally anxious to follow its progress.

104. With regard to the important TAXIR (GR/CIDS) Programme, the progress of which was commended, it was felt that the international centres involved should not be charged any of the costs in view of their considerable inputs to the work of the Programme.

105. Mention was made of the large provision for meetings in the budget, occasioned by the formation of the Crop Advisory Committee. It was pointed out, however, that these were expected to meet only on an ad hoc basis, rather than regularly and that the costs should not necessarily be regarded as a recurring item.

106. The Committee noted that the IBPGR had recently discussed forest genetic resources and had approved in principle support for a restricted operation, subject to the CGIAR's reaching some definite decision regarding financial support for forestry. In this context the Committee was reminded that the Board was also expected to coordinate activities funded from other sources than its own budget.

107. Remarking that the IBPGR was a new body, still in a formative stage, the Chairman drew the attention of the Committee to the fact that the 1977 budget, as far as could be seen, allowed for the continuation of activities already planned or started and that the total requested was only little higher than the previous year. It was concluded that rather than attempt to pass ill-informed views the Committee would reach a decision following a review of full documentation at its October meeting.

ANNEX I

A TAC PROPOSAL FOR AN INTERNATIONAL COOPERATIVE BUFFALO RESEARCH PROJECT

The domestic water buffalo population of the world, which numbers about 150 million, constitutes a major source of farm power, milk and meat; that in spite of its great importance to the overall economy of many Asian, Far East and Near East countries, no major effort has been made to increase farm level output from the buffalo through programmes of improved feeding, management and the conservation and use of selected superior germplasm. It is considered that many of the biological and socio-economic problems limiting the efficiency of production and utilization of the buffalo require careful and intensive research.

This project proposal is presented as an alternative to the original proposals for establishing an international buffalo research and training centre to achieve the same purpose. As such, although the magnitude of the investment requirements may be about the same, this proposal would have the advantage of moving the programme at a faster rate and at the same time build the necessary infrastructure for institutionalizing buffalo development schemes by strengthening basic national buffalo research capabilities and maximizing advances in the use of the technology that may be developed.

Objectives of the Project

Long-term objectives

The long-term objectives of the project are to assist the governments of the developing countries in which buffaloes have a potentially important role in agriculture, to strengthen their national buffalo research and development programmes and to establish cooperative arrangements between research institutions and organizations in the different countries, so as to improve their efficiency in the utilization of scarce research resources and in the implementation of research results.

In particular, the project will:

1) Build the necessary infrastructure for an international buffalo research and development programme by strengthening the basic national research capabilities and maximizing advances in technology developed on an international level.

2) Establish a linkage mechanism that would meaningfully weld the national research programmes together in an international network for buffalo development; and thereby

3) Improve buffalo production and utilization so that large numbers of the farming population of the developing countries in Asia and the Near East could benefit through improvement of agro-livestock production, increased income and better nutrition.

Immediate objectives

1) To catalyze effectively the establishment and strengthening of national buffalo research and development programmes.

2) To stimulate new/continuing in-depth assessment of the national buffalo development programmes in the countries concerned, including the identification of benchmark information, developmental constraints, and evolving/updating relevant strategies for national buffalo research and development.

3) To utilize the existing resources and capabilities in some of the countries involved and utilize them for research and research training activities which would have implications in several of the countries included in the project, for example, along the following lines:

Egypt	- nutrition studies (meat type)
India	- dairy production
	- germplasm conservation and resource development
	- reproductive physiology and artificial insemination (dairy)
Pakistan	- nutrition (dairy)
Philippines	- meat production technology
Thailand	- reproductive physiology and artificial insemination (meat-type)
	- germplasm resource conservation and development (meat-type)
Sri Lanka	- buffalo diseases, including reproductive diseases.

4) To establish a sustained national documentation programme on the buffalo in each of the countries involved and feed the information into an international buffalo documentation centre which will be established as a repository of information on the buffalo and which would be responsible for dissemination of such information to all interested countries.

5) To develop an effective mechanism for interaction between research institutions at the country and international levels; this would involve inter alia the establishment of research cooperation between institutions active in research on specific subjects with a view to tackling related problems in a concerted manner, by organizing the exchange of information on recent research findings, exchanging staff and consultants, and organizing workshops and seminars on topics of common interest to participating institutions.

6) To establish an international coordinating unit for the project which would develop and implement an effective mechanism for coordinating an international buffalo research development programme.

Institutional Framework

The project shall operate under the basic concept of injecting self-reliance in the various country development schemes. Thus, the project shall operate through the appropriate ministry of the countries concerned. In so doing, the government of each particpating country shall establish a national buffalo research and development centre, or simply identify an existing institution to serve as such and designate a national research coordinator as liaison officer for the project.

Buffalo research capabilities are not equally developed in all countries. A few countries, such as Egypt, India, Philippines, Pakistan, Thailand and Sri Lanka, which have developed some relatively advanced capabilities in certain key areas of buffalo production, will be asked to take on added responsibility in the initial stages, for inter-country cooperation in research and research training.

The project shall be organized through a flexible framework of cooperating national institutions and with a small coordinating unit.

There would be a national buffalo research coordinator in each cooperating country, who would be the national focal point for international cooperation. The project would be headed by a small international coordinating unit assisted by a Project Programme Committee consisting of four members to be nominated by the Chairman of TAC and by FAO.

It was considered that the proposed machinery would permit of a high degree of autonomy in the research organization without alienating it from development, and bearing in mind that national research programmes should serve national development. It was agreed that activities and funding should be in accordance with capabilities and all activities should be thoroughly reviewed annually.

Considering that the project would involve the channeling of funds to research programmes in a number of different countries, the arranging of workshops and seminars with participants from several national institutes, the use of consultants, and the services of a project director to guide the effective utilization of international inputs into the national buffalo research programmes, and recognizing that the necessary agreements already existed between FAO and the governments concerned for executing projects of this nature, it is recommended that the project should be executed through FAO. It is further suggested that FAO consider making full use of the mechanism provided by its Regional Animal Production and Health Commission for Asia, the Far East and the Southwest Pacific (RAPHCAP) in the implementation of the Project. It was felt that through this mechanism the participating national institutions could ensure that the project would respond to their needs for buffalo research and development.

The international cooperative buffalo research project proposed here could initially involve seven countries (Egypt, India, Indonesia, Pakistan, Philippines, Sri Lanka and Thailand) which collectively have some 70 percent of the world's buffalo population. However, as the project develops, additional countries may be brought into the programme of cooperation. For research training the project would also be open from the beginning to selected participants from other countries with sizeable buffalo populations.

It is proposed that the support to the International Cooperative Buffalo Research Project (ICBRP) be phased as follows: a preparatory phase in year 1, and an establishment phase in years 2 and 3. It should be stressed that the proposed budget for the establishment phase is purely indicative and would be refined during the preparatory phase. In year 3, a review mission should be mounted to take stock of the progress made and to develop concrete plans of action on a longer term basis.

Appendix A

International Cooperative Buffalo Research Project

Proposed Budget for Preparatory Phase (Year 1)

		Total US$	
1.	Coordinating Unit		
	a) Personal		
	Project Director (12 mm)	55,200	
	Production Planning Specialist (6 mm)	25,200	
	1 Secretary (12 mm)	15,000	
			95,400
	b) Operating costs		40,000
	c) Travel expenses		30,000
	Subtotal		165,400
2.	Programme Planning Meetings		30,000
3.	International Buffalo Documentation Centre		25,000
4.	Consultancies (3 mm)		12,000
	TOTAL		$232,400

Appendix B

International Cooperative Buffalo Research Project

(Proposed Budget in U.S. Dollars)

		1977 Year Preparatory phase	1978* Year 2 (Establishment phase)	1979* Year 3	1980* Year 4 - Year N (Implementation phase)
Centrally organized					
1)	Coordinating Unit	(165,400)			
2)	Programme planning	(30,000)			
3)	International workshops	-			
4)	International Buffalo Documentation Centre	(25,000)			
5)	Fellowships				
6)	Review Mission				
	Subtotal	(220,400)			
Support of national activities					
1)	Consultants	(12,000)			
2)	Research programme contracts	-			
3)	Support to national buffalo documentation programme	-			
	Subtotal	(12,000)			
TOTAL		(232,400)	1,500,000	1,800,000	2,200,000

* Tentative calculations

ANNEX II

PROPOSED INTERNATIONAL VEGETABLE RESEARCH PROJECT

The Technical Advisory Committee to the Consultative Group on International Agricultural Research at its 13th meeting at Los Baños, Philippines, in May 1976 resolved to have a special mission of one or two consultants to formulate an internationally-based short-term pilot research project on vegetables. The total time involved in this mission is not to exceed 4 man-months.

Terms of Reference for the work of the International Vegetable Research Project Formulation Mission.

"The mission shall visit areas where a two-location pilot project might be established in South/S.E. Asia and Africa, and collect information that will permit a concrete recommendation and justification to TAC on:

a) locations in both South/Southeast Asia and Africa where an internationally-based pilot research project can be established;
b) institutions that might be considered as suitable for hosting the project in each region. Both existing national and international research institutions to be considered without making any commitments;
c) the main geographical areas of action and the main species of vegetable crops where research should be concentrated taking into account the recommendations of the TAC Vegetable Research Appraisal Mission, 1975;
d) a broad outline of the work for the duration of the project (3-5 years) with more explicit details of the first year's activities including the experimental work to be initiated, the surveys and analytical work to be conducted, and inauguration of research training for the project. Although the basic objective will be to collect information that will later permit decisions for longer-term actions, it is expected that the information and genetic material collected will enable the project to actually contribute to the improvement of the selected crops through the distribution of valuable germplasm, training and application of results of the research activities.

The draft report of the Mission's findings, conclusions and recommendations should be submitted to the TAC Secretariat by 15 March 1977, in time for consideration at the 15th meeting of TAC, May/June, 1977."

The tentative time schedule for the mission is as follows:

Briefing - FAO, Rome by TAC Secretariat and appropriate Technical Divisions -- 1 week.

Field Work - Visits to research institutions, etc., in selected countries of S. /S.E. Asia and Africa -- 4 weeks (each region).

De-briefing/Reporting - FAO, Rome -- 2 weeks.

Yellow File
cc

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

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Telephone (Area Code 202) 477-3592
Cable Address – INTBAFRAD

F-1
F-2 K
F-3
(Post-Harvest Technology Research)

To: Members of the Consultative Group

From: The Secretariat October 13, 1975

Subject: Co-ordination of Assistance for Post-Harvest Systems Research.

1. From time to time Members of the Consultative Group have expressed their concern that a significant proportion of food crops harvested is lost in storage, processing and distribution. At the request of the Technical Advisory Committee (TAC), the International Development Research Centre (IDRC) provided TAC with a report on the need for research and technical assistance on post-harvest systems, particularly in the rice-producing nations of Asia. TAC considered this report and its recommendations and in his report to the Consultative Group at its Centers Week meeting last July, the Chairman of TAC commented on them. He said that TAC endorsed the IDRC's recommendations that no new institution dedicated to post-harvest research and development need be created, but rather that the CGIAR should encourage and promote an integration of effort among the various initiatives of CG Members in collaboration with IRRI and various national and regional research institutions of South and South East Asia. A group of Members interested in this subject had met informally earlier in the week and had recommended that they form a working party to co-ordinate their assistance for post-harvest systems research and development, initially for the countries of South and South East Asia, but subsequently for other regions. The Chairman of TAC noted this initiative and commended it.

2. Later in the meeting the representative of the IDRC reported further on this informal meeting and other members expressed their interest in coordination through the vehicle of such a working party. The point was also made that there was a great need for investment in storage, processing and distribution and that capital aid for this purpose also needed coordinating and might well be a matter for the new Consultative Group on Food Production and Investment. The representative of one Member suggested that this was such an important area of co-ordination that the CGIAR might wish to establish an official Committee to exercise this function. The Chairman of the Group said this was clearly an important activity which Members would wish to see pursued in whatever was the most effective way. Yet there was a general reluctance to see committees proliferate and Members might wish to have some general criteria for establishing new committees, particularly if they were likely to be permanent - or standing - committees. He proposed that the Secretariat explore with Members how they felt about it.

3. The Secretariat has explored the question with a representative number of Members. There is a strong feeling that research and development to overcome post-harvest losses is important and that bilateral aid for this and also for investment needs some coordination. Most, however, noted that TAC had not felt the need to institutionalize in any very formal way the work in this area and neither the IDRC nor TAC had seen any need for funds for research on this subject to be provided through the CGIAR. Many also

were reluctant to see a proliferation of committees.

4. The Secretariat believes most Members would wish to see some form of co-ordination of assistance for post-harvest systems research and development and that most would be content to have this done for the time being by the informal, unofficial working party of CGIAR Members already in being. The Secretariat found no basis for recommending any change in its status.

F2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Via delle Terme di Caracalla, 00100 Rome, Italy
Cables: FOODAGRI ROME - Telex: 61181 FOODAGRI
Telephone: 5797

PR 3/10.11 September, 1975

To: All Members of the Technical Advisory Committee

From: The Executive Secretary

Subject: 11th Meeting of the Technical Advisory Committee

As you will recall, it has been agreed that the October meeting of the Technical Advisory Committee will be held at CIMMYT, by kind agreement of Dr. Hanson.

Members plans to attend have already been noted. Those members who have already visited the CIMMYT programmes recently or who are not participating in the visits to CIMMYT's stations should endeavour to reach Mexico City at the latest on Sunday, October 26. CIMMYT will arrange transport to El Batan (40 km), where members will be accommodated at the Institute's guest facilities.

The meeting will last two days (Monday and Tuesday, October 27 and 28), and will be in closed session with no observers. This is the maximum length feasible since there are no flights from Mexico City to Washington on Wednesday except in the morning and it is essential for the Chairman to be in Washington in time for the Consultative Group meeting which starts on Thursday, October 30.

The Provisional Agenda is attached. Please cable any comments or suggestions for alteration which you may have.

DRAFT

Madamba/Iya/Pillai
24/6/75

PROJECT PROPOSAL OUTLINE

UNITED NATIONS DEVELOPMENT PROGRAMME

PROJECT OF THE GOVERNMENT OF INDIA, INDONESIA, MALAYSIA, NEPAL, PAKISTAN, PHILIPPINES, SRI LANKA AND THAILAND

Title: Regional Cooperative Buffalo Research and Development Programme

Number: ..... Duration: 5 years

Sector: 05 Agriculture Forestry and Fisheries

Sub-sector: 05 20 Animal Production and Health

Government Co-operating Agency: Ministry of Agriculture of the countries concerned

Executing Ageny: Food & Agriculture Organisation of the United Nations (FAO)

Date of Submission: August 1975

Starting Date: July 1, 1976

Government Contribution: .....

UNDP Contribution: US$6 551 500

Approved: ..... Date: .....
on behalf of Governments

..... Date: .....
on behalf of Executing Agency

..... Date: .....
on behalf of UNDP

UNITED NATIONS DEVELOPMENT PROGRAMME

PROJECT OF THE GOVERNMENTS OF INDIA, INDONESIA, MALAYSIA, NEPAL, PAKISTAN, PHILIPPINES, SRI LANKA AND THAILAND

Regional Cooperative
Buffalo Research and Development Programme

A. BACKGROUND AND JUSTIFICATION

In terms of livestock units, over two-thirds of the world cattle and buffalo production is claimed to be distributed in the developing countries, but production is only one-fifth and one-third of the world milk and beef output, respectively. This alarmingly low animal production in most developing countries, aggravated by a generally high rate of population increment, of which two-thirds of the world's human population are found to be in these developing nations, accounts for the characteristic low per capita protein intake of animal origin.

It is estimated that in 1974, the world population of buffaloes totalled some 150.7 million head. The same estimates indicate that approximately 97 percent of the total world population of buffaloes is found in Asia. Thus, it may even be said that the buffalo is essentially an "Asian animal."

In the developing countries of the South and Southeast Asian region, it is estimated that about 76 percent (114.6 million) of the total world popu-

lation of buffaloes constitute the main source of draft power and meat production for the small farmers in the region who likewise constitute the overwhelming majority of the total population of these countries. However, inspite of such a prominent role that the buffalo plays in the economy of these countries, it is a regrettable fact that in none of these countries has any significant emphasis been made in efforts to increase the farm-level output from buffaloes through a programme of better feeding and management coupled with the conservation and widespread use of high quality buffalo germplasm.

It is generally recognised that the buffalo is an efficient converter of low quality roughage, a farm resource that does not directly compete with the requirements of the human population. In fact, it does ensure a more efficient use of farm resources.

In Southeast Asia, the swamp type buffaloes predominate and are primarily used for draft. They are low producers of milk, giving about one litre per day (with about 7 percent fat) in less than 300 days lactation. They have been the traditional meat resource in these countries and are now increasingly being reared for meat production. Slaughtered at comparable ages with cattle, at two to three years of age, after good feeding and management, the meat quality is hardly distinguishable from good beef. Hence, the term "carabeef" has been adopted for the meat of the carabao (the water buffalo) in the Philippines.

The buffalo is a major milk source in the Indian sub-continent. The river buffalo types present in these countries, such as the Murrah and the Nili/Ravi breeds, are dairy breeds. The good buffalo cows produce about 2,000 kg milk (with about 8 percent fat) in at least 300 days lactation period. Some outstanding buffalo cows have lactation records of 2,500 to 3,000 kg of milk.

The buffalo has been closely associated with the small farmer of the developing countries of Asia for ages. However, this basically "rich Asian resource," which are already in the hands of these small farmers, has hardly been tapped to any major extent. In fact, it is estimated that Asian farmers are utilising only about a third of the full potential of the buffalo. This is most likely due to the fact that they have not fully realised the real potential of the buffalo. Another contributory factor is the situation where most governmental efforts at agricultural development in the past have essentially been crop-oriented, and hence, farm inputs, resources, and services have always been geared in that direction.

Within this century, science has opened up "new frontiers" in agricultural technology and the potential for rapid progress in agricultural development has been an exciting goal that all developing countries are striving for. However, no matter how much spectacular progress there is in agricultural technology, such progress in technology would only be, at best,

an "interesting exercise" if this is not understood and adopted by the farmers. Recent experience in the transmission of the "green revolution technology" has pointed out the urgency of making such technology relevant to the farmer's resources and capability. Since the buffalo is already a "familiar" but untapped resource that the small farmer already has, and this has been so for decades, it would definitely be a logical development strategy to make such an "indigenous farm resource" more productive and more efficient.

However, it should be recognised that there are many technical problems which limit the efficiency of production and utilisation of the buffalo. These problems need careful and intensive research. The following may deserve research attention:

1. Feeding and nutrition of the buffalo with emphasis on maximal utilisation of forage and farm and industrial by-products.
2. Farming systems studies for a more efficient integration of buffalo raising and production among the small farmers of Asia.
3. Prevention and control of major diseases and parasites of the buffalo.
4. Carcass quality and meat processing studies.
5. Further improvement in genetic potential of the Murrah and Nili/Ravi breeds of buffaloes for milk production.
6. Improvement in genetic potential for meat production of the swamp type buffaloes.

7. Study of the reproductive physiology of the buffalo for improvement of reproductive efficiency.

8. Collection, processing, preservation, handling and transport of buffalo semen for artificial insemination.

9. Buffalo production economics and marketing.

10. By-products utilisation from buffalo production.

In recent years, a growing general awareness on the economic importance of the buffalo and its consequent role in contributing a greater impact on agriculture in the near future has been developing. This can be gleaned from the number of symposia on the buffalo held in the following countries:

1. Malaysia - October 1971. Seminar on the water buffalo. MAKA Institute of Technology, Kuala Lumpur.

2. Australia - February 1972. Ninth Biennial Conference of the Australian Society of Animal Production, Canberra.

3. Philippines - March 1973. "Carabeef - for improved nutrition and better economy." National Science Development Board, Manila.

- February 1975. "A National Carabao Research Programme." Philippine Council for Agricultural Research, Manila.

4. Thailand - October 1973. Seminar workshop on the water buffalo. Khonkaen University.

- April 1975. "The Asiatic Water Buffalo: Its present and potential value." A regional workshop (Thailand, Taiwan, Philippines, Vietnam). Sponsored by ASPAC Food and Fertiliser Technology Centre, and held at Khonkaen University.

5. India - December 1974. International Dairy Congress. New Delhi.

This awareness on the need for meaningful and concerted action for buffalo improvement and development has been growing and firming up among the developing countries of Asia since the early 1970's. In July 1973, the first proposal for the establishment in Asia of an International Buffalo Research and Training Centre was forwarded by the Philippines to the Consultative Group on International Agricultural Research. In that proposal, no specific country was pinpointed as the recommended site but the proposal stressed however, that the site of such a Centre should be in Asia. Later, Pakistan and India came up with similar proposals.

Meeting in Denmark in August 1974, the FAO Expert Consultation on Animal Production and Health Research unanimously endorsed a recommendation that an International Buffalo Research and Training Centre be established in the South and Southeast Asian Region.

A few months later, in December 1974, at the UNDP/FAO Expert Consultation on the "Improvement of Farm Technology in the Rainfed Agricultural Region of Asia (held in Kuala Lumpur), the proposal for the establishment of an International Buffalo Development Scheme was reiterated and unanimously endorsed by participants from 10 Asian countries.

Similarly, at the International Dairy Congress, held at New Delhi in December 1974, a unanimous resolution was passed during the Session on Tropical Dairying, urging the early establishment of an International Buffalo Production and Research Centre in the South and Southeast Asian Region.

The UNDP/FAO Regional Livestock Development Survey (RAS/72/023) fielded a Buffalo Production Expert who has, within the past year (1974-75), completed a survey on the buffalo production programmes of Thailand, Philippines, Indonesia, Malaysia, Sri Lanka, India and Nepal. The general impression has been that after many years of neglect of the buffalo, these countries have begun to take notice of this gap and have shown considerable enthusiasm to initiate buffalo production and training activities at the national level. Consequently, the Regional Livestock Survey Team has recommended the strengthening of National Centres for Buffalo Research and Development.

Thus, at the present time, there is a felt real need for a meaningful approach to making a latent Asian resource - the buffalo, more efficient and productive in the Asian agricultural scene. The

developmental strategy for increasing meat and milk production from the buffalo to ensure the success of narrowing the protein gap in developing countries, requires coordinated and sustained research and manpower training in all important aspects of this long neglected major economic animal. So does the determined effort to inject greater efficiency in the work output of the buffalo.

Every country which has a sizeable and economically important buffalo population has a responsibility to do some research about the problems limiting its productivity and contribution to the national economy. However, seldom is there a developing country with sufficient highly trained scientific manpower and financial resources to do a meaningful and sustained research undertaking.

This Project Proposal is designed to provide the mechanism for achieving the following:

1. Effectively catalyse the establishment and strengthening of national buffalo research and development programmes and ensure the institutionalisation of such national capabilities;
2. Tap the existing resources in some of the national programmes which have developed some relatively advanced technical resource and capability in certain key areas (such as germplasm conservation/utilisation, dairying, meat production technology, nutri-

tion studies, and integrated farming systems) and provide for its accelerated development so that the latest technology emanating from such special centres may be rapidly disseminated and adapted to other countries in the region; and

3. Establish a linkage mechanism that would meaningfully weld these national programmes together in a regional network for buffalo development.

It would be necessary to stress the "catalytic" effect of having regional or non-country inputs being infused into the national buffalo programmes to ensure meaningful marshalling of the country's capability available for the programme and starting off a conscious effort of moving into a truly integrated (crop/livestock) approach to evolving an optimum mix in farming practices. Such "catalytic inputs" could be in the form of consultants, key equipment and a linkage mechanism (at in-country and regional level), and would be made to complement and supplement the country's own resource inputs into the programme.

The above activities would likewise require a mechanism for coordination, information pooling/ exchange and technology support services at the regional level.

This Project Proposal is being presented as a possible alternative to the original proposal for

establishing an International Buffalo Research and Training Centre to achieve the same purpose. As such, although the magnitude of the investment requirements may be about the same, or even slightly higher, this proposal could have the advantage of moving the programme at a faster rate and at the same time build the necessary infrastructure for institutionalising the regional buffalo development scheme by strengthening the basic national capabilities and maximising advances in technology developed within the region.

It is interesting to note that some 111.8 million head or about 74 percent of the world's buffalo population are to be found in the eight countries that this project proposes to cover. The development impact of this regional buffalo development programme on such a critical mass of the world's buffalo population would likewise certainly have such a spread effect on the well-being of the small farmer who own and raise these buffaloes in the developing countries concerned.

B. INSTITUTIONAL FRAMEWORK

The Project shall operate under the basic concept of injecting self-reliance in the various country development schemes. Thus, the Project shall operate through the Ministry of Agriculture of the countries concerned. In so doing, the Government of each participating country shall establish a National Buffalo Research and Development Centre, or simply

designate an existing institution to operate as such.

A few countries, such as India, Philippines, Thailand and Sri Lanka, which have developed some relatively advanced capabilities in certain key areas of buffalo production, will be asked to take on an added responsibility of operating Regional Centres of Excellence which will undertake research and training with a regional focus in their respective areas of specialisation. Such Regional Centres of Excellence shall be grafted into the scheme of operations of the National Centres of the countries involved.

At the regional level, an institutional mechanism will be evolved which would effectively link and weld together the various national programmes in a meaningful regional network for buffalo development. The regional buffalo development programme shall operate within the framework of FAO's medium-term priority activities in the region. Eventually, this programme shall be integrated with the activities of the Regional Animal Production and Health Commission for Asia and the Southwest Pacific (RAPHCAP), as soon as RAPHCAP becomes operational.

C. PROVISION FOR GOVERNMENT FOLLOW-UP

Because of the unique approach of this Project - that of strengthening national capabilities directly, the Governemnts of the countries concerned will be in a better position to follow through in sustaining such

national capabilities. Hence the basic infrastructure for institutionalising the regional buffalo development programme would already be on the ground.

D. OTHER RELATED ACTIVITIES

The Food and Agriculture Organisation has adopted a Regional Livestock Development Programme for Asia and the Far East which has the goal of stimulating livestock production, marketing, and trade to help: a) the subsistence economy of small farmers; b) improve nutrition of vulnerable sections of the population; c) reduce imports; d) build up a strong base for the livestock industry; and e) contribute to generating a more year-round profitable employment.

One of the immediate action measures taken to implement the above programme was the funding and implementation of a UNDP/FAO Regional Livestock Development Survey Project (RAS/72/023) which was fielded in July 1973. Livestock development studies have already been completed for Thailand, Korea, Philippines, Sri Lanka, India and Nepal. The Regional Livestock Survey Team expects to cover Malaysia and Indonesia within the next few months. The Buffalo Production Expert of the Team, who has already completed his survey of buffalo production in the eight above-mentioned countries, has recommended the establishment of National Centres for Buffalo Production.

The Proposal to establish a Regional Animal

Production and Health Commission for Asia and the Southwest Pacific (RAPHCAP) is now drawing the interest and support of countries within the region. The formal establishment and inauguration of RAPHCAP has been scheduled for December, 1975.

Some countries like India, Philippines and Thailand, have already formulated national buffalo research programmes.

E. FUTURE UNDP ASSISTANCE

Soon after this project gets underway, it may be desirable to invite other possible bilateral or international sources of support in order to further accelerate the development momentum that this programme proposes to catalyse.

Since buffalo development and involvement with small farmers is a rather complicated but manageable problem, it may be necessary to continue UNDP assistance for this programme for a further period depending on the progress made.

Also it should be recognised that other developing countries in Asia may be brought into this programme at some appropriate future date.

OBJECTIVES OF THE PROJECT

A. Long Term Objectives

The basic rationale for the project would be to build a firm foundation for an institutional infrastructure which would correct an apparent developmental oversight in attempts at improving farming in Asia. Thus, more meaningful attention would now be directed toward making the buffalo - an indigenous resource of Asia's small farmers, more productive and more efficient. Since the buffalo and the small farmer of Asia have been so intimately associated in their mutual struggle for survival, it is felt that the mechanism for transfer of improved technology for such a "familiar" Asian farm resource as the buffalo would be much simpler. Likewise, any economic benefits to be derived from the improvement of buffalo production would go directly to the small farmer of Asia and would thus have a much more meaningful development impact.

In particular, the long-run objectives of the project are to:

1. Improve buffalo production and utilisation so that large numbers of the farming population of the developing countries in Asia could benefit through improvement of agro-livestock production, increased income and better nutrition;

2. Establish a linkage mechanism that would meaningfully weld the national programmes together in a regional network for buffalo development; and

3. Build the necessary infrastructure for institutionalising the regional buffalo development scheme by strengthening the basic national capabilities and maximising advances in technology developed within the region.

B. Immediate Objectives

1. To effectively catalyse the establishment and strengthening of national buffalo research and development programmes and ensure the institutionalisation of such a national capability;

2. To stimulate new/continuing in-depth reassessment of the national buffalo development programmes in the countries involved on the basis of crystallising current benchmark information, identification of development constraints encountered, and consequent analysis to evolve/update a relevant strategy for both a national buffalo research programme and a plan of action for buffalo development;

3. To tap the existing resource and capabilities in some of the countries involved and establish the following Regional Centres of Excellence for Buffalo Research and Training:

India	- dairy production and technology
	- germplasm conservation/improvement
	- semen technology
Philippines	- comprehensive nutrition studies
	- meat production technology
Thailand	- comprehensive nutrition studies
	- integrating of buffalo enterprises in farming systems
Sri Lanka	- purebred stock multiplication and dispersal

4. To establish a sustained national documentation programme on the buffalo in each of the countries involved and have these feed into a Regional Buffalo Documentation Centre which will be established as a repository of information on the buffalo and which would be responsible for dissemination of such information to all interested countries;

5. To develop an effective mechanism for interaction at both in-country and regional levels among all sectors involved in buffalo development (through regional conferences, in-country workshops, travel/study opportunities, etc.); and

6. To establish a Regional Coordination Unit which would develop and implement an effective mechanism for coordinating a regional buffalo development programme.

WORK PLAN

A. DESCRIPTION OF PROJECT ACTIVITIES

1. Preparatory activities to be carried out prior to project implementation:

1.1 The Governments of the eight countries identified for this project should indicate their willingness to participate in the Regional Cooperative Buffalo Development Programme.

1.2 It is strongly recommended that FAO sponsor a Regional Buffalo Conference early in 1976 (January or February). This conference should bring together at least two representatives (one in research/training sector and another in production/development sector) from each of the proposed eight participating countries and have them come to the meeting with an updated Country Report which would include information on: latest buffalo statistics (actual figures/estimates up to 1974), current developmental constraints in the buffalo sector, previous/current research on the buffalo, current training/extension activities for buffalo development, and the Government's current buffalo development programme.

In addition, selected outstanding professionals in buffalo development work should be invited to give review papers on the following topics: buffalo development activities in Asia, buffalo germplasm resources: current status and potential, animal health situation in the region with special reference to the buffalo, buffalo nutrition studies, buffalo dairy production and technology, buffalo meat production, and studies on buffalo production economics. The wealth of information (updated to a comparable time-frame) that would be collected from such a pre-implementation Regional Buffalo Conference would provide the vital benchmark information that would be necessary for setting the start-off momentum when the Project is launched both at the regional and national levels.

2. Activities to be undertaken during the project:

2.1 National

The Government of each participating country shall establish a National Buffalo Research and Development Centre or simply designate an existing institution to operate as such. A Country Programme Director shall be appointed/designated by the Government to oversee the national buffalo programme.

With insights gained from the pre-implementation Regional Buffalo Conference, an in-country Buffalo

Workshop shall be organised as soon after inception of the programme as possible, to: a) review and crystallise current benchmark information on the national buffalo industry; b) identify problems that act as constraints to buffalo development in the country; c) determine priorities for a buffalo research programme that would work on such problems identified and d) develop a plan of action for buffalo development in the country (including training requirements). Such in-country Buffalo Workshops would be held annually for updating purposes and also to provide a national linkage mechanism for buffalo development.

Each country shall establish and sustain a national documentation programme on the buffalo which shall feed into a Regional Buffalo Documentation Centre.

The regional inputs into the country programme shall be in the form of short-term consultants, key equipment, provision for in-country linkage opportunities, and travel/study fellowships. A flexible mechanism will be developed whereby project staff working in close consultation with the Country Programme officers, will determine the specific requirements for the various inputs into the country programme.

For example, the Governments of each participating country will be asked to designate at least three technical specialists with different discipline backgrounds (in addition to the Country Programme Director) who will devote major attention to the country buffalo programme. The country technical team will be responsible

for formulating, monitoring and updating the country buffalo development programme. Gaps in the technical/discipline capabilities of the country technical team will be quickly identified and be the basis for identifying discipline requirements for the fellowship programme. Likewise, such technical/discipline gaps will temporarily be filled by a flexible mechanism of bringing in short-term consultants with appropriate expertise that the country programme requires. Similar need analyses, dovetailed to specific country programmes, will also be made in the case of regional inputs for key equipment and linkage opportunities.

The regional inputs into the country programme shall be transferred from the Regional Coordination Unit to the National Centre for local disbursements. Appropriate financial disbursement/monitoring mechanisms shall be worked out.

2.2 Regional

Regional Centres of Excellence. A few countries which have developed some relatively advanced technical resource and capability in certain key areas of buffalo production will be asked to accelerate the development of such capabilities. Regional inputs will likewise be infused into such Regional Centres of Excellence so that these may assume added regional responsibilities for generating new technology in their respective areas of specialisation for dissemination to appropriate country programmes in the region.

The Regional Centres of Excellence are as follows:

India - a) dairy production and technology
b) germplasm conservation/improvement
c) semen technology

Philippines - a) comprehensive nutrition studies
b) meat production technology

Thailand - a) draft animal improvement
b) integration of buffalo enterprises in farming systems

Sri Lanka - will serve as a purebred stock multiplication unit (in close cooperation with the India buffalo germplasm scheme).

While the National Centres will be engaged in applied research and training relevant to the needs of their respective country programmes, the Regional Centres of Excellence will be asked to undertake, as an added responsibility, research and training with regional focus in their respective areas of specialisation.

The regional inputs for the Regional Centres of Excellence would essentially have the same category classification as that for National Centres with the main difference being that a provision is made for bringing in a very limited number of Buffalo Scientists who would be serving these Regional Centres of Excellence for periods of more than a year. However, the same flexibility and need analysis mechanism,

similarly dovetailed to specific Regional Centres of Excellence,will be undertaken.

The programme and operation of the Regional Centres of Excellence will be grafted into the scheme of operations of the National Centre of the countries concerned and will operate as such on an integrated basis.

Regional Coordination Unit. A Programme Manager, assisted by a Livestock Production Planning Specialist and appropriate support staff, shall operate the Regional Coordination Unit. All regional inputs shall be channelled through and monitored by the Regional Coordination Unit.

Regional Buffalo Conferences shall be held during the second and fourth years of the Project period and shall serve as a venue for collective reassessment, by the participating countries, of the regional thrusts in buffalo development.

A Review Mission shall be fielded on the fifth year of the project period to assess progress made and need/requirements for an extension of the programme.

Provision is made to enable the Regional Co-ordination Unit to bring in a reasonable number of short-term consultants who would assist the RCU in looking with a regional focus at the buffalo development programme requirements.

The Regional Coordination Unit shall be provided appropriate support to establish a linkage mechanism that would meaningfully weld these national programmes together in a regional network for buffalo development.

It is suggested that the Regional Coordination Unit be located in Bangkok, Thailand, in close association with both the FAO Regional Office for Asia and the Far East and the Regional Animal Production and Health Commission for Asia and the Southwest Pacific (RAPHCAP).

Regional Buffalo Documentation Centre. It would be necessary to have all national buffalo documentation programmes feed into a Regional Buffalo Documentation Centre which would serve as the repository of information on the buffalo and which would be responsible for exchange and dissemination of such information to all interested countries.

The Regional Buffalo Documentation Centre shall receive operational funds directly from the Regional Coordination Unit.

For financial and coordination considerations, it may be appropriate to attach the Regional Buffalo Documentation Centre to the Agricultural Information Bank for Asia (AIBA) which is now operated by SEARCA (Southeast Asia Research Centre for Agriculture). The AIBA is fed by national documentation centres, operates on a regional basis, and is tied up with the AGRIS network in FAO/Rome.

B. DESCRIPTION OF UNDP INPUTS

1. Assignment of International Staff

	Location	Starting Date	Duration
A. Regional Coordination Unit:			
(1) Buffalo Expert/Programme Manager: Should have good academic and research background and have at least 7 years experience in large animal production and utilisation work in any developing country. Some experience in formulating country livestock research/development programmes is preferred. He will be responsible for formulating programmes, organising implementation in the field and coordinating all aspects of buffalo development work in the different countries involved in the Project.	Bangkok Thailand	July 1, 1976	60m/m
(2) Livestock Production Planning Specialist: Should have a good academic background in agricultural	Bangkok Thailand	October 1976	48m/m

		Location	Starting Date	Duration
	economics and/or livestock development. Experience in planning and organising research/ development schemes in livestock in developing countries is preferred. At least 5 years of professional experience in above-mentioned areas is necessary. Will be responsible for providing planning and economics input in regional/national buffalo development programmes.			
(3)	Consultants: Short-term consultants in different fields of specialisation will be utilised at appropriate periods to assist the RCU in looking with a regional focus at the buffalo development programme requirements.	Bangkok Thailand	As required (Begining July 1,1976)	As required (a total of 48m/m)

B.	National Centres [1/]	Location	Starting Date	Duration
(1)	Buffalo Scientists (for Regional Centres of Excellence) May be in the field of Animal Nutrition, Animal Breeding, Animal Physiology, large Animal Production, or any other field of specialisation which the Regional Centres of Excellence concerned may require. Should have good academic and research background in their respective fields of specialisation and have at least 7 years professional experience. Previous work with buffaloes preferred.	Countries concerned	As required (beg. July 1, 1976)	As required
		India		60m/m
		Philippines		60m/m
		Sri Lanka		30m/m
		Thailand		60m/m

[1/] Including inputs for Regional Centres of Excellence in India, Philippines, Thailand and Sri Lanka

	Location	Starting Date	Duration
(2) Consultants: Short-term consultants in different fields of specialisation will be utilised to meet specific needs of countries.	Countries concerned	As required (beg. July 1 1976)	As required
	India		54m/m
	Indonesia		30m/m
	Malaysia		18m/m
	Nepal		24m/m
	Pakistan		48m/m
	Philippines		54m/m
	Sri Lanka		30m/m
	Thailand		54m/m
2. Training Fellowships[1/] Fellowships would either be of two types: observation or work orientation (one to three months), and degree-oriented studies leading to a postgraduate degree. The programme for fellowships will be worked out by the Project Staff in	As appropriate	As required (beg July 1 1977)	As required

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1/ Primarily for National Centres, with some additional man-months provided for Regional Centres of Excellence.

	Location	Starting Date	Duration
consultation with country governments concerned to meet specific needs for trained personnel and provide a mechanism for observing/exchanging experiences in the countries concerned.	India		150m/m
	Indonesia		90m/m
	Malaysia		48m/m
	Nepal		72m/m
	Pakistan		120m/m
	Philippines		150m/m
	Sri Lanka		102m/m
	Thailand		150m/m

3. UNDP-provided Equipment and Supplies
(details of lists will be submitted later)

		Non-Expendable Equipment	Expendable Equipment	Total
A.	Regional Coordination Unit	$ 100 000	$ 50 000	$ 150 000
B.	National Centres (including inputs for Regional Centres of Excellence)			
	India	$ 450 000	$ 150 000	$ 600 000
	Indonesia	$ 150 000	$ 50 000	$ 200 000
	Malaysia	$ 50 000	$ 25 000	$ 75 000
	Nepal	$ 120 000	$ 40 000	$ 160 000
	Pakistan	$ 200 000	$ 70 000	$ 270 000
	Philippines	$ 400 000	$ 125 000	$ 525 000
	Sri Lanka	$ 300 000	$ 100 000	$ 400 000
	Thailand	$ 400 000	$ 125 000	$ 525 000
	Sub-total for National Centres	$2 070 000	$ 685 000	$2 755 000
	Grand Total (3A + 3B)	$2 170 000	$ 735 000	$2 905 000

4. Miscellaneous

A. Regional Coordination Unit (RCU)

(1) Operational expenses of RCU	$ 100 000
(2) Regional travel of international staff and consultants	$ 90 000
(3) Regional Buffalo Conferences	$ 60 000
(4) Regional Buffalo Documentation Centre	$ 100 000
(5) Review Mission	$ 20 000
(6) Contingencies	$ 25 000
Sub-total	$ 395 000

B. National Centres

	In-country Workshops	Contingencies	Total
India	$ 5 000	$ 15 000	$ 20 000
Indonesia	$ 5 000	$ 5 000	$ 10 000
Malaysia	$ 5 000	$ 5 000	$ 10 000
Nepal	$ 5 000	$ 5 000	$ 10 000
Pakistan	$ 5 000	$ 5 000	$ 10 000
Philippines	$ 5 000	$ 15 000	$ 20 000
Sri Lanka	$ 5 000	$ 10 000	$ 10 000
Thailand	$ 5 000	$ 15 000	$ 20 000
Sub-total	$ 40 000	$ 75 000	$115 000

Grand Total for Miscellaneous expenses = $510 000
(4A + 4B)

C. DESCRIPTION OF GOVERNMENT INPUTS

1. Pre-requisite

Each participating Government shall identify two outstanding technical specialists involved in the country's buffalo development efforts (one in research/training sector and the other in the production/development sector) who shall prepare a comprehensive Country Report on the Buffalo (see description in Work Plan) and represent their country in the pre-implementation Regional Buffalo Conference that may be organised by FAO in early 1976.

2. Assignment of National Staff

In addition to the Country Programme Director, each Government will appoint/designate a core country technical team composed of at least three technical specialists from the following disciplines: animal health, buffalo nutrition, buffalo breeding and physiology, buffalo production management, feed and fodder production, and livestock economics. Likewise, appropriate supporting staff will be drafted to backstop the country technical team in the national buffalo programme.

The exact quantification and breakdown in the assignment of national staff to the national buffalo programme will be finalised after the first In-country Buffalo Workshop.

3. Government-provided buildings, supplies, and equipment

Details of these will be provided later.

4. Miscellaneous

Details of these will be provided later.

In general, the Governments of the countries concerned shall also provide appropriate counterparts for international staff and consultants, internal transport, and other usual facilities required for in-country programme activities for such international staff and consultants.

APPENDIX - TABLES

Table 1: Estimated world distribution of buffalo population in 1974.[1/]

Area	Country	Number (in million head)	Total Number (in million head)
EUROPE			0.8
AMERICA			0.2
AFRICA			2.7
OCEANIA			0.1
ASIA			
	India	77.4	
	China	31.7	
	Thailand	10.3	
	Pakistan	9.3	
	Philippines	5.2	
	Indonesia	4.3	
	Nepal	3.7	
	Burma	1.6	
	Sri Lanka	1.3	
	Vietnam	1.2	
	Malaysia	0.3	
	Others	0.6	
			146.9
		GRAND TOTAL	150.7

[1/] These estimates were extrapolated from data collected and collated from various sources.

Table 2: Summary of cost requirements for UNDP-assistance needed for various country schemes, and operation of Regional Coordination Unit (in thousand US dollars)

1.	India	$ 1 149.5	
2.	Indonesia	$ 417.5	
3.	Malaysia	$ 199.0	
4.	Nepal	$ 337.0	
5.	Pakistan	$ 574.0	
6.	Philippines	$ 1 074.5	
7.	Sri Lanka	$ 777.5	
8.	Thailand	$ 1 074.5	
	Sub-total for country schemes		$ 5 538.5
9.	Regional Coordination Unit		$ 1 013.0
	GRAND TOTAL		$ 6 551.5

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August 1975

conference

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS ROME

Item 8 of the
Provisional Agenda

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Eighteenth Session

Rome, 8-27 November 1975

STRENGTHENING OF NATIONAL AND INTERNATIONAL AGRICULTURAL RESEARCH

Summary

1. This paper opens by examining briefly the progress made in strengthening agricultural research in and in the interest of the developing countries in the 1970s. As requested by the Programme Committee, it then describes the role and benefits of the Consultative Group on International Agricultural Research and issues it is now grappling with; problems facing the developing countries in building their research capabilities and how FAO might extend its present cooperation with other oganizations in helping them; approaches to accelerating the adoption of new technology; and, finally, recent advances in linking basic to applied research, highlighting some gaps requiring urgent attention.

2. The guidance of the Conference is solicited on:

(i) Future priorities for international agricultural research.

(ii) How FAO might attempt to help countries further in six identified priority fields (research planning, training, scientific information, research operations, action to speed the adoption of results, and linking developed and developing countries in new research activities of high priority).

(iii) How demand for such services might be identified, financed, and made better known to potential beneficiaries.

(iv) Ways in which FAO, the International Centres, and other organizations might cooperate most effectively with developing countries in these matters.

3. The attention of the Conference is drawn to more detailed suggestions made in Part 5 for follow-up action by FAO and other Agencies, particularly those designed to help national programmes in the planning, organization and conduct of research. It is suggested that FAO's Headquarters' staff and regional organization, may need strengthening if more effective services are to be provided.

4. Further detailed information on the activities of the Consultative Group and of FAO in support of research may be obtained from the brochure "International Research in Agriculture", which has been tabled for information of delegates, and from FAO's "Register of Activities Related to Research".

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1. Introduction

1.1 Background

1. The 1973 FAO Conference decided that agricultural research should be a major topic for discussion at the Eighteenth Conference in 1975.

2. This paper has therefore been written to inform the Conference of progress in the development of support for agricultural research in and in the interest of developing countries since 1973; to draw to its attention priority problems still requiring urgent attention, and to seek its guidance on approaches to meeting them, with particular reference to the role of FAO. The format follows that laid down by the Programme Committee, although it has proved a difficult task to provide all the information requested in a paper of moderate length.

3. Strengthening agricultural research was accorded high priority by the World Food Conference, which commented on current weaknesses and future needs in several resolutions, but particularly in Resolution 4 of the First Committee. The Conference recommended that the resources devoted to research, extension and training should be increased "several-fold" in real terms by 1985.

4. Adopting the Oxford Dictionary definition of several as "more than two but not many", and assuming expenditure on research by the developing countries themselves, at international and regional research centres, and in other technical assistance programmes to be around $350 million in 1970, this could imply an outlay of rather more than a thousand million dollars at constant 1970 prices by 1985. While this sounds formidable, it would be equivalent only to an estimated 0.5 percent of agricultural GDP for those countries, compared to around 0.25 percent in 1970. By contrast the scientifically advanced countries spend about 1 percent of agricultural GDP on research, and in the case of Japan almost 2 percent. A recent estimate puts federal, state, and industry investment in food research in the United States at $1.6 billion for 1974 - probably higher than the expenditure anticipated for developing countries as a whole by 1985 which could be inferred from the World Food Conference resolution.

5. Although such comparisons have to be viewed with caution, they suggest that, despite the injection of new money and manpower through the Consultative Group on International Agricultural Research (CGIAR), agricultural research in the developing countries is still grossly under-supported and likely to be subject to financial constraints for some years to come. The serious implications of current under-investment will be referred to in more detail later. While the ultimate remedy lies in the political will of nations to allocate more resources to agricultural research, it is of the highest importance in the immediate future to strengthen research planning and management so that scarce resources are directed to issues of national and international significance, and the results help to advance national agricultural and socio-economic objectives both in the short and the long-term. Much of FAO's effort in support of research has these goals in mind.

1.2 The role of research in development

6. The inadequacy of investment in agricultural research in many developing countries appears to be due largely to two basic misapprehensions. The first of these is that research is slow-yielding, low-yielding (or both) compared to alternative uses of scarce resources; the second, that it is unnecessary because there is a massive reserve of existing technology which can be drawn on to solve the problems. The latter is probably a main reason for the fact that developing countries spend more than twice as much on extension as on research, (1) and seems also to have coloured the past attitudes and resources allocated by FAO and other development agencies to agricultural research.

7. While both of these assumptions contain elements of truth, their validity is open to challenge for the following reasons:

(i) While inappropriate or badly-conducted research is clearly a waste of resources, investment in well planned and implemented agricultural research can have a very high pay-off, internal rates of return well above average opportunity costs for use of public funds being reported in several recent studies. Nor is the return necessarily slow compared to many alternative investments, such as major irrigation projects. It is significant that evidence of high returns from developing countries is mainly from those which have devoted special efforts to building sound research bases such as Brazil, Colombia, India, and Mexico. (See Bibliography references (2)-(6). This underlines the importance of raising the general standards of national research systems as well as the need for deeper insight into the factors determining successful returns to research investment and for more research on the constraints hampering the use of improved techniques.

(ii) Although there is undoubtedly a considerable stock of knowledge not being adequately utilized, much of this originates from industrialized countries and is often unsuited to the needs of developing countries without further adaptive research for social as well as technical reasons. The chances of success in its utilization are therefore greatly diminished where a country lacks a sound multi-disciplinary research capability.

(iii) The International Agricultural Research Centres have been created in the hope of generating new knowledge more nearly attuned to the needs and environment of the developing countries than that which can be "borrowed" from temperate areas. Nevertheless, they too depend on national research programmes for the application of this knowledge and its local testing to facilitate its transfer to farmers.

(iv) Numerous commodities and problems important to developing countries require research which is not covered by international or developed countries research programmes; and, given resource constraints, cannot be in the near future. Countries must build their own capabilities to respond to these challenges.

(v) Research must provide basic information to guide national planners on the validity of the technical assumptions on which their development objectives are based and on choices between technological alternatives and their socio-economic implications.

(vi) There is a very important trade-off between research and extension, both being essential links in the chain leading to the achievement of development objectives. Extension workers need to be able to demonstrate successful and profitable technical innovations to farmers if they are to find a receptive audience. For this research is needed both to develop the technology, and to identify possible constraints to its adoption or "second generation" problems arising from its use. However, to ensure that farmers, and particularly small farmers, are able to utilize the results of research, an effective delivery system is essential. Feed-back of experience from this system is invaluable in guiding research workers as to the real problems and priorities of farmers.

8. Research must thus be viewed as a vital national resource - an essential component of the development process, both to raise productivity in the shorter-term, and to prepare and orient the longer-term transformation of a society to meet future exigencies. It is an umbilical cord linking the present to the future.(7)

1.3 Recent trends towards the evolution of an integrated international agricultural research system

9. During the present decade there are signs that this is being more widely appreciated, partly due to a greater recognition of the benefits which can accrue from well organized research and supporting services, and partly from the wish of many countries to reduce their dependence on imported technology. This is vital to the New Economic Order.

10. An important outcome of this trend has been a move towards greater cohesion and coordination of agricultural research activities throughout the world, involving both developed and developing countries. This is leading to the evolution of a global agricultural research system; within which more immediate objectives are being approached through a series of sub-systems of cooperating national and international institutions, largely concentrating on

applied or adaptive research; while scientific capabilities, of organizations such as CSIRO, ORSTOM, and other advanced research establishments and universities are gradually being harnessed to tackle more intractible problems related to long-term demands for food, raw materials, cheap renewable sources of energy, and environmental management. (See part 4).

11. This emerging global system includes the rapidly expanding network of International Agricultural Research Centres and other activities supported by the CGIAR; regional integration activities such as the IICA/CATIE programme in Latin America, SEARCA and the Asian Coconut Community in Asia, the WARDA programme in Africa, and collaborative research efforts such as the FAO/UNDP regional programmes in the Near East and North Africa on land and water use, field food crops and animal institutes; and supporting activities such as the international information networks being developed by FAO on current research activities (CARIS), agricultural documentation (AGRIS), plant genetic resources, and sector analysis (PICASA).

12. Because most of these involve arrangements for training and information exchange, as well as research, they offer an approach which both accelerates the implementation of an agreed programme of research and helps to build up further research capabilities.

13. There are also, as will be seen later, indications of increasing strength within and collaboration between national systems in both developed and developing countries. This is evinced by the strong demand for technical assistance in institution-building in research and training in FAO's field programmes, by an increase in trained manpower in many developing countries, and by an interest in cooperative research programmes.

14. Although there are no grounds for complacency - there are many gaps and weaknesses both in technical fields of research, and in research related to the adoption of new technology by producers - the situtions overall has improved markedly during the current decade. This encouraging trend is drawn to the attention of the Conference.

2. The Role and Activities of the Consultative Group on International Agricultural Research (CGIAR)

15. In this process an increasingly significant role has been played since 1971 by the CGIAR, of which FAO, UNDP, and the World Bank are the co-sponsors. Although only one component of the system, its influence both as a catalyst and directly through the international and regional research centres and programmes it supports and their interactions with national programmes, as well as with international and bilateral development assistance agencies, has been very considerable.

16. This section will therefore describe briefly the evolution of the CGIAR, the potential benefits of its activities, and some of the issues it faces in its future development. For more details the attention of the Conference is drawn to the brochure entitled: "International Research in Agriculture" prepared jointly by the three co-sponsors, which has been distributed to delegates for information.

2.1 The nature of the CGIAR

17. The idea germinated as a result of informal meetings between senior representatives of national and international development assistance agencies and certain private foundations where various means of accelerating food and agricultural production in the developing countries were discussed. It was recognized that internationally financed research independent of political constraints could play a significant role in this respect, particularly if focussed on tackling difficult problems for which a critical mass of inter-disciplinary expertise and supporting facilities likely to be beyond the resources of individual countries was required. At the same time it was felt that international efforts in this field were inadequate, since several key food crops and livestock were not within the ambit of the four existing International Agricultural Research Centres, nor were certain important ecological zones or research problem areas adequately covered by existing international or national programmes.

18. In order to reinforce and broaden the basis of support for agricultural research in developing countries, in a way which would both complement and strengthen national efforts, it was decided to adopt the device of an informal Consultative Group, whose objectives would be to mobilize additional financial support to cover identified crucial gaps and weaknesses in agricultural research, affecting a broad mass of the population in the developing countries which required for their successful solution a concentrated and continuing multi-disciplinary effort of an international or regional nature.

19. The Group was established in 1971 and its present membership consists of FAO, UNDP, World Bank, UNEP, the Ford, Rockefeller and Kellogg Foundations, the African, Asian and Inter-American Development Banks, the EEC, the Canadian IDRC, eighteen donor countries (Australia, Belgium, Canada, Denmark, France, Germany, Iran, Italy, Japan, Netherlands, New Zealand, Nigeria, Norway, Saudi Arabia, Sweden, Switzerland, the United Kingdom and the United States). Representative membership from the developing countries, on the basis of two countries per region was added following the 1971 FAO Conference and Council. The current representation agreed by the countries is: Latin America - Brazil, Argentina; Africa - Nigeria, Morocco; East and South Europe - Romania, Israel; Asia and the Far East - Thailand, Malaysia; Near East - Pakistan, Arab Republic of Egypt.

20. Recognizing the need for sound technical advice on new proposals being submitted for financing, as well as for monitoring the progress of ongoing research programmes it would be supporting, the Group decided to establish a Technical Advisory Committee of eminent agricultural scientists and economists, appointed in a personal capacity on a rotating basis, but representative equally of the major developing and developed regions and of a wide range of disciplines. FAO provides the Secretariat for the TAC, and is responsible for its meetings, for assistance to its technical sub-committees and review missions, and for arranging consultancies and providing advice and special papers as inputs to its expanding work.

2.2 Programmes being supported by the CGIAR and their objectives

21. In 1975 the Consultative Group is supporting nine International Research Centres and three related programmes.

22. The nine International Centres (the first four of which were already functioning when the CGIAR was formed) are as follows:

(i) The International Rice Research Institute (IRRI), Los Baños, Philippines; one of the two oldest International Centres, working on all aspects of the improvement of the rice crop and the main cultural systems in which it is grown.

(ii) The International Maize and Wheat Improvement Centre (CIMMYT), El Batán, Mexico; devoted mainly to developing improved types of wheat and maize, including high-lysine maize, but with smaller programmes for the improvement of barley, high-altitude sorghum, and wide crosses (Triticale, etc.).

(iii) The International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria; focussing on farming systems for the humid tropics, mostly in Africa, with special attention to the use of tropical soils; it has crop specific programmes on maize, rice, cassava, yams and cowpeas.

(iv) The International Centre of Tropical Agriculture (CIAT), Palmira, Colombia; aimed at increasing productivity of key food commodities in tropical areas of Western Hemisphere. In addition to field beans and cassava, it works on maize and rice, and has a major beef and pasture improvement programme.

(v) The International Potato Centre (CIP), Lima, Peru; a one crop institute working to improve yield and quality of the potato and to expand its cultivation in the tropics.

(vi) The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India; attempting to develop more stable production systems of particular benefit to small farmers in hot, dry, summer rainfall regions of high climatic stress. The main crops being worked on are millet, sorghum, chickpeas, pigeon peas and groundnuts; and there is strong emphasis on soil and water conservation and water harvesting.

(vii) The International Laboratory for Research on Animal Diseases (ILRAD), Nairobi, Kenya; concentrating on immunological methods for controlling two major animal diseases - East Coast Fever and Trypanosomiasis.

(viii) The International Livestock Centre for Africa (ILCA), Addis Ababa, Ethiopia; working to increase animal production in Africa through improved ruminant husbandry systems.

(ix) The International Centre for Research in Dry Areas (ICARDA), now being established, to help strengthen research in the Near East and North Africa. This is mainly a zone of winter rainfall followed by hot arid summers and thus has a different agricultural environment to the tropical areas covered by the other International Centres. ICARDA will work on the improvement of major food crops in this region (wheat, barley, food legumes), cultural techniques for soil and water conservation, and on the development of more productive land use systems, particularly for rainfed areas.

23. In addition to their own multi-disciplinary research programmes all of the International Centres are charged with the development of strong cooperative research and information linkages with national and regional research institutions in other parts of the world, and with training research scientists and production specialists. On average some 55 percent of their "core" budgets is devoted to research and supporting services, 12 percent to conferences and training, 5 percent to documentation, and the remainder to station operations and administration. Additional "off-campus" activities involving cooperation with national programmes, usually funded as individual projects outside "core" appropriations, are equivalent to around a quarter of the "core" expenditures of the five older Centres.

24. The Centres with major crop responsibilities are also building up collections of the world's germplasm for these crops; these will make a valuable contribution to the programme of an important new activity being supported by the Consultative Group, the International Board for Plant Genetic Resources with headquarters at FAO. This has its origin in concepts developed by FAO and its expert panel on plant genetics and is developing a worldwide network of gene banks supported by a comprehensive information system and a training programme. It has a carefully worked out set of priorities for crops and threatened areas in which it plans to promote and coordinate action to collect and preserve genetic resources in danger of extinction, and to evaluate them for use in future crop improvement programmes. Consideration is being given to including forest genetic resources in its programme.

25. The CGIAR is also supporting the rice research programme of the 14-nation West Africa Rice Development Association (WARDA), with which FAO has had close links from its inception; and the development phase of the FAO Current Agricultural Research Information System (CARIS) project.

2.3 The benefits of the international research system

26. Because only CIMMYT and IRRI out of the institutions described above have had a significant research operation for more than six years, attempts at quantitative estimates of benefits have been limited to their work, and even those are in a comparatively early stage. Before discussing them more specifically it is therefore desirable to try and express the value of the system as a whole in terms of the special advantages it offers the developing countries, rather than in monetary terms.

27. While a number of countries have excellent national institutions, the International Centres are the only group of politically independent related institutes specifically charged with agricultural research aimed at priority problems of wide importance to the developing countries within the evolving global agricultural research system referred to earlier. They thus have a unique role in the system and are particularly well placed to develop backward and forward linkages; on the one hand to draw on the advances made in scientific knowledge and research throughout the world by other institutions, and on the other to recycle this knowledge direct to the developing countries they serve, and/or to test it for its utility in their own research programmes and if necessary modify it to suit specific environmental needs.1/

1/ An example is their utilization of high lysine breeding materials in corn, sorghum and barley obtained from specialized research centres in developed countries for improving nutritive value of cereals.

28. In particular this gives the crop-specific Centres ready access to very large collections of germplasm which they have the resources to evaluate, to incorporate the favourable characters thus identified rapidly into broadly adaptable populations of genetic material, and to send the progeny to a large number of cooperating national and international stations for further testing and recombination at various stages of segregation, or for direct use by national programmes if suitable. 1/ This offers the latter, particularly the smaller countries, a significant gain in time and wider access to world genetic resources than if they had to work alone, starting from scratch.

29. The Centres have a second unusual advantage in their ability to take risks. Because of their wide base of support, and the fact that they are expected by their supporters to be in the vanguard of innovation, they have more flexibility to test out new methods than is given to many government-supported institutions, either in developed or developing countries. They are better able to hazard some steps backwards in order to advance more rapidly!

30. As more institutes have been built and their geographical coverage has increased, the internationally supported programmes have become increasingly able to draw on each other's resources to avoid duplication of facilities and programmes and yet to expand their geographical coverage, a third important source of strength. Thus CIMMYT and IRRI both have agreements with IITA in Africa, and CIAT in Latin America, for those Centres to undertake work on testing and adapting their mazie and rice materials respectively with countries in those regions.

31. The international institutes also perform a major training function. They provide in-service training fellowships for young scientists, facilities for doctoral and post-doctoral research, and special training in agricultural economics, laboratory technology, experiment station management, and courses for research directors. At any one time there may be up to 150 people on these longer courses at the older Centres. There are shorter courses (for which there is a large unsatisfied demand) to train production specialists for on-farm testing and demonstration of experimental results linking adaptive research to extension work. This overall output of trained people is not only of great value to the developing countries, but contributes a major input to the Centres' programmes since they are all actively involved in the mechanics of the research in their training, and when they return to their own countries provide strong working linkages between the Centres and the national system. 2/ This helps to provide an antidote to the "brain-drain" in science: a recent evaluation of the training programmes of CIMMYT and IRRI shows that an encouragingly high proportion of ex-trainees are still employed by their countries in activities directly relevant to their training. (8)

32. Finally each Centre acts as a focal point for information, workshops and seminars, in relation to its specific commodity and geographical research orientation, and often as a result of these activities becomes a catalytic agent for further individual or cooperative research.

33. A number of other effects of the development of the Consultative Group and the International Centres can be identified which seem likely to have a beneficial impact on the world agricultural community, but which can only be ranked as imponderables in terms of measurement. These include:-

(i) The representation of scientists and leaders from both developing and developed countries and from international agencies on the Consultative Group itself, the TAC, the Boards and Advisory Committees of the Centres;

1/ Some national institutions also have important germplasm collections and breeding programmes, but these are generally directed to the improvement of national agriculture, nor is the material always readily available to all countries.

2/ As the Director-General of CIMMYT has recently pointed out, an informal network of some 600 trained wheat workers has grown up which includes about 300 of CIMMYT's former visiting scientists, 20 former doctoral fellows, 300 participants in seminars, and 13 CIMMYT staff members in national programmes.

(ii) The physical presence of the Centres themselves, their cooperative and "outreach" work, and that of other programmes supported by the CGIAR in an increasing number of developing countries;

(iii) Greater continuity in research and increasing expertise in research management related to problems of developing countries resulting from the system;

(iv) The wider acceptance of an inter-disciplinary approach to research; and

(v) The extent to which it has led planners at both the international and the national level to re-think not only their support to research and information systems but also their policies and institutions designed to facilitate the adoption of new technology by farmers.

34. The quantification of financial benefits accruing to any research programme is difficult and full of pitfalls since even if the data base is adequate to enable gains to be estimated in physical terms these depend on a complex of related inputs and services, and other costs may be incurred to achieve those gains. Imputing prices to these costs and benefits is often a controversial matter. In addition to technical factors, social gains or losses have to be taken into account, and these may interact with technological change.

35. Nevertheless efforts have been made to calculate the returns accruing to the use of genetic material from the two oldest Centres (9), (10), using both simple yardsticks such as changes in area and yield in countries where "high-yielding" varieties are in wide use, estimates of yield differentials between those and traditional varieties, and also more sophisticated analytical techniques. However in view of the problems mentioned above it is not too surprising that the estimates of the gross value of output vary considerably, ranging from a high of approximately $4 billion to a more conservative estimate of $1.1 billion for 1972/73 on the same price assumption but using different methodologies. Nevertheless even the lower of these figures is impressive when related to a total overall cost at IRRI and CIMMYT in 1972/73 of under $10 million and perhaps a comparable cost of working to select, adapt and improve on their materials in national programmes.

36. A review of these first attempts to assess the impact of international research programmes highlights the following facts:-

(i) the great complexity of quantifying even the direct benefits from research, and the need for research to refine the methodology to do this.

(ii) the probability of other, more intangible benefits such as the release of land from a given crop to other uses of national importance as a result of increasing its yields; increased cropping intensities made possible by the development of short-maturing non-photo-periodic varieties; and the improvement of nutritive value, e.g. by introducing high lysine genes.

(iii) the importance of careful monitoring of the adoption by farmers of research results, since this - despite the difficulties outlined above - does enable fairly strong inferences to be drawn as to the effectiveness of international and national programmes. It is valuable both for improving the data base for benefit/cost analysis, and for identifying the gaps in research and the constraints to its adoption, and feeding this information back to research and development planners for remedial action. For example it is clear that wheat and rice varieties have been most widely adopted under irrigated conditions and in areas of relative ecological homogeneity even though sometimes widely separate geographically.1/ It is also clear that equal success has not yet been achieved with maize at least partly because these conditions do not apply to the same extent with that crop.

1/ 80 percent of the area under high-yielding varieties of rice, and nearly 70 percent of that under wheat is irrigated. Incentives are better environmental stability and greater variety/fertilizer interaction.

(iv) the interdependence not only of international and national research programmes in generating results of direct value to farmers, but also of national development policies (particularly pricing of inputs and products) geared to promoting their implementation. 1/ Because of these reciprocal relationships it is difficult to attribute benefits to a single innovation, such as an improved variety, or to allocate them meaningfully between international and national research programmes.

(v) the need to devote more effort to this type of evaluative analysis as the CGIAR supported institutes evolve. Arrangements have been made for continuing review of the technical soundness and balance of their "core" programmes, but "impact analysis" on a field basis in cooperating with national institutions is also necessary. This is a gap in the system.

2.4 Some problems facing the Consultative Group

37. Because of its rapid expansion the whole international research system is still developing; its complementarities and potential for internal synergism have yet to be fully exploited, its weak spots are still unclear, its linkages with national institutions are still evolving. The latter is crucial to its success since the justification for its creation is the value of its output to those institutions, but it also poses a real dilemma to the International Centres, and the CGIAR as a whole, related to the extent to which support services in various forms should be extended to national systems.

38. The Consultative Group has always held that its task was to support international research which would be complementary and additive to national research programmes. The latter might be assisted where necessary to utilize the results of this research either through bilaterally funded "outreach" activities of the Centres; or, where more general reinforcement was required, by FAO or other means, but the CGIAR would not finance individual national programmes.

39. Over time it has become apparent that this concept leaves a good deal to be desired. The Centres have found the adoption of their research results impeded not merely by weaknesses in national research systems, but also in extension and other supporting services, and in development policies. This has led them first to extend their research activities from their original biological crop-oriented focus to include farming systems and socio-economic studies, and secondly to take on an expanding range of "outreach" work far from their home base. Both these trends, although responding to felt needs, have increased the programme complexities, costs, and strains on management of the Centres, while the pay-off is not yet clear. 2/

40. To alleviate these strains and accelerate adoption of their results some Centres feel a need to outpost "core" staff to provide "regional services".(11)These vary in nature from activities such as disease surveillance and regional seed testing nurseries which have direct feedback links to the Centres' breeding programmes, to information, consultancy, and training activities, the latter with strong emphasis on production technology and reaching out to activities marginal to research such as extension methods and seed production.

41. Particularly where there are areas with groups of small countries with weak institutional bases there are sound arguments for regionalization; however, for the Centres themselves to attempt to provide such services could tax their resources to the detriment of their main research missions as originally conceived. Alternatively their field staff and budgets would have to be considerably augmented, which is in fact what is now being proposed in some cases.

42. Here the donors are faced with difficult decisions. As a result of inflation and proposed programme expansion, expenditures have escalated from $45 million in 1975 to around $70 million in 1976. Capital costs of building new institutes have risen particularly fast. Despite new membership, there is a danger that growth may outrun funding and as there is no sign of slackening in demand in terms of new proposals coming to the TAC for consideration, some challenging issues need to be faced in the review of the Group's future operations agreed on at its August meeting.

1/ In certain countries lack of adoption is clearly correlated with price disincentives.

2/ CIMMYT senior staff spent the equivalent of 6½ man-years in duty travel outside Mexico Mexico in 1972/73.

43. Apart from measures related to its internal management and review and evaluation procedures aimed at improving the efficiency and sensitivity of its operations, these include five crucial policy questions which may be summarized as follows:

(i) Should the system continue to expand, or should there be a halt for consolidation? If so, what can be done to meet requests "in the pipeline" or new exigencies? Could approaches less costly than large institutes be devised to do so?

(ii) If there is continued expansion should this be within the framework of priorities agreed on the advice of the TAC in 1973 (essentially restricted to staple food, crops and ruminant livestock, or should this be changed? What should the new priorities be? - some possibilities are indicated in Part 4 of this paper.)

(iii) If there are changes, should these be at the expense of some existing activity? Current programmes are not sacrosanct; even if they have been successful in the past "exhaustion" can set in.

(iv) Is the ultimate mission of the International Centres to become "research-oriented development institutes", or would they ultimately have a greater impact on agricultural progress in developing countries if they were to revert more narrowly to their primordial role of pathfinders in the development of new technology and in helping to train national scientists to plan and utilize it, leaving broader aspects of adoption of technology to others.

(v) If the latter, who else could bridge the gaps that the Centres have identified between what they are doing and what they believe needs to be done to strengthen national research and development institutions, and to provide the various services outlined above. Should the Centres stop at assisting countries in research related to their specific mandate or should they offer general advice on building research capabilities if requested? Where is the borderline between research, extension, and other development activities essential to its successful adoption?

44. It is clear from discussion at the Consultative Group meeting that certain of these functions, particularly those related to strengthening national research institutions, are seen as the task of its co-sponsors, and especially of FAO, in cooperation with bilateral development assistance agencies. Moreover, there is a feeling, reflected both in the attempts of the International Centres to expand their activities in technical assistance, and in a proposal to set up a privately funded International Agricultural Development Service 1/ that FAO is not doing enough in this field at the moment. Both the TAC and the CGIAR have expressed the hope that its activities could be reinforced to enable it to do more.

45. FAO is in fact already involved in a great range of such activities, although this does not appear to be as widely understood as it ought to be, (possibly because FAO has not in the past been given the resources to publish regularly a consolidated record of its work in support of research). This includes over 300 projects in 80 developing and 26 developed countries while FAO has assisted over 20 countries in building national research and training institutions in the last five years.2/ Even though much more remains to be done these are not negligible achievements and they form an essential component of FAO's role in fostering agricultural and rural development. While the range of FAO's work is much wider than that of the International Research Centres, their activities and those of FAO are complementary in many respects. For example, the results of the Centres' work are of great value to FAO as an agricultural development agency. Conversely, FAO's wide contacts with developing countries enables it to identify gaps and to offer guidance to the CGIAR on what is important; and its field activities both generate experience and knowledge of value to the Centres and help to bring new technology into practical use. The efforts of FAO and the Centres in support of agricultural research must therefore be integrated in a way which will maximize these complementarities.

46. While the Conference may wish to offer guidance on all these issues, that of how to strengthen national research, related services, and supporting links to development is particularly important to FAO. (It is stressed in the 1976-77 biennial programme of work)

47. It is therefore necessary to consider the relevance of what FAO is currently doing to strengthen national systems, what moreneeds to be done, and the respective roles, linkages and comparative advantages of FAO and other technical assistance institutions - including the International Centres - in this respect.

1/ An initiative being considered by the Rockefeller Foundation.

2/ Including Afghanistan, Burma, Chile, Cyprus, Ethiopia, Egypt, Guinea, Indonesia, Iran, Iraq, Jamaica, Jordan, Liberia, Libya, Pakistan, Senegal, Somalia, Thailand and the Yemen Democratic Republic.

3. Strengthening National Research Systems

3.1 Common weaknesses of national research systems in developing countries

48. While all countries are "developing" in the sense that the generation of new knowledge through research is a never-ending process and no country is truly technically independent, there are great differences between countries in the strength of their scientific establishments.

49. No systematic overall assessment of what needs to be done to help those less well endowed to build up their research capabilities has yet been undertaken, but evidence from 48 projects in the 1972/73 Review of FAO Field Programmes, as well as from several other studies of a regional nature, suggest the following major problems to which both national efforts and outside help might most effectively be directed.

(i) Research is chronically under-financed; expenditure for research in developing countries still representing under 15 percent of overall expenditure on agricultural research in 1970, despite a four-fold increase over the last twenty years. In some countries where money has been lavished on buildings and equipment, there is no flexibility for funding small items essential to operational efficiency.

(ii) Research is often not well aligned to national needs and priorities, due to poor communication and understanding between planners, administrators and research directors, and inadequate machinery for review and appraisal of the validity of research programmes to changing national goals or wider objectives. (This, it might be added, is often a source of weakness in countries with advanced scientific capabilities.)

(iii) Research organization is frequently weak and fragmented between various ministries, departments, universities and semi-autonomous agencies. Liaison between these is often very poor. Over all developing countries 70 percent of institutions still have less than 10 workers. This results in dissipation of resources, an absence of inter-disciplinary effort, and accentuates the manpower constraint.

(iv) There is an acute shortage of trained scientists (and particularly those with conceptual scientific skills), with only half as many researchers per dollar of product as in developed countries, and those generally trained to a lower standard. There is also a serious training gap in respect of field and laboratory technicians. Manpower planning tends to be weak and training not clearly related to identified needs, both in developed and developing countries. Nor are the results of training properly evaluated. Deficiencies in priority setting, planning and implementation of research are inevitable under these circumstances.

(v) As a consequence of (i) most scientists in developing countries are starved of funds for travel or publications, and are therefore poorly informed as to the state of knowledge and availability of materials emanating from international or other institutes outside (and sometimes even within) their own countries.

(vi) Conditions of service (lack of equipment, immobility, and inadequate supporting intermediate level field and laboratory staff), often frustrate sound research.

(vii) Salaries and career prospects fail to provide adequate initiatives to keen young scientists, nor do they have sufficient freedom and flexibility to publish in reputable journals. This, together with working frustrations, is a major cause of the "brain drain". FAO's field programme review repeatedly urges governments to do more to attract and retain trained staff. Where such support is lacking technical assistance is largely wasted or even counter-productive. Aid should not substitute indefinitely local staff, and the ability of a country to carry on an institution or research project and evolve it to meet new challenges after expatriate staff have left is the test of its success.

(viii) Linkages between research institutions and extension and other services essential to successful implementation of their results are poor. Researchers blame extension services for this, but their results are often presented in a way which has has little meaning, either because of failure to integrate biological and socio-economic information, or because they have insufficient relevance to conditions on the farm. Means must be found of increasing researchers' awareness of farmers' needs and of testing new technology at the farm level, and it is difficult to draw a hard and fast line between research and extension at this point.

(ix) The successful introduction of improved agricultural technology may require adaptation of extension and other public or private sector services to the changed conditions that will result, or even the creation of new institutions. For example, alternative crop planting strategies if rains are delayed stand little chance of acceptance if seed supplies are not available locally; watershed management practices may not succeed without farmer cooperation or consolidation; water harvesting and recycling without cheap pumps. There is more to strengthening national research than building up research institutions; unless systematic planning linkages to implementation can be created, research may still have a limited impact.

50. Certain of the problems outlined above, despite their importance, for example the question of salaries, incentives and conditions of service, are matters of internal policy. However, there are other areas in which external assistance could do much to help, six of which are particularly crucial. These are:

(i) Identifying major priority fields where research is needed to remove bottlenecks to development.

(ii) Providing technical assistance to national institutions in planning, organization and institution building; and where necessary helping to establish and operate research institutions until national staff can take over.

(iii) Building national research capabilities through education and training.

(iv) Upgrading scientific and technical knowledge through consultation, information exchange, documentation and bibliographic services and publications.

(v) Helping to establish and operate appropriate cooperative research activities or research projects related to identified regional or national priorities.

(vi) Integrating research more closely with development institutions and services at the farm end.

3.2 Identifying priority fields in research

51. This is perhaps the most difficult task facing research planners, and one with which scientists and administrators in advanced countries are wrestling to develop more precise approaches. In the case of the developing countries in addition to determining individual needs, there is the problem of working out priorities for international support to research, often involving cooperation with groups of countries.

3.2.1 Helping to determine priorities for international support to agricultural research

52. While the FAO Conference, and the Regional Conferences provide a valuable forum for discussion of priorities, divergent views are often expressed at large meetings and a means of clarifying these and bringing the key issues into sharper focus is required.

53. A useful instrument for this purpose is the research consultation on an ecological zone or problem-oriented basis. Consultations of this nature can bring together research administrators, scientists, and planners from national and international research institutions, developing and developed countries, and provide a means for exchange of

information on work being undertaken in various countries and through programmes of International Centres and development assistance agencies, as well as for interaction between scientists in different disciplines. This can lead to the identification of major gaps in current research and indicate opportunities for cooperative research programmes on priority problems where there is a community of interest, or other possible approaches to their solution. Details can be worked out in greater depth than is possible at larger meetings.

54. For example, an FAO Expert Consultation on Animal Production and Health Research was organized in Copenhagen in 1974 in cooperation with the World Association for Animal Production, the World Veterinary Association and the European Association for Animal Production, to identify and formulate proposals for research and research training of major importance to the developing countries that could be undertaken through cooperative arrangements between different national institutions.

55. The Consultation recommended that FAO should initiate cooperative research programmes in four priority areas, and that it should organize, in collaboration with the cooperating universities and research institutes and other institutions, a series of refresher courses for research workers in selected subjects such as animal breeding, animal nutrition, livestock development planning and epidemiological surveillance of animal diseases. Action has since been taken in both these respects.

56. FAO has been active in sponsoring other such inter-disciplinary meetings, for example, in the Sudanian and Guinean Zones of Africa in 1968 and 1970; in Asia (with special emphasis on problems of rainfed agriculture) in 1974; and in Latin America in 1974 and 1975. A further expert consultation is planned for the Near East in 1976.

57. Meetings of this nature, supplemented by information from FAO's technical assistance work at the regional and national level have proved of considerable value to FAO's own programme formulation and in advising the TAC and the Consultative Group, as well as other UN bodies such as UNDP and the ECOSOC, Committee on Science and Technology, etc., on regional research needs and priorities; thus facilitating decision-making and adjustments in aid policies to research where necessary.

3.2.2 Determining national research priorities

58. At the level of individual countries decision as to priorities for research can really only be made by research directors after consultation with national planners; and if aid to national research is to be effective policies must be worked out in close harmony with these decision-makers to ensure that any external support will have the maximum impact on national development.

59. Recent studies indicate that economic models and parameters derived from them may provide useful policy guidelines; for example in helping to provide answers to such questions as to which commodities should be given priority, who is likely to be the main beneficiary of research, what factor combinations would best serve national interests in the choice of technology, what conflicts of interest might be expected if certain options were adopted, the different strategies which might have to be followed in different regions of a country and the sort of information which ought to be gathered to provide better judgments in the future. This suggests that country perspective studies and sector analysis ought to provide a valuable basis for deriving research priorities. These are fields in which FAO is cooperating with a number of countries, but the work is very time-consuming and an enhanced training effort would help to accelerate progress.1/

1/ Recently the first steps have been taken at a meeting attended by FAO, UNDP, the World Bank, and several bilateral agencies including U.S.AID and CDM, to set up an international sector analysis programme (PICASA) to improve implementation, methodology, information and training on agricultural sector analysis.

60. Within any broad framework of priorities, operational decisions have to be made by research planners as to how to distribute resources in the most effective way between different programmes related to the several priorities, and within each programme they may also have to choose between several pathways which could lead to the achievement of a research objective, possibly with different costs and time horizons. 1/ This is a universal problem and has led to some sophisticated attempts to use mathematical programming, modelling, and benefit-cost analysis techniques in order to try and evaluate gains from past research, to predict probabilities of a successful outcome from research, and to develop these and other guidelines as a means of allocating resources to competing alternatives.

61. Some of these approaches and the criteria which might help to guide research planners in their decisions were discussed in Chapter 4 of the State of Food and Agriculture in 1972,(12) and FAO has recently followed this up in more detail with a bulletin on the "Planning and Programming of Agricultural Research".(13) A further major contribution to this field of development was the meeting sponsored by the Agricultural Development Council at Airlie House, Washington, in January 1975, of scientists, economists and research administrators from developed and developing countries, international research centres and international and bilateral aid agencies.

62. In general it appears that while some progress has been made in developing ex post evaluative techniques, and also for programme budgeting once a decision has been made to undertake a specific research programme, we are still far from being able to forecast success, the related pay-off, or the time required to obtain it from an individual research project.

63. This leads back to the conclusion expressed in the 1972 issue of SOFA referred to earlier, i.e. "that the probability of success will continue to require a strong element of faith, and that a combination of mathematics, perspiration and inspiration - seasoned with experience - will form the basis of judgment as to priorities for some years to come, as well as for the definition of specific problems related to those priorities in a way that makes them amenable to research".

64. Positive steps which could be taken to accelerate progress would be:

(i) to initiate more research on the methodology of defining priorities and how the information base for this can be improved, i.e. research on what to research on!

(ii) to train planning economists and research planners in conceptual thinking so that they can work jointly on interpreting national plans in terms of research objectives. Such a dialogue is rare at present.

(iii) to provide advisory services to help countries on request, while their own people are being trained. FAO could profitably expand its research and training efforts, as well as its participation with individual countries in analytical studies with these objectives in view.

3.3 Improving national research organization and management

65. Capable management and sound organization is essential both to the correct identification of research priorities and related projects, and the efficient allocation and use of resources for their implementation. It is perhaps the field in which most rapid short-term progress could be made in strengthening national programmes, thus also enabling them to reap the benefits of the international research system. It is not irrelevant to note that the two main causes cited for rejected applications for research grants in the United States are poor problem definition and inadequacies in design and research procedures!

1/ Thus the control of plant pests and pathogens can be approached by chemical, biological, genetic, or cultural pathways - or some optimal combination of these methods.

66. An essential first step is the establishment of internal machinery linking national planners, ministries responsible for agricultural development, research directors, universities, and the private sector, for example through the medium of a National Agricultural Research Council, with links to National Science Councils where these exist. Such a body can help to stimulate a multi-disciplinary and systems-oriented approach to research. It can also provide a focal point, through its secretariat, for research and training linkages with external assistance agencies.

67. A further step towards reducing fragmentation of effort which has already been taken by several developing countries is the creation of a central national agricultural research organization, grouping all main physical, biological and social science fields within an umbrella organization which has sufficient strength and flexibility to enable research to be undertaken either within disciplines or on a multi-disciplinary task force basis for specific commodities and problems. Malaysia and Brazil are following variations on this pattern.

68. As will be apparent from the discussion of problems facing the International Centres, there is a most delicate balance between effective concentration of effort, over-centralization leading to isolation of researchers from the real needs of their customers, and dissipation of resources resulting from trying to tailor solutions to fit increasingly narrow environmental niches.1/ Japan with its "assigned experiment system", and India in its "All-India Coordinated Programmes" provide working examples of effective decentralization, but these are both countries with a strong central organization and a generous base of trained manpower, and unless these can be assured, or the Chinese model of rotating research workers adopted, extensive decentralization is likely to lead to scientific isolation, disincentives, low-level skills and consequent inefficiency.

69. There is clearly no single institutional model which can fit all circumstances, and external assistance agencies helping developing countries therefore need to be able to study and draw on a wide range of experience and to consider the options very carefully before offering advice. This is all the more necessary because research directors and planners in the countries themselves have generally had limited opportunities for comparative analysis of alternatives to their own organizations; and although the number of senior scientists who have trained abroad is steadily increasing, this may not be the best source of knowledge or inspiration for designing research systems appropriate to a totally different environment. Indeed a major criticism of research in developing countries is that it tends to emulate and even duplicate that undertaken in more affluent societies.

70. At a recent "Bellagio" meeting, the question was therefore raised as to whether a sufficient demand existed for some special assistance to national governments in research planning, organization, and management, and if so, what type of system could best provide the necessary services. FAO's experience and that of other agencies and countries present suggests that there is a strong demand for such services, even though no systematic approach has yet been made to assessing it, and a number of suggestions was made as to how existing facilities could be strengthened. These included:

(a) Establishing a permanent diagnostic planning unit based on a small core staff of well qualified scientists and administrators and supplemented by a panel of part-time consultant scientists, to help diagnose problems, establish priorities, design plans and identify sources of funding for strengthening agricultural research systems. This unit could be affiliated with FAO, or be some new undertaking.

(b) Establishing some new internationally supported organization capable of supplying a range of advisory and operational services to national research programmes on a contractual basis using long-term and experienced career staff.

(c) Utilizing existing international and regional centres (e.g. IICA, SEARCA) and selectively creating new "service centres" to provide diagnostic and planning functions and to coordinate and transfer to national programmes the technology arising elsewhere in the world system. A problem here is that existing institutions vary widely in their structures and objectives.

1/ The contract agricultural research system in the U.K. is one model of an attempt to align research more closely to national priorities.(14)

(d) Assembling, under bilateral agreements, ad hoc teams for the range of activities referred to above. This is already being done by various donor agencies including FAO, but with variable results. For example, there is a tendency for advisers to push projects in fields with which they are familiar, often with links to institutes in their own countries. The latter, of course, has considerable value for training and backstopping the recipient country, but the projects are not always apt to its needs. The same applies to advice on institutional models. International agencies, although equipped to take a broader view, have not been immune from sectoral or disciplinary biases; whereas an inter-disciplinary team approach is frequently essential to a balanced solution.

71. Perhaps the best and most flexible solution would be to improve collaboration between international agencies (FAO, UNDP and the World Bank) to provide such services. Coordination could be provided through FAO, where machinery already exists, although its staff would certainly require strengthening. Ideally there should be:

(i) A means for determining needs for assistance more systematically and making its availability widely known to countries. This might perhaps be linked to country programming. The CARIS system, when fully operative, should provide a good basis for assessment of what needs to be done.

(ii) Diagnostic services or consultancies for project preparation or appraisal.

(iii) Project staff for longer-term assistance which might be recruited through the normal arrangements of the agencies, or on contract, or under bilateral aid arrangements from other research institutions either as teams or individually. (FAO's experience suggests that technical assistance staff need very careful matching to national needs. More advanced countries often require high level short-term consultants on a periodically recurring basis; less developed ones may require experienced but less narrowly specialized experts over a much longer period, able to participate in operational activities if necessary, and with an in interest in imparting knowledge and skills to others and not just in doing research.)

(iv) A flexible means of funding especially for smaller projects or cooperative research since the Bank is not geared to small lending, UNDP national funds are tied to country IPFs, and FAO has no such provisions in its Regular Programme. This could be provided either through the TAC/CGIAR mechanism, by the new Consultative Group on Food Production and Investment, or by some new informal consortium of donors for support to national research.

72. The Conference might wish to recommend what should be done to improve facilities for assistance to member countries in these aspects of building national institutions and to indicate how it sees FAO collaborating with other agencies in this respect.

3.4 Narrowing the trained manpower gap

73. A recent FAO assessment of numbers of qualified agricultural research workers and technicians in developing countries, based on the most up-to-date information from regional surveys, (15)-(19) indicates that there were approximately 3,600 in Africa, 3,750 in Latin America, 4,200 in the Near East, and 7,700 in Asia and the Far East - a total of 19,250, excluding China with an estimated 5,500 workers, and Japan with 3,850.

74. These figures are not directly comparable with data quoted by Evenson for 1965 (1) showing a total of 9,850, since the latter only covers 58 developing countries in respect of crops and livestock, whereas the FAO data cover more countries and all sectors of agriculture. While comparisons of data for individual countries suggests that there has probably been an overall improvement, two factors need to be borne in mind. These are:

(i) The summarized figures conceal the fact that roughly 50 percent of all the workers in developing countries are concentrated in five countries - Brazil, Egypt, India, Pakistan and the Philippines. In this respect the situation has changed little since 1965.

(ii) Even assuming there had been no increase since 1965 in the scientific establishment of the 26 economically "developed" countries listed by Evenson, they would still have, with 45,000 scientists in the crop and livestock sectors alone, more than twice as many scientific workers than all developing countries in all sectors of agriculture in 1975. The imbalance

is striking in relation to the urgent problems faced by the latter, and suggests that shortage of trained manpower remains the principal restraint on strengthening their national research efforts.

75. Narrowing this gap should therefore be a main aim of national and international effort, but it is difficult to assess the magnitude of the problem because we have no "overview" of the need and no consolidated record of existing training programmes.1/

76. Allowing for an annual wastage, even as low as 10 percent, approximately 2,000 scientists per year would have to be trained just to hold the present inadequate level steady; and given the present concentration of force in a few countries, there is clearly an enormous job of training new entrants to be done for most other countries. Assuming optimistically that present numbers of agricultural scientists in developing countries were to be doubled by 1985, at least 50,000 would have to be trained during the next decade. This excludes the equally important task of retraining and updating both scientists and production specialists, which the standards of entrants for the "in-service" training programmes of the International Centres indicates to be of the utmost urgency. Training of middle level technicians is also vital, in many countries inadequately trained supporting staff is a major constraint on the work of scientists.

77. How to quantify this gap between demand and training capacity, to develop a more systematic approach to the determination of manpower requirements by discipline, and to tailor education and training (including retraining) assistance to cover any major gaps therefore merits urgent attention by the Conference.

78. Some possible approaches include:

(i) The CGIAR (perhaps in cooperation with FAO which has already started work on this problem on an inter-divisional basis but with severely restricted resources) could sponsor a survey of manpower and training needs for research. If an overall review is considered too big a task the effort might initially be focussed on identified priority fields where known shortages exist, e.g. legume microbiology, aquaculture, farming systems, and social scientists. The danger exists, however, that partial analysis might lead ultimately to greater imbalances, even if helping to stop some immediate gaps.

(ii) A register could be compiled of appropriate institutions in more advanced countries willing to accept trainees in designated disciplines.2/ Some countries or agencies have prepared a list of such institutions, but the existence of these is not widely known in potential beneficiary countries, and in any case a more systematic approach seems desirable, leading perhaps to a recurrent FAO publication.

(iii) A training fund could be established, either by the Consultative Group on Research or that on Investment, to be allocated according to a specific programme - perhaps based on the survey indicated in (i) above. Would developed countries be prepared to accept trainees free at institutes listed under (ii) as part of their contribution to it?

(iv) The training capacity of International Centres or regional research institutions (such as SEARCA, IICA) might be expanded. However, the older established International Centres might have difficulty in expanding training without their research work suffering. To what should they give priority in training - scientists, managers or production specialists?

(v) An International Training Institute might be created, supported by the CGIAR, to fill known training gaps, i.e. training for research managers, production specialists, and research technicians; leaving formal scientific and post-graduate "in-service" work related to the conduct of research to existing arrangements.

1/ Present annual training capacity of the International Centres and Regional Institutions such as SEARCA and IICA totals about 800 at degree level or above. FAO spends around 10 percent of its funds in research-oriented projects on training. Of the 1,600 fellowships granted each year 54 percent are of nine months' duration or more, and are considered as degree or diploma-oriented, but data on the number actually being trained for research work or related activities is not yet available. Most bilateral donors also accept trainees in their own programmes.

2/ For example, FAO has already made an arrangement of this type with European institutes in the field of animal production and health.

3.5 Upgrading levels of knowledge of national workers

79. This is partly a question of improving the information base, and partly of providing scientists with the means of keeping up to date in other ways, by attendance at seminars, workshops, refresher courses, etc.

80. In respect of information FAO has a number of important on-going and new activities, which, taken together, should do much to help improve research efficiency, both through increasing current awareness among scientists and through providing better access to the vast and ever growing mass of data which many developing countries cannot easily afford to obtain.

81. Two major initiatives taken recently are the creation of the International Information System for the Agricultural Sciences and Technology (AGRIS), which will provide current awareness on published results of completed research through AGRINDEX, and the Current Agricultural Research Information System (CARIS), which will record information and publish directories concerning on-going research. The latter is being established with Consultative Group support on the recommendation of the TAC, after careful evaluation of a pilot project undertaken by FAO with the cooperation of fourteen countries of West Africa. Once the sytem is operational, for which the target date is the end of 1976, it is seen as a continuing Regular Programme activity.

82. CARIS aims to collect, organize and disseminate basic data on agricultural research institutions, workers, programmes and activities carried out in or on behalf of the developing countries in order to:

- improve communications between institutions and between scientists,
- assist decision-makers at both the national and international level in the evaluation of the adequacy of existing research effort and the identification of major gaps and weaknesses.

The services to be provided initially will take the form of Directories of Research Institutions, Research Workers, and Research Programmes, linked to AGRIS in respect of published results.

83. CARIS is conceived as a cooperative undertaking: there will be a coordinating unit in Rome, but collection and distribution of information will be carried out at the national level by a CARIS Liaison Office - to be designated by each country - which will act as an intermediary between national research workers and research institutions, the CARIS Coordinating Centre and the proposed CARIS Regional Centres. In order to help establish local CARIS systems, it is envisaged that the CARIS "software", including the methodology, questionnaires, indexing system, and computer programmes, will be at the disposal of countries and regions.

84. A project with closely similar objectives operated by FAO's Fisheries Department is the Aquatic Sciences and Fisheries Information System (ASFIS), which produces two monthly journals - "Aquatic Sciences and Fisheries Abstracts", and in conjunction with UNESCO - "Marine Science Contents Tables". This project is being expanded to include Registers of Experts, Institutions and Projects in Aquatic Science Research.

85. Other FAO activities to improve the information base include the Land and Water data files, such as the Soil Data Bank and the geographical files being developed in connection with the FAO/UNESCO Soil Map of the World: the Nutritional Information Service; and the collaboration being developed with the University of Colorado to adapt the TAXIR system to the needs of the International Board for Plant Genetic Resources and the global network of plant genetic resources centres which it is building up with FAO technical support. Another initiative in which FAO is playing a coordinating role, this time in the field of animal production, is the International Network of Feed Information Centres (INFIC). Work has begun in the Research Development Centre on a register of donor support for research in developing countries, and it is also hoped to up-date, computerize, and publish the FAO Research Register in all official languages in 1976 for which funds were not sufficient in the current biennium.

86. Despite the acknowledged benefits of and need for modern information systems they seem to lack "sales appeal", and although the World Food Conference in Resolution IV, went out of its way to stress the need to improve information linkages, and the Consultative Group has also given considerable moral and financial support to both the CARIS/ACRIS and TAMIR projects, such programmes tend to be among the first elements of FAO's Regular Programme to suffer budgetary cuts. Inter alia this impedes wider understanding of FAO's considerable contribution to research and development. Further guidance from the Conference on the priority which should be accorded in future to this type of activity would therefore be welcome.

87. In addition to deficiencies in availability of information and publications, 1/ scientists' ability to widen or refresh their basic knowledge by attending meetings, training courses, etc., is often constrained by lack of funds for travel, time, or other constraints. It is sometimes argued that there are too many meetings, but the expert consultations on research referred to earlier all indicate that valuable working contacts are developed between national institutions and with International Centres in respect of methodology, exchange of genetic material and information, and arrangements for training which would in themselves in most cases justify the cost of the meeting. Moreover most successful meetings generate suggestions for practical action arising from participants, some of which require further meetings before detailed plans can be drawn up.

88. FAO is active in organizing scientific meetings in cooperation with many bilateral agencies but scientific staff are not always able to take full advantage of the opportunities offered and Governments should provide adequate contingency funds for their staff to attend external meetings as well as to organize their own special courses in selected fields of research.

3.6 Helping to establish and operate research programmes

89. Although much can be done to help countries improve their own research capabilities through institution-building, training, and information, the indications are that their resources will be severely strained for some years to come, and that assistance in the actual implementation of research will still be required. There are three main instruments for achieving this, with all of which FAO is to varying degrees involved. These are the large multi-disciplinary 'International' research centres; cooperative research programmes involving several countries (usually but not necessarily supported by external funding); and bilaterally supported research projects related to individual national objectives. Beyond these, but forming part of the chain linking research to development, are the various services essential to the successful adoption of research results.

3.6.1. International and regional research

90. The International Centres are uniquely equipped to undertake research on problems of wide significance that cannot be handled adequately by national research programmes and which require a strong centrally-focussed inter-disciplinary mass of effort for their solution. However, as will be apparent from section 2, they are not a panacea, and they are costly to establish and maintain. Also there are many research problems of importance to developing countries outside their terms of reference.

91. A means of strengthening research on such problems which may offer an economical alternative to establishing further International Centres, but which does not necessarily preclude utilizing the capabilities of existing ones is the cooperative research network. Working examples exist in the FAO Cereal Nursery Programmes in the Near East and North Africa now being operated in cooperation with ALAD and CIMMYT, the FAO Mediterranean and Near East Olive Improvement Project, the Inter-Asian and Andean Corn Programmes, and WARDA. These are all commodity-oriented; but networks can also be factor-oriented (e.g. the FAO/IFIAC fertilizer programme), or problem-oriented either in the technical and socio-economic fields or both (e.g. the IRRI "constraints" programme).

1/ FAO publications such as "World Animal Review" offer a valuable means both of disseminating scientific information and providing opportunities for scientists to publish.

92. Research networks are intended inter alia to:

(i) Facilitate the identification of common problems in order to organize cooperative research on those of high priority;

(ii) Facilitate communication and scientific bonds among research workers in relation to those problems;

(iii) Increase national and individual research competence and develop leadership;

(iv) Speed up the generation of dependable research results and their application;

(v) Accelerate the transfer of research materials and experience produced, and facilitate verification of its local adaptation in new situations (thus providing a better basis for generalizing site-specific information).

(vi) Provide a "critical mass" of research effort without concentrating all resources in one place;

(vii) Economize in the capital costs and fixed administrative overheads involved in building and maintaining large institutes.

93. They may also be helpful in detecting early signs of diseases and pests of potential general danger and in identifying new problems which require research.

94. Any research network to be successful will need to contain a number of components essential for its operational effectiveness. Most commonly these will consist of mechanisms for: establishing and executing a cooperative programme - coordinator(s), planning workshops, consultants; exchange of research inforamtion - publications, seminars, etc.; exchange of research materials such as planting materials organized for systematic testing; group training and fellowships; an advisory council or similar body with representatives of research planners, government policy makers and the private sector, and national task forces or other mechanisms for securing a multi-disciplinary approach toward the application of the results of the research at the national level; some kind of "nerve centre" to provide leadership, develop methodology, assemble and disperse materials, collate and analyze results of experiments, and disseminate information. This could be provided by an international or regional research institution, or a strong national one, or by an organization such as FAO.

95. The approach is attractive in offering a means of involving research institutions in both developed and developing countries, International Centres and agencies, universities, foundations, etc., in a jointly planned effort. If the objective is well chosen in line with a generally accepted need this sense of involvement should be reflected in the interest of participants both in the success of the programme and in the wide application of the results. Networks can be quite flexible in the conduct of research; provided that the planning and coordination are sound all cooperating institutions do not have to contribute exactly the same input, they can participate according to their capabilities. Publication of the results is subject to less restraints and can be more widely disseminated than those from individual national programmes, and the externalities of the network management make it easier to transmit its findings to planners or those in the corridors of power.

96. While networks have low capital costs and relatively modest operating expenses both FAO and the International Centres have found that, if they are to be successful, funds may have to be channelled to the support of participating national institutions as well as any central coordinating body. The latter is likely to incur the main costs, which may include additional scientific and supporting staff and equipment; but a proportion of costs must be reserved as "seed money" for national workers cooperating in the research projects, preferably in convertible foreign currency. This can be used for purchase of small items of equipment and books, hire of vehicles for internal travel, statistical or other clerical assistance, etc., and helps to give much-needed flexibility to the operations. As things stand, no provisions exist for providing such support and the Conference may wish to consider the idea of including grant money in the Regular Programme for support to networks approved by the Programme/Finance Committees - an idea which the latter rejected when it was proposed for the 1976-77 biennium.

3.6.2. Assistance to national projects

97. FAO has more projects than any other agency in the agricultural sector with the specific objective of helping countries to build and operate research and training institutions, or with research components built into them. These together amount to approximately 40 per-cent of FAO's total activities and they cover both pre- and post-harvest technology. The FAO Research Register shows that in 1974 there were 313 projects of which 148 were in the Agricul-ture Dept. (31 in Animal Production and Health, 28 in the Joint FAO/IAEA Division, 25 in Land and Water, 55 in Plant Production and Protection, and 9 in Agricultural Services); 71 in Fisheries, 49 in Forestry, 30 in Economic and Social Dept; 9 in the Development Dept; 5 in Legal Office and 1 in the Library and Documentation Division. The total expenditure budgeted in that year, but to be spent over an average project span of 4 years, is shown below: 1/

	Regular Programme	UNDP	Bilateral	Trust Fund	Total
All projects	6,905,117	77,435,883	2,939,159	2,927,850	90,208,009
Training projects	76,227	9,603,168	354,384	249,000	10,282,279
Training as % total	1.1	12.4	12.0	8.5	11.4

98. The main objective of many of these projects is to broaden the capacity of countries to manage and implement their own research in the long run, and it is encouraging to note that evaluation of 48 such projects in the 1972-73 Review of FAO's Field Programmes reports (i) a substantial increase in demand for inter-country and country projects concerning research and training - a recognition that sustained growth requires adequate personnel at all levels. (ii) more consistent government support for such projects than for other types. (iii) despite an often disappointingly slow rate of maturation to the point where a project was self-sustain-ing, most projects reviewed were felt to be making a worthwhile and lasting contribution to development.

99. Such projects have probably represented the main contribution of FAO to strengthening national research capabilities, and valuable lessons have been learnt from them. A main conclusion is that while continuity is essential careful phasing of activities within this continuum is critical to success. For example difficulties in recruiting and retaining good local staff have often been under-estimated and the numbers available over-estimated. Time required for building programmes and their costs have often been under-estimated. This leads to the conclusion that a formative phase of 2-3 years is required, with a relatively small technical assistance but a high planning and training component, before a full-scale research plus "in-service" training project can be launched. This second phase could last at least five years; after which, assistance should taper off as national managerial and technical competence matures. This suggests a 10-12 year project life in countries with less developed scientific capabilities, borne out by actual experience in several ongoing projects.

100. Both FAO and the World Bank also have a considerable number of area development and other projects with research components, generally designed to increase production through the introduction of new technology at the farm level, but sometimes to generate an improved technological package for a larger follow-up investment project, or as part of a network linked to some wider priority objective. Sometimes the need for research has appeared only after a project has been launched and a component has then been added. On the whole the results of these projects (which vary greatly in size and nature in the case of FAO) have received little study, and analysis and synthesis of experience would be valuable.

101. Historically the approach has probably been largely ad hoc and there may in fact be a case for a more deliberate attempt than in the past to work with countries in establishing programmes to test new technology at the farm level in relation to agreed priorities. In countries with relatively strong central research institutions but limited trained manpower for trials in outlying areas this could accelerate the adoption of research results in the short run on a region-within-country basis without having to build up a permanent fragmented infrastructure. They could also be designed on a standard methodology to test a relatively simple innovation, e.g. a new machine, herbicide, or fertilizer formulation under a wide range of conditions involving more than a single country according to a standard methodology.

1/ This excludes an approximately equivalent sum in national contributions

102. This approach is a good means of overcoming location-specificity in identifying constraints to the adoption of promising research results and evaluating the likely benefits or "second generation" problems resulting from their more widespread use. This will be discussed in more detail in the next section.

3.7 Accelerating the adoption of research results

103. A principal reason for the slow adoption of much available technology by farmers and other users, e.g. agro-industries, is not that it offers insufficient advantages over traditional practices, but that it is impeded by constraints of a non-technical nature. Not enough is known about the processes of technological change and the impact of policy on technical innovation. It is therefore essential not only to improve research organization and management so as to be able to undertake technical research more efficiently; but also to do research on the factors likely to effect its implementation, so as to ensure as far as possible the pre-requisites for the adoption of successful research results.

104. The idea that this is a simple almost hierarchical process of transfer from experiment stations to extension services to farmers must be challenged; research does not stop at the farm gate - nor does extension start there. Because of this the possibility of unified research and extension services is being considered by several developing countries, and this may well be a logical solution if potential clashes of interest can be overcome.

105. There is not space in this paper to discuss in detail FAO's activities related to extension, which in any case were considered at some length by the Committee on Agriculture. There is, however, a wide measure of agreement that there is no hard and fast division between research and extension, and that there is a need to do more to re-think conventional approaches and linkages, and to test new concepts.

106. With this end in view the following lines of action are suggested for consideration by the Conference:

(i) To accelerate the analysis and synthesis of experiences in the wide range of UN (FAO/UNDP, World Bank, UNEP) and bilateral development projects, wherever a major aim has been to raise productivity or achieve other development goals through the introduction of improved agricultural technology. The Evaluation Service is undertaking considerable work in this field, but until recently it has been mainly of a qualitative nature, and reinforcement of FAO's resources to facilitate more quantitative analysis would be valuable.

(ii) To reinforce and extend to other areas or other crops the type of farm-level "adoption" research now being undertaken on a limited scale by certain international and national institutions; of which IRRI's International Rice Agro-Economic network and the All-India Coordinated Rice Improvement Programme's "mini-kit" management experiments are good examples.

107. Essentially these programmes aim to define the technical factors accounting for the gaps identified between maximum yields attainable on farms and the yields farmers are actually getting, and why they are not using the inputs or cultural practices which would enable them to attain higher yields. In order to decide on what remedial measures are necessary and design appropriate follow-up action, both the biological and socio-economic elements contributing to the gap must be understood, and these will vary from one region to another within a country. This implies correlation of the results with specific physical environments, both as a guide to priorities for further research and to help in determining conditions and areas where the largest and/or most immediate benefits were likely to accrue to a production-oriented demonstration/extension campaign.

108. Such work is not cheap because it is time-consuming and involves both survey, experimentation, and recording of soil, climate and other physical parameters on farms. These costs must be added to those of generating and testing the primary inputs of improved technology, e.g. new varieties or cultural priorities at main experimental stations. It seems inevitable, however, that increasing weight will have to be put on on-farm research-cum demonstration of this type if faster progress is to be made in increasing food production, and this is a field in which FAO working with national programmes and, where appropriate, in collaboration with International Centres, could make a substantial contribution.

(iii) To step up training of production-oriented applied scientists, which experience has shown make the best disseminators of new knowledge and technology. These are required in various fields related to the transfer of technology, including work of the type outlined in (ii) above, the in-service training of extension workers for production campaigns, and of staff for other essential supporting technical services, e.g. seed production.

(iv) To examine and compare institutional innovations adopted in different countries, their effectiveness in providing the advisory, input, credit and other services needed to ensure the adoption of new technology and the degree to which the availability of those services led producers to their choice of technology within a given area of a country. FAO is undertaking studies in a number of countries on various aspects of the effectiveness of individual institutions (cooperatives, credit, marketing, extension services) or other measures designed to accelerate production and provide incentives to producers (changes in agrarian structure), and how these could be strengthened.

(v) To draw on FAO's knowledge in these fields, together with its experience and data collection system on farm management to work with countries in the establishment of "test bed" projects designed to increase on-farm adoption of promising new technology. These would aim at developing a total approach including the provision and application of new knowledge, the involvement of the local community, and the institutions and services (including those in the private sector) required to facilitate its adoption and market the increased production.

109. The International Centres have undertaken some projects of this type with national agencies in their host countries, i.e. Plan Puebla (CIMMYT) and the Masagana 99 project (IRRI), but the wisdom of their diverting resources from their primary and increasing tasks of research, training, and outreach support to national research in order to develop and manage additional projects essentially of a development nature further afield may be questioned. FAO on the other hand is experienced in project management, and therefore has comparative advantages for working with national agencies in this particular field, drawing on the experience of International Centres for technical guidance where appropriate. While their main aims should be to increase production in the areas selected, projects of this type offer valuable means of understanding farmers' motivations and constraints, thus helping to guide research managers as to their needs and priorities, as well as avoiding errors due to failure to take social and economic factors into account when trying to introduce new farming methods. They can also provide a valuable in-service training ground for social scientists, technical research workers, and extension staff, all of whom have to work as a team if the project is to succeed.

110. Since the Consultative Group on International Agricultural Research does not finance individual national research institutions or projects, some other means of funding would have to be sought for research-oriented development projects of this type. This might be through UNDP, the World Bank, or bilateral sources - possibly through the mechanism of the Consultative Group on Food Production and Investment. This is, of course, only in its formative phase, but will no doubt wish to consider at a fairly early stage what its relationships with the CGIAR will be and how it might wish to complement it in respect of support to research at the national level. The Conference may wish to comment on this.

4. Priorities for Further Basic and Applied Research

111. Basic research is aimed at the generation of scientific knowledge and may, but does not necessarily, lead to the development of new or improved technology. Basic research can be directed to the development of new principles which widen the horizons of understanding with a specific goal in mind but even this must be complemented by further research to apply that knowledge to practical uses and to adapt it to more and more specific local needs.

112. Agriculture is an applied science; it has benefited greatly from advances in basic knowledge in physical and biological sciences, but often more or less indirectly; and while in the short to medium term there is a considerable stock of knowledge remaining to be applied, the possibility of providing food, fibre and other agriculture-based products at a rate adequate to meet a world population projected to reach 6.5 billion people by the end of the present century with current agricultural technology, is increasingly being questioned.

113. A result both of the immediate urgency of the food problem in developing countries and the even more cloudy horizon for the world as a whole in terms of energy and other non-renewable sources, and ominous warnings of adverse climatic change, has been a resurgence of interest in research of a more basic nature directed to harnessing fundamental sciences consciously towards the solution of these problems, and especially to the improvement of food production. This is a significant advance.

114. An important move in this direction is the recent request of the President of the United States to the National Academy of Sciences, to cooperate with government agencies to assess the problems of combating chronic food shortages and the debilitating effects of malnutrition, and to advise him on specific ways in which the research and development capabilities of that country, in cooperation with other scientifically and technologically advanced countries can best be applied to meeting this challenge.

115. A further encouraging sign is the recent agreement of the ministers of the EEC to devote a higher proportion of their advanced scientific effort to the solution of problems which could lead to the acceleration of food and agricultural production, with particular reference to the tropical areas.

116. The possible lines of research are legion and in order to help define priorities various attempts are being made to use advanced mathematical techniques to indicate resource availability, resource constraints, and policy options by constructing simulation and other models defining global and regional systems and sub-systems. These include the pioneering "Limits to Growth" Study of the Club of Rome, an improved version of which is now in train; a major effort being undertaken at the University of California called SPECULATER 1/; and an important joint MIT/Harvard University Study examining possible effects of decisions related to US food policies in a world context. These, together with FAO's efforts to construct an early-warning system and buffer-stock policies, are aimed at improving the management of world food and agricultural resources over the medium to long term 2/.

117. In its technical work, FAO mainly supports research of an adaptive nature, although in some cases, i.e. through its joint division with IAEA, or through other contacts, more basic research may be sponsored. It maintains a watching brief on all research with possible implications for the future of world agricultural development. This indicates several areas of high priority where a combination of basic and applied science is resulting in encouraging progress as well as some important gaps remaining. Some of the more important of these will now be mentioned for the information of the Conference, although the list is not exhaustive.

118. The first of these relates to the nitrogen fixation process and is a good example of the interlinked nature of basic, applied, and adaptive research referred to above. The main current source of biological nitrogen supply in agriculture is the legume/bacterial symbiosis, and an FAO/TAC Working Group supported by the German and Indian Governments was held in Delhi in September 1974, to examine problems restricting yields of legumes, and means of improving their yields and the efficiency of the Nitrogen fixation process.

119. The conclusions were (x) that there is an immediate need to launch village or similar level production-oriented projects of the type discussed in section 3.7 to encourage farmers to adopt known improved methods of growing these crops, backed up by provision of clean seed, phosphate, and locally adapted innoculants (the latter a field in which FAO is actively collaborating with UNEP); (ii) that over the medium term, further progress could be expected by a reinforced applied research effort to screen legume germplasm and to try and design plant types with wide adaptation to a range of factors holding down yields and in particular to improve performance under environmental stress and pest/disease resistance; to investigate soil factors affecting nitrogen-fixation, rhizobial strain adaptation etc.; and (iii) that there are also a number of problems impeding yields which appeared to be related to more fundamental physiological factors for which a strong basic research effort is required, the results of which might benefit other C3 plant species of economic importance.

1/ A "Simulation Programme examining the Causalities underlying land agriculture, transportation and energy relationship".

2/ The newly established International Food Policy Research Institute (IFPRI) in Washington, supported by the Ford and Rockefeller Foundations and the International Development Research Centre of Canada is also a contribution to these overall objectives.

120. Attention is also being directed towards other possibilities for improving biological nitrogen fixation. It has been shown, for example, that blue-green algae and possibly other organisms in the rhizosphere of padi rice can produce the equivalent of 60 kg N per hectare per annum, which may account for the stability of rice yields over centuries in areas where fertilizer has never been used. UNDP is supporting an ambitious cooperative study by IRRI, the Brookings Institute, and Cornell University to investigate this further.

121. Another important advance has been the demonstration by scientists in Brazil of nitrogen-fixing relationships between bacteria and certain tropical grasses. Recent reports of cooperative work with UK scientists suggest that nitrogen-fixing phenomena may exist in relation to maize, sorghum and wheat in certain tropical soils. This brings closer the ultimate hope of being able to induce biological N-fixation by cereals. It is difficult to conceive a more valuable advance in respect of world agriculture, especially for the developing countries.

122. "Genetic engineering" is a second field into which a great deal of effort is being channelled including basic research on gene manipulation with the objective either of transferring valuable properties from one species to another through cell fusion where this cannot be done by normal reproductive processes due to sexual incompatibility or (in its most ambitious form) to create new species of unique agricultural value. While the latter appears far away, the various techniques of molecular biology offer a new and promising addition to the armament of plant breeders, both in order to study fundamental processes such as photosynthesis and respiration, and possibilities of modifying them genetically or chemically, and ultimately to produce novel combinations of characters of agricultural importance, including improved nutritional quality.

123. A number of other techniques are being used in attempts to create new viable, and agriculturally valuable species by wide crossing. These include microsurgical grafts of parts of reproductive organs from one plant to another, the use of chemicals to double chromosome numbers or to counter rejective reactions (immuno-suppressants) the induction of mutations through radiation, all forming part of an inter-disciplinary effort to increase the variability of crop germplasm to continue the expansion of world food production beyond the present century.

124. The collection, preservation, storage and evaluation of new and existing genetic material both of plants and animals for use in more conservative breeding work is an essential complement of such programmes, and this in itself may require research both of a basic and applied nature, for example, to ensure viable storage and transfer of healthy germplasm, and in breeding techniques. FAO's important work in respect of plant genetic resources is now closely linked to that of the International Centres through the IBPGR; in the animal field regional semen banks are being established for use in experimental and developmental work, and cooperative breed comparison, cross-breeding programmes with a number of countries are one of the designated fields of priority.

125. Throughout human history one of the main causes of instability and loss of potential production has been pests and diseases of plants and animals. The conventional approaches of varietal resistance and chemical control, are still largely empirical and more basic research is required to achieve a better understanding of the mechanisms of disease resistance/tolerance, of host/parasite relations, of insect physiology and life-cycles, and the conditions which favour the build-up of pathogens and parasites and their predators.

126. An increasing weight of effort is being devoted to linking applied and basic research in combating pests and diseases. The crop-oriented International Centres, realizing that insects are one of the major problems impeding higher productivity, are examining the possibilities of cooperation through contract or other arrangements with the International Centre for Insect Physiology and Ecology (ICIPE), and other advanced institutions such as the Indian Agricultural Research Institute. A major effort is being launched by FAO in collaboration with UNEP, Member Governments and the International Scientific Community, to develop a cooperative global programme for the development and application of integrated chemical, biological and cultural pest control comprising national projects cooperating in regional networks for main crops such as cotton, rice, maize and sorghum.

127. In the fight against insect-vectored animal diseases such as Trypanosomiasis and East Coast Fever, the establishment of ILRAD will complement, through immunology, other research programmes being conducted in Africa on insect physiology at ICIPE, by FAO with EAVRO on vector control, and on Trypano-tolerance by ILCA and IEMVT.

128. A fourth major field of combined research activity is aimed at the better understanding of management of the natural environment for food and agricultural production including forestry and fisheries. This involves a wide range of sciences and fields of activity covering both the reactions of the plants and animals themselves, and their interaction with the natural factors - water, soil and climate on which they - and the human race - depend on for their survival.

129. The range of tools available for examining or simulating some of these inter-relationships, for example, the electron microscope, the phytotron, the mass specto-photometer, and remote sensing with improved cameras and film, has greatly improved analytical capabilities; but the problems are enormous. This particularly applies to the vast areas of rainfed agriculture in the soils of low base status, which occupy over half of the world's potential agricultural area, and which have largely been by-passed by the "green revolution". These soils, as indicated by FAO work on soil and water resources in cooperation with UNEP and UNESCO, nevertheless have a considerable under-utilized potential, given proper management, but this will require study of plant/soil/climate relationships, the development of stress-resistant crops and animals, the more effective use of fertilizer, nitrogen and naturally-occuring sources of phosphate and calcium, the improvement of tillage systems, and research on inter-crop relations to conserve water, reduce erosion, control weeds and maximize output of food per unit area per unit of time. These are all subjects in which basic and applied science can interact to raise productivity. For example, a major initiative to develop fertilizer formulations more suitable than existing ones to tropical conditions using the chemical engineering skills and pilot plant facilities of TVA is being launched with USAID support, but the results will have to be field-tested in the developing countries.

130. Study of the influence of climate, weather and their variability on agricultural production in various agro-climatic zones, is also receiving increasing attention, both in attempts to identify possible long-term trends and their implications for humanity, and to correlate climate information with crop growth studies aimed at developing more flexible cropping strategies and management practices to suit different weather conditions so as to minimise the adverse effects of aberrant weather, and encourage production patterns in tune with the climatic potential. Such studies could also lead to improved means of forecasting crop yields and the development of simulation models derived from standardized information on crop/soil/water relations which might facilitate the extrapolation of research results and thus save much research currently expended in repeated field trials.

131. The energy crisis and the need to create employment in developing countries have stimulated basic research in "appropriate" technology. This goes beyond the development of improved mechanical processes to perform critical tasks in production or processing of agricultural products more efficiently without labour displacemnt (a field in which FAO is already using computer science and systems analysis to select suitable equipment for on-farm use, storage and processing), into the development of unconventional power units and the use of solar, wind and other renewable natural resources for generating electric power, heating, pumping water, and so on. FAO has noted an interest by several bilateral agencies in these fields of activity, in which successful research could offer great benefits to the economy and foreign exchange situation of developing countries.

132. A further field in which basic research could make an important contribution to world agricultural development is in the conversion of crop by-products, water, paper, straw, etc., into sources of human or animal food or other uses, including energy. Possibilities include enzymatic fermentation of sugar derived from cellulose to produce ethanol and protein; extraction and isolation of protein direct from leaves; conversion of various types of by-products normally used for livestock (brewers grains, oilseed and cottonseed cakes) into protein for human use; production of single-cell protein (SCP) on a wide range of organic substrates, including methane derived from sewage. These opportunities are attracting the attention of scientists in many countries (there is a joint US/USSR project on fermentation research); and although there are engineering, economic and social problems facing the industrial production and consumer adoption of such products, they may prove to be of increasing significance in feeding the world of the future.

133. The decline in total world fish catch and the economic return to increased fishing efforts has also led to increased basic research. This has been directed partly to investigating the potential for use for human food of the many marine species (both plant and animal) not presently of economic importance, partly to determine the physical and biological conditions affecting the harvest from the sea, and partly to changing the emphasis from fish hunting to fish farming through the development of aquaculture.

134. As the overwhelming proportion of world fishery production still comes from the harvesting of wild stocks of aquatic organisms, problems of fishery research are very different from those of agricultural research in the narrow sense. Research in fisheries is oriented toward the study of the biological characteristics of the organisms involved, the dynamics of exploited fish populations and their response to natural and man-made changes in the environment, and the application of scientific knowledge to the management of these wild stocks.

135. Fishery research has two main phases - a stage of fundamental research in which the nature of the reaction of these stocks to such factors as large-scale harvesting, other human activities such as pollution, and short and long-term environmental features, is studied, and quantitative models describing these reactions are formulated; and a stage of applied research in which the models are used to understand and predict events in a particular fishery.

136. As the general nature of fishery problems is similar in all parts of the world, the results of fundamental research are readily transferable. Because of the rather different nature of fisheries research it has not been discussed in detail in this paper. Nevertheless, it is important that the mechanisms whereby FAO assists in the stimulation of and collaboration in fishery research be continually examined. A particular need for such examination arises out of current discussion and decisions relating to the Law of the Sea. Here FAO's role may well need significant alteration. It is also important that the role of research in improving food production, and especially the task of FAO in assisting developing countries in the establishment and management of their own research institutions, be considered in broad perspective, so that the varied demands on land and water resources can be examined jointly as well as separately.

137. The solution of many of the complex problems outlined above would undoubtedly have wide benefits to agriculture throughout the world. Increasing basic and applied research effort is also now being channelled to commodities or problems more specifically related to the needs of developing countries; in which high priority is being given, to improvement of yield and quality of the staple cereals (wheat, rice, maize, millet and sorghum); to the six most important food legumes, and to the tropical roots and tubers. In the case of animals, first place is being given to improving the productivity of cattle, including efforts to control Trypanosomiasis and tick-borne diseases.

8. Nevertheless there are still weak spots not well covered by International Centres or other strongly-supported programmes in which FAO is stepping up its own efforts but to which it feels more attention should be directed internationally. These include:

(i) Tropical vegetables and fruits; where a wide range of crops and problems, both in production and marketing, needs to be covered and the resource basis is weak.

(ii) Certain oilseeds, e.g. coconuts, and the main annual oilseeds.

(iii) Utilization of food nutrients by consumers. More work is required both on technical questions such as digestibility, physiological availability of nutrients, presence of pharmacologically-active compounds and toxicants, and characteristics that affect such properties; and on socio-economic factors related to consumer preference, family consumption, and economic demand.

(iv) Post harvest food technology. In the past there has been a tendency to treat production as all-important and to neglect what happens after a crop is harvested. Research is needed to integrate certain aspects of pre and post-harvest technology more efficiently e.g. crop drying; and in many other aspects of the chain from primary producers to the consumer in storage, conservation, and processing. Whether a new International Research Institute of post-harvest technology would be the most effective approach or whether other and perhaps cheaper means of tackling the problem could be found is a matter the Conference may wish to discuss.

(v) Agricultural raw materials; some of which, such as cotton, have multiple uses, and which require research both in production e.g. to reduce costs per unit/output, and to widen their potential utilization. (FAO has just completed a collaborative study with the Tropical Products Institute and the Commonwealth Bureau, on the research needs of ten such commodities (oilseeds, fibres and hides and skins).(20)

(vi) Water buffalo. The most important source of meat, milk and draft power in many of the countries of Asia and the Far East.

(vii) The improvement of food supplies for ruminants, including the improvement of natural range and the integration of pastures in farming systems, and the better use of by-products and wastes.

(viii) On-farm water use and management. This must include research on biophysical relationships, improvement of soil fertility, determination of when and how much water to apply, design of equipment and systems which can allow small farmers to use water effectively, and on human and management problems, neglect of which may wreck even the best laid plans.

(ix) Socio-economic research. This needs reinforcing both at the farm and village level, with backward/forward links to policy research at the national level; and on wider issues of agricultural development policy transcending national boundaries. It is ironic that although a proposal for an International Food Policy Research Institute was not supported by the Consultative Group because of a strong feeling that the alternative of using FAO should be explored, this institute is nevertheless being established with support from private foundations in North America; whereas the FAO proposal for an autonomous Agricultural Development Research Institute, with somewhat similar aims of undertaking research to offer guidance on important but controversial issues of policy, but with a broader mandate, was received with some lack of enthusiasm by the Council.

(x) Forestry. In some fields (e.g. genetic improvement of species, fertilization, seed handling, diseases, etc.), the problems to be solved by research and methods of work are identical or at least similar to agricultural research, but more time is generally needed in order to achieve sufficiently proven results of research and consequently continuity and long-term planning of research is of even higher importance. However there are other important fields of great future significance in which research needs strengthening including resource assessment and management of natural forests (especially in the tropics) for sustained production, and in rational land use systems which help to conserve soil and water resources.

139. The CGIAR up to now has not supported or suggested any international forest research centre, and in the TAC no forest scientist is represented. COFO at its Second Session (22 -29 May 1974) discussed this situation and stated in its report: "The Committee agreed with the TAC that, in the present situation the limited resources of the CGIAR should be concentrated on food production. This, however, should not preclude forestry research from being internationally supported which is complementary to food production and could indirectly help to improve food crop yields. It therefore welcomed the proposal of the US delegation, and their preparedness to cooperate in this respect with IUFRO and the Forestry Department of FAO, that a cooperative forestry research programme should be developed within the above context. Meanwhile, the possibility of adding forestry-slanted projects to the work programmes of the existing international institutes should be investigated".

140. It would be interesting to get the Conference's view on the idea and desirability of an International Centre for tropical forestry and research, supported by the CGIAR. Such a centre could contribute considerably to filling the gap in the present international network of forest research institutions which needs urgently a strengthening of research capacity in the wet tropics.

141. Beyond this, however, the Conference might wish to consider further the whole question of how to draw additional urgent needs either for basic or applied research which do not fall within the present priorities of the CGIAR (or which it feels would be better supported bilaterally) to the attention of countries with advanced scientific capabilities and to secure financial support for an agreed programme.

142. Various avenues are open - a contract with an institute under an FAO/UNDP agreement; support from the country in which the institute is located as part of its overall contribution to development; or for larger programmes some informal donor consortium as is now being considered for cotton under UNDP inspiration.

143. This issue relates to that of how developed and developing countries' institutions can link in research on problems of common interest. At the moment it seems logical that basic research should be done mainly by the former. However over the next decade an increasing number of developing countries will have reached a point where they will be anxious to undertake more advanced research. It would therefore be valuable in the type of arrangements outlined above for the developed country institutions cooperating in joint research to assist selected scientists from developing countries to acquire knowledge of the techniques required, either to undertake such basic research themselves, or to apply the results to practical use in their agricultural research programmes. This might be done either through on-the-job training or in appropriate cases through a collaborative research programme. Such collaboration would help to reduce the scientific and technical dependence of developing countries which is an important aim of the New Economic Order.

144. FAO could act as an "honest broker" in helping to identify gaps in priority research needs of developing countries and drawing these to the attention of governments and institutions with advanced scientific systems for potential action. It could also accelerate, perhaps on a more systematic basis, its current efforts in various units to identify and record institutions and scientists able and prepared to cooperate. This might be assembled and published as a supplement to CARIS.

145. A final question is whether anything could be done to organize the community of agricultural science more effectively for such collaboration, and if so who should take the initiative? A possible model might be the International Union of Forestry Research Organization (IUFRO), which has over 290 member organizations in 80 countries, with the scientists of these institutions joining one or several working units of their special field of interest. Its main objectives have always been the development of standardized methodology, the organization of multi-national trials and research programmes, and the exchange of results and experience.

146. IUFRO has its own Executive Board, with regional representation, on which the ADG of FAO's Forestry Department is an ex-officio member; and as IUFRO is older, FAO has always relied largely on it for questions of international forest research. FAO and IUFRO have joint working parties and meetings and IUFRO members have developed close personal and working relations with FAO Forestry Department staff.

147. Whether any such organization would be beneficial or even feasible for other aspects of agricultural research where so many more interests and institutions are involved; or whether existing professional groups on a sub-sectoral basis such as the World Association of Animal Production, provide adequate linkages (or could be helped to do so) is a further issue the Conference may wish to discuss.

5. Follow-up action for consideration by the Conference

148. The evolution of existing international and national research programmes and the changing imperatives of development, demand systematic monitoring of progress in agricultural research so that priorities can be adjusted to needs. FAO will continue to expand its efforts to identify and draw to the attention of its governing bodies and the CGIAR further needs for support to research in fields of wide importance to developing countries (particularly those not presently covered by International Research Programmes) both by drawing on its national contacts, and through regional and other meetings aimed at identifying common research problems and working out priorities for co-operation, linking international and national efforts in developed and developing countries. These priorities will be assembled periodically in a consolidated form to provide a continuing "overview" of action required.

149. FAO is ready, in close collaboration with interested donors, to provide services on demand to individual countries in the following fields, and to make their availability widely known.

i. Assistance (mainly through high-level consultant teams) in diagnosis of research priorities, planning, resource allocation, training and preparation of related proposals or projects for strengthening national research institutions.

ii. Provision of staff under longer-term arrangements for technical assistance, including operational activities to fill gaps in national research establishments, e.g. on contract.

iii. Support to related institutions and services (seed production, extension, credit, etc.), essential to the effective adoption of research results by farmers.

iv. Independent review and analysis of the effectiveness of results of on-going research programmes.

150. To facilitate this, more flexible means of funding than are at FAO's disposal now need to be worked out. This should provide for grants to support consultancies, or to help national institutions to participate in cooperative networks; for longer-term funding for project (UNDP type) activities, and for loans directed to major restructuring of national institutions. Various approaches, including an informal donor consortium or a UN Cooperative Programme approach involving the three co-sponsors of the CGIAR are being examined.

151. FAO proposes to put together and if possible to publish and up-date at regular intervals, a more complete inventory of existing arrangements and facilities for training agricultural research workers and technicians at all levels and of institutions competent and willing to undertake training in specific fields. Set against an assessment of demand, this could provide an improved basis for proposals to meet major gaps either through reinforcement of present arrangements at international centres, regional, or national institutions (CSIRO, IRAT, IARI, etc.), or through some new mechanism, e.g. special training courses organized by FAO, perhaps on a regional basis - using facilities of an existing institution, but with FAO preparing curricula, contracting teachers, etc.

152. More support would be desirable to enable FAO to provide up-to-date information on scientific activities, institutions, and workers both generally (CARIS, AGRIS, AFSIS), and in specific technical fields (e.g. genetic resources, nitrogen fixation, feed information etc.), since this helps to maximize the effectiveness of scarce manpower resources in national programmes and to identify weaknesses and areas where help is most needed. (It also helps to make FAO's activities in support of research better known). Both the World Food Conference and the CGIAR have stressed the overall need for strengthening such services.

153. Means must be found to accelerate the testing and application of research results both on farms and in the various fields of post-harvest technology. FAO should review and evaluate its present assistance to countries in this respect as a basis for determining whether a more deliberate effort could not be made to establish special projects, or to build components into area development projects , to identify existing levels of technology (particularly on small farms), the key inputs and practices, required to increase output, income and employment, the reasons why they are not being used, and the research and development policies needed to remove those constraints. Such projects could form a major field for collaboration with international and national research institutions to help overcome location-specifity in research.

154. The results should be made available to national planners, decision-makers, research directors and FAO/UNDP country and headquarters staff. To complement on-farm 'adoption' research FAO must attempt to reinforce its analytical activities of development institutions and experience related to delivery systems for the application of improved technology; and the two streams should merge together to guide the establishment of innovative institutional models for testing in production-oriented development projects. Such projects might be financed through UNDP, World Bank, Regional Banks or the Agricultural Development Fund when established. There should be close association with the CGFPI, to orient resources towards these objectives.

155. Many of the activities outlined above will be undertaken in close liaison with the International Research Centres so as to develop an integrated approach to support for national research and related development efforts, with the aim of maximizing the complementarities between their programmes and the work of FAO. FAO will appoint a liaison officer for each Centre in the near future to help develop this cooperation.

156. FAO will give increased attention to fostering global/regional linkages of scientific institutions in specific fields or sectors of agricultural research, for which the International Union of Forestry Research Organization (IUFRO) offers one model. This could facilitate the establishment of international research programmes in selected fields, with the participation of institutes in developed and/or developing countries according to their capabilities and interest. Such programmes could be presented for support to the CGIAR as the umbrella organization for sponsoring international agricultural research.

157. As part of its review of the overall priorities in the medium-term, the Conference may wish to examine the adequacy of FAO's present resources for support to international and national research activities, in the light of the requests being made for it to do more in this field, both by the World Food Conference and the CGIAR, and their expectation that it will be able to respond flexibly to this need. Particular emphasis needs to be placed on systematic analysis of the needs for research and training; the provision of services to assist in research planning, information, management and institution building; stimulation of cooperative research activities in priority fields; and assistance in research and development efforts directed to accelerate the adoption of new technology.

Selected Bibliography ANNEX A

(1) Evenson, J., Investment in Agricultural Research; A survey paper. CGIAR Washington, October 1973.

(2) Ardila, J., Hertford, R., Roche, A. & Trujillo, J., Returns to agricultural research in Colombia.
Proc. Agricultural Development Council Conference, Resource allocation & productivity in agricultural research: Airlie House, January, 1975.

(3) Hayami, J. & Masakatsu, A., Organization & productivity of Agricultural research systems in Japan: Airlie House 1975.

(4) Kahlon, A.S., Bal. H., Saxena, P., & Dayanatha, J. Returns to investment in Agricultural research in India: Airlie House 1975.

(5) Peterson, W.L. and Fitzharris, J., The organization and productivity of the Federal State Research System in the United States: Airlie House 1975.

(6) Evenson, R., Cycles in research productivity and international diffusion patterns in sugarcane, wheat, and rice: Airlie House 1975.

(7) Mellor, J., et al, Developing rural India, Cornell University Press 1968, states: "The obvious lesson is that the first step in any agricultural development programme should be the initiation of a substantial highly integrated research programme directly connected to farm problems at one end and to basic research and foreign efforts at the other".

(8) Swanson, B., Impact of the international system on national research capacity: the IRRI & CIMMYT training programmes: Airlie House 1975.

(9) Dalrymple, D., Measuring the Green Revolution: USDA/USAID Foreign Agricultural Economic Report No. 106, July 1975.

(10) Evenson, J. and Kislev, Y., The Green Revolution & recent development experience. American Journal Agricultural Economics: May 1974 pp. 387 - 394.

(11) Hanson, H., Articulation of the International & National Systems: the CIMMYT outreach programme: Airlie House 1975.

(12) FAO The State of Food & Agriculture, Ch: 4, p: 141 - 164, 1972.

(13) FAO The planning and programming of agricultural research, Rome 1975.

(14) A framework for Government Research & Development. Cmnd. 4814 HMSO London, 1971. See also Ulbricht, T.L. Contract Agricultural Research & its effect on management: Airlie House 1975.

(15) Fernandez, C.E., and Marcano, L., Estaciones Experimentales Agricolas de America Latina: Banco Interamericano de Desarollo, Washington, 1975.

(16) Estaciones Experimentales Agricolas de la Zona Andina, Instituto Interamericano de Ciencas Agricolas de la OEA, Zona Andina, Lima, Peru, 1970.

(17) FAO Near East Mission Reports on Organization & Administration of Agricultural Research, FAO Regional Office, Cairo, 1975.

(18) Kassapu, S., Enquête sur les dépenses en matiere de recherche agricole: Afrique - OECD, Paris, August, 1973.

(19) Agricultural Development Council: National Agricultural Research Systems in Asia, Report of seminar, ADC., New York, 1971.

(20) Tropical Products Institute: Research needs & priorities in relation to certain agricultural commodities (oilseeds, fibres, hides & skins), 3 Volumes. Study commissioned by FAO: T.P.I., Ministry of Overseas Development, London, 1975.

F-2

Messrs. Baum, Yudelman and McNally July 17, 1975

Michael L. Lejeune (signed) Michael L. Lejeune

Meeting with Sir John Crawford

This confirms that we have fixed a meeting with Sir John Crawford for 3:30 p.m. Friday, July 18. It will begin with Sir John and Mr. Baum holding a private session after which I and Mr. Yudelman will join. We shall be on call as from 3:45 p.m.

MichaelLLejeune:js/F-2

File F-2

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Michael L. Lejeune

DATE: July 15, 1975

FROM: John K. Coulter

SUBJECT: Meeting of TAC

You will note that a report of the Bellagio meeting is item 8 on the agenda of TAC (afternoon of Wednesday, July 23). Will you be attending this session or is there any briefing that you would wish to give me?

Mr Coulter

Do we yet have
from Henke the minutes?
If so, let me see &
will decide whether I
can go - if I don't,
I will brief you.

JKCoulter:apm

File F-2

F2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Via delle Terme di Caracalla, 00100 Rome, Italy
Cables: FOODAGRI ROME - Telex: 61181 FOODAGRI
Telephone: 5797

July 4, 1975

TO: Members of the Technical Advisory Committee
Members of the Consultative Group on International Agricultural Research

FROM: The Executive Secretary, TAC

SUBJECT: Tenth Meeting of the Technical Advisory Committee, World Bank Headquarters, Washington, D.C., 22-26 July, 1975.

Further to my memorandum of June 27, 1975, please find attached the following documentation for the above meeting:

i) Agenda Item 4

Report of the TAC Mission to Review the Agricultural Engineering Programme of the International Rice Research Institute (IRRI) DDDR:IAR/75/19 RESTRICTED

Report of Visits to Philippines, Thailand, Indonesia, Singapore, India, 24 April - 14 May, 1975, by P. A. Oram, Executive Secretary, TAC (Members Only) DDDR:IAR/75/21

ii) Agenda Item 7

Application of Satellite Sensing to Agricultural Research and Development (Background Paper) DDDR:IAR/75/19 RESTRICTED.

Attachments

F2

DDDR:IAR/75/19 RESTRICTED
JUNE 1975

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

Tenth Meeting, Washington, D.C. 22-26 July 1975

APPLICATION OF SATELLITE SENSING TO AGRICULTURAL RESEARCH AND DEVELOPMENT

(Background Paper)

(Agenda Item 7)

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ROME 1975

WS/H0343

1.0 INTRODUCTION

1.1 The World Food Conference in its recommendations requested (Resolution IV) that, in early action to achieve goals related to food and agricultural research, extension and training, "the Technical Advisory Committee and the Consultative Group study the feasibility of an international programme on the use of remote sensing techniques in agriculture, including data from the earth resources satellites".

1.2 As a follow-up to this recommendation, this paper provides a brief overview of the present state of the art and science of remote sensing applied to agricultural research and development and draws attention to potential international co-operative programmes. Special emphasis is placed on remote sensing by satellite (satellite sensing), as it is the facet of remote sensing most promising to international cooperation, as it is the newest of the remote sensing techniques needing adequate support with research and training programmes and as, due to its inherent ability ot sample sequentially in time, satellite sensing is likely to play an increasingly important role in agriculture.

2.0 BACKGROUND

2.1 Remote sensing is concerned with the detection of objects on the Earth's surface using a sensing device not in contact with the objects being sensed and includes the evaluation of the collected data. In practice, remote sensing is more often confined to the electro-magnetic spectrum, to collection of data which can be presented as imagery and to the collection of data from a space platform (whether aircraft, helicopter, rocket, balloon or satellite). However, non-imaging sensors are increasingly used in mineral exploration, pollution studies and atmospheric and oceanic studies. The imaging device (or "tool") is usually an aerial camera or mechanical scanner; and with the exception of side-looking airborne radar (SLAR), which is necessarily an active system, remote sensing of the Earth's resources is confined to passive systems in which the signal sources are emitted energy or reflected solar energy from the Earth's surface.

2.2 Thomas writing in Nature, as early as 1920, drew attention to the role of aerial photography by aircraft in the study of the Earth's resources. Also in the 1920's, black-and-white (panchromatic) aerial photography was used experimentally in various agricultural activities. For example, Taubenhaus et al.(1929), used aerial photographs to detect Phymatotrichum omnivorum on cotton in the Sudan. However, it was not until about a decade after World War II, that aerial photography began to be used widely in agriculture and attention was given to understanding the basic reflective characteristics of healthy and diseased plants (e.g. Colwell, 1956).

2.3 This was followed in the 1960's by a period in which not only black-and-white but also infrared colour and panchromatic ("normal") colour aerial photography were increasingly applied to agricultural problems (cf. Manual of Photo Interpretation, 1960) and greater attention was given to understanding the emmissive and reflective properties of plants (e.g. Gates in U.S.A., Rossetti et al in France; Howard in Australia). Also new sensing techniques were tested for agricultural purposes, including side-looking airborne radar (SLAR), thermal sensing and optical mechanical sensing in the ultra-violet, visible and near-infrared.

2.4 At the present time, the principal space platforms used in agriculture are light aircraft at low altitudes and larger non-pressurized aircraft at medium altitudes. Of the several sensors, the single-lens aerial camera with its various film-filter combinations remains pre-eminent, although the mechanical scanner with its multi-spectral capability and much greater coverage of the electro-magnetic spectrum is likely to gain in importance. Multi-spectral photography, although restricted by a small photographic format, has been successfully used in activities ranging from the identification of fields of opium poppy to avocado pear attacked by Phytopthora (vide Wenderoth et al, 1974).

2.5 Thermal scanning by mechanical scanner has been found particularly useful in forest fire operations, in fresh water studies, in river and tidal pollution studies and experimentally for detecting differences in soil moisture and in combination with other spectral bands for improved species discrimination. Side-looking airborne radar (SLAR), despite its unique cloud penetrating capability and its ability to discriminate between some plant types and stages of plant growth by differences of surface roughness and of die-electric constants, has not received the attention it might in its application to agriculture. This may be due to the small scale of most SLAR imagery (i.e. 1:250,000 to 1:400,000), to the theoretical high cost of survey by SLAR and that the equipment used and results obtained are often militarily classified. Further, airborne television is being tested operationally in Brazil to assess coffee production. As often with mechanical scanning techniques, the system relies on recording the received signals directly onto magnetic tape; and, in turn, facilitates the analysis by computer of the large amount of data - a problem facing satellite sensing in the near future.

2.6 However, most commonly the agriculturist relies on the manual interpretation of imagery. Many of the aerial photographic applications available nowadays have been developed and proved technically and economically sound over one or more decades. Careful choice of the film-filter combination, season of photography in relation to plant growth and photographic scale (as expressed by the focal length of the camera lens and flying height) enables crops (including cereals) to be identified (cf. Brunnschweiler, 1957; Bomberger et al, 1960; Anuta and Macdonald, 1970), their areas measured, their condition and yields assessed (e.g. Howard and Price, 1973), insect infestations located (Spurr, 1960) and the presence, absence and development of disease determined (e.g. Brenchley and Dadd, 1962). Frequently photographic scales between about 1:8,000 and 1/20,000 are used, but much smaller scales are satisfactory for land-use and land capability mapping (e.g. 1:80,000 in Australia). Infrared colour photography at 1:120,000 was used in the study of maize blight in the U.S.A. which included crop identification. In comparison, low-level strip, pin-point and oblique photography is favoured in insect, disease, wild-life and livestock studies (e.g. Jolly, 1969).

3.0 STATE OF SATELLITE SENSING APPLIED TO AGRICULTURE

3.1 Although the first man-made satellite was launched in 1961 by the USSR and some "normal" colour photographs from space were available in the mid-1960's (e.g. Gemini-4), it was not until the advent of Landsat-1 (1972) that the potential role and impact of satellite sensing on agriculture was generally appreciated. As compared with aircraft sensing, remote sensing by Earth resources satellites (i.e. Landsat-1 and 2) has the advantages of being able to provide a synoptic view of large ground areas which can be covered at frequent intervals. The repetitive capability, not normally available by aircraft sensing due to cost, offers the agriculturist a new and powerful method for approaching major problems (e.g. crop forecasting; monitoring extensive areas of disease and insect infestation; up-dating statistics on the area of cultivated lands). In addition, Landsat (18 day orbiting cycle) can be supplemented at daily or shorter intervals by lower resolution meteorological/oceanographic satellite imagery. Lower resolution imagery is providing a major in-put to the screw worm control programme of the Unites States and Mexico (vide Barnes and Forsberg, 1975). As compared with aircraft imagery, however, even

Landsat imagery has the disadvantage of a fairly low resolution (i.e. 0.4 ha.); but this is partly offset by the sensing being simultaneously recorded in four spectral bands (0.5/6μ, 0.6/0.7μ, 0.7/0.8μ, 0.8/1.1μ).

3.2 Particularly in high rainfall areas, the imagery may be partly or completely cloud covered. A recent FAO estimate of Landsat-1 coverage (1972-1974) of Africa indicated about 9% had not been covered with scenes of less than 10% cloud cover; but it must be borne in mind that coverage at 18-day intervals was not attempted continuously and that the United States (with its own receiving stations) is covered by Landsat-1 imagery. Also, most of the world is likely to be served by regional Landsat data receiving stations within a few years. These stations have a range of at least 3,000 Km. and by early 1976 stations will be operating in Zaïre and Iran in addition to Brazil, Canada, Italy and the USA.

3.3 As indicated by the increasing range of publications on the applicational uses of satellite imagery (vide NASA Proceedings, 1973, 1974; Abstracts NASA Survey Symposium, 1975; Proceedings, Remote Sensing of Environment, 1973, 1974; 1st/2nd Canadian Remote Sensing Symposia), Landsat imagery is proving increasingly useful in different parts of the world in the preparation of thematic maps at scales upto 1:200,000 related to geology, landforms, hydrology, soils, broad land-use classes and land capability (cf. Stewart and Fleming, 1974). Examples include the following. An information system has been set up by the Louisiana State Planning Department, which provides for the continual up-dating by Landsat imagery at 1:250,000 of land-use maps and a 48-hours read out of the 1975 floods In coastal Alaska, Landsat imagery has been used to delineate the major pathways of sediment distribution. In Nebrake, biomass estimates covering 52,000 Km^2 has been shown to be a viable method for making decisions on grazing management, including stocking. Studies in Pennsylvania indicate that digital processing of Landsat data can be used to analyse and map the progress of defoliation by Gypsy moth. In part of N. Dakota, the area under small grains has been recently inventoried with an accuracy of 96.5%. Also the Large Area Crop Yield (LACY) programme in the USA is using Landsat imagery to estimate experimentally the area under cereals (commencing with wheat) and to assess the continuing condition of the crop. Temporary imagery composites, combining two or more bands in time sequences, are proving essential to the study of seasonal changes occurring over large areas (e.g. pastoral savanna burning in Africa). Spectral band combinations have been found useful in showing up hitherto unknown large-scale natural patterns on the Earth's surface, the significance of which are yet to be determined. In Thailand, Landsat-1 imagery was used to determine the rate of de-afforestation - between 1961 and 1973, the forest cover decreased from 50% to 37%.

3.4 Based on the experience of the life of Landsat-1 and the recent US announcement on Landsat-C (Frutkin, 1975) global coverage by these satellites seems secure until nearly 1980; and by that time an Earth-shuttle and space laboratory may be operational. Further, Landsat-C is likely to be equipped with a thermal scanner and have a ground resolution of 35/40 m, which is twice that of Landsat-1. An assessment made from various published sources indicates that space technology is sufficiently advanced to be able to provide satellite imagery with a resolution of 5-7 m. or better.

4.0 OVERVIEW

4.1 At the present time satellite sensing is still very much at the applied research stage of development as compared with aerial photography, but its operational uses are rapidly increasing. These are more and more computer assisted, although the cost of developing computer software programmes is considerable. Further, an increasing range of nation-wide regional and global surveys are likely in the future to rely on satellite based data.

4.2 As may be expected, most research and development has occurred in the developed countries; and this unfortunately is leading to a widening of the gap in knowledge and applications between the development and developing world. SLAR equipment is usually only available on hire from the USA; and, with very few exceptions, thermal sensing equipment is only available in developed countries or from survey companies based in the developed countries. However, satellite imagery is readily obtainable and inexpensive (e.g. US$2 per black-and-white Landsat print covering an area of about 34,000 Km^2); and many developing countries have aircraft and aerial cameras suited to photogrammetric mapping. In fact, some developing countries produce their own planimetric and topographic maps, although few have the equivalent experience with colour photography. This may indicate not so much a lack of funds for capital equipment, but primarily a need for the educational transfer of knowledge related to remote sensing research and its applications.

4.3 Techniques less spectacular than those resulting from the development of satellite sensing, and perhaps eclipsed by the availability of satellite imagery at low cost are those provided by light aircraft and inexpensive aerial photographic equipment and developed only recently. They are well suited to research and applications in agricultural crop forecasting, forestry, hydrology, land-use, livestock surveillance and insect and disease surveys. For example, light aircraft have been used in a livestock surveillance of S. Kordafan Province (Democratic Republic of the Sudan), where an area of 145,000 Km^2 were covered in less than 4 weeks at a low cost.

4.4 In general, however, initial cost of collecting remote sensed data is considerable; but it represents only a small part of the total cost of most well planned surveys including the collection of field data (cf. van Asch, 1961; Stellingwerf, 1963; Lyons, 1964). On the basis of reduced overall costs and/or improved greater efficiency and accuracy, the application of remotely sensed data has come to be recognized as essential to most large-scale surveys. Also the type of information collected may be difficult to obtain or is unobtainable by ground survey alone.

5.0 NEED AND POSSIBILITIES OF INTERNATIONAL COOPERATION

5.1 As mentioned, a widening gap exists between the developed and developing countries in the applications of remote sensing. Steps need to be taken, therefore, through international cooperation to improve the know-how of the developing countries and to associate the applied research of the developed countries with the problems of developing countries, particularly those related to the survey of resources, crop forecasting and the monitoring of pests and disease. Although attention has been directed in the past to resources survey using aerial photography, several major projects have used other sensors. These include the US Brazilian RADAM programme using SLAR, which has enabled most of the Amazon basin to be mapped despite cloud cover; and at the present time an FAO/UNEP programme is being planned for the monitoring of tropical forest cover using satellite imagery as an important input.

5.2 Often what appears to be an identical applications problem in developed and developing countries assumes a different priority in developing countries (e.g. thematic mapping at 1:250,000, using Landsat imagery); and, also, a different approach is needed if the infra-structure and know-how are to be built up and retained in the developing countries. Too frequently, a problem existing in a developing country, which requires the application of remote sensing, has been tackled with external expertise and little or no local involvement, including training.

5.3 Training in the wider-aspects of remote sensing is being provided at universities particularly in the United States, but this usually requires two or more years of study in association with other subjects. Short courses in photogrammetry and aerial photo-interpretation are provided at ITC in Netherlands and at similar centres in Colombia and India. Short courses in satellite sensing are given at INPE in Brazil, the US Geological Survey, EROS Data Centre in the USA and at the Purdue University; and occasional seminars/ workshops in remote sensing are being held under bilateral and multilateral agreements with the UN and its agencies (e.g. UN/FAO Training Seminar in Remote Sensing, Indonesia, 1975). However, the remote sensing courses are not usually oriented towards the specific needs of agriculture, the meeds of developing countries and the particular problems of the tropics. There is therefore a definitive and probably urgent educational and training gap to be filled through international cooperation.

6.0 PROPOSALS FOR INTERNATIONAL CO-OPERATION IN REMOTE SENSING FOR DEVELOPING COUNTRIES

6.1 As indicated in previous sections, international cooperation is needed to assist developing countries in both the fields of remote sensing applications and remote sensing training particularly related to satellite sensing. There is, for example, no international co-operative programme in crop forecasting or the monitoring of insect pests and diseases; but, in recent months possibilities have emerged as follow-ups to the World Food Conference. FAO (1975) has already prepared a programme plan for developing the capability of international crop forecasting, and this will be reviewed by an expert consultation in September. In due course, their recommendations could be submitted to TAC for further consideration.

6.2 Further, the Desert Locust Commissions are examining the feasibility of improving the existing methods of locust control using Landsat and Metsat data to indicate areas within which breeding of the migratory locust is occurring. Satellite imagery is likely to help greatly in defining more accurately sandy outwash plains favourable to the breeding of locusts and within these areas sites having been recently inundated or having received substantial rain or run-off. Satellite imagery can also be used to follow-up the development of ephemal plant cover and the greening of perennial vegetation (e.g. Pedgley in Saudi Arabia, Muller in Mali) and the methodology developed in the screw-worm study in the USA and Mexico may prove useful. At this stage, there appears to be a need for international cooperation in the processing of the satellite data, in real-time analysis of the imagery, in determining the best means of telecommunication, in basic research to provide a better understanding of what is being observed and in providing training programmes for local staff.

6.3 The need for international cooperation in establishing a training programme in remote sensing was voiced recently by the UN Scientific and Technical Sub-Committee (UN Committee on the Peaceful Uses of Outer Space). In their 12th Session Report, it is stated that "The United Nations together with the FAO in Rome and the ILO in Turin should study the feasibility of utilizing the expertise of FAO and ILO and the existing remote sensing facilities of FAO to establish, on an experimental basis, an international centre to train and to, assist persons from developing countries to make the most effective use of remote sensing information. If the study demonstrated that such an experiment could be carried out without additional financial implications, the Sub-Committee was of the view that it could be undertaken immediately and a report on the results of the experiment should be made to the Sub-Committee at its next session".

6.4 In indicating Rome for the pilot international remote sensing centre, the Sub-Committee was influenced by FAO's leading role within the UN family in remote sensing and its experience in training and the close proximity of the data receiving and processing facility being developed near Rome by Telespazio. The international pilot centre was visualized to compliment the activities of future regional centres in remote sensing, the development of national data receiving centres with a regional function and to assist countries not covered by these centres (e.g. Sierra Leone, Senegal, Thailand, Colombia).

6.5 The establishment of the pilot training centre will require careful planning, international cooperation, and no doubt would benefit greatly by an international supporting network to cover its agriculturally oriented activities. Consideration could be given at the present time to establishing such a network which would assist in a number of matters including assistance with research and training and provision of follow-up studies for selected students.

BIBILIOGRAPHY

Anuta, P.E. & Macdonald, R.B. (1971) — Crop surveys from multiband satellite photography using digital techniques. Remote Sensing of Environment 2; 53-67.

Asch, van P. (1961) — The growth of aerial survey and its effect on the work of the New Zealand private surveyor. N.Z. Institute of Surveyors.

Barnes, C.M. & Forsberg, F.C. (1975) — An overview of the development of remote sensing remote sensing techniques for the screw-worm eradication programme, NASA Survey Symposium, Houston, 21 pp (awaiting publication).

Bomberger, E.H., Dill, H.W. et al (1960) — Photo-interpretation in agriculture. Manual of Photo-interpretation, ch. 11, 561-666.

Brenchley, G.H. & Dadd, C.V. (1962) — Potato blight recording on aerial photographs. N.A.S.S. Q. Rev. 21-5. London.

Brunnschweiler, D.H. (1957) — Seasonal changes of the agricultural pattern. Photogramm. Engng. 23, 131-9.

Canadian Symposium on Remote Sensing (1974) — The applications of remote sensing and benefits to Canada. University of Guelph, Canada, 346 pp.

Colwell, R.N. (1956) — Determining the prevalence of certain crop diseases by means of aerial photography. Hilgardia, 26 (5), 223-86.

Environmental Research Institute of Michigan (1972,1974) — Proceedings of the 8th/9th international symposia on remote sensing of the environment. ERIM, Ann arbor, Michigan, USA.

FAO — Programme plan for developing the capability of forecasting crop production - (A.B. Park) unpublished, 39 pp.

Frutkin, A. (1975) — US Delegate, 12th UN Scientific and Technical Sub-Committee (UN Committee on the Peaceful Uses of Outer Space, New York, USA).

Gates, D.M. (1965) — Characteristics of soil and vegetional surfaces to reflected and emitted radiation. Proc. 3rd. Symposium of Remote Sensing. Report 4864-9-x. University of Michigan, Ann Arbor, USA.

Howard, J.A. (1970) — Aerial Photo-Ecology. Faber & Faber, London, 325 pp.

Howard, J.A. & Price, R.D. (1974) — Using aerial photography to estimate yield loss in oats due to barley yellow dwarf virus, Revue Photo-Interpretation, Paris.

Jolly, G.M. (1969) — The treatment of errors in aerial counts of wilflife populations. East African Agricultural and Forestry Journal, Vol. XXXIV - July 1969.

Lyons, E.H. (1964) — Recent developments in 70 mm stereo-photography from helicopters. Photogramm. Engng. 30 (5), 750-6.

Manual of Photo-Interpretation (1960) — American Society of Photogrammetry, Washington, D.C.

Muller, W. (1975) — Etude metereoligue. Report on Project PNUD/FAO/RAF/09/146. (unpublished)

NASA (1973) — Symposium on significant results obtained from the Earth Resources Resources Technology Satellite-1. (2 Vols) Washington, D.C.

NASA (1974) — Third Earth Resources Technology Satellite-1 Symposium (Sections, A,B), Washington, D.C.

NASA (1975) — Earth Resources Survey Symposium. Abstracts, Houston, Texas.

Pedgley, D.E. (1973) — ERTS surveys a 500 Km^2 locust breeding site in Saudi Arabia. 3rd Earth Resources Technology Satellite-1 Symposium. I: Technical Presentations: 233-46.

Rossetti, C. (1966) — Reflections sur l'utilization des photographies aériennes de la végétation. Photo-interpretation, 5.

Spurr, S.H. (1960) — Photogrammetry and Photo-Interpretation, Ronald Press, NYS, 443 pp.

Stellingwerf, D. (1963) — Volume determination on aerial photographs. ITC. Series B, No. 18, pp. 19.

Stewart, R.A. & Fleming, E.A. (1974) — Mapping activities: SKYLAB and ERTS imagery. 2nd Canadian Symposium on Remote Sensing, University of Guelph, Canada. 14 pp.

Taubenhaus, J.J. et al (1929) — Aeroplane photography in the study of cotton root-rot fungus. Phytopathology, 19. 1025-9.

Thomas, H.H. (1920) — Aircraft photography in the service of science. Nature, 105 (No. 2641), 257-9.

Wenderoth, S. & Yost, E. et al (1975) — Multispectral Photography for Earth Resources. University of Long Island, N.Y.S.

F-2

June 30, 1975

Dear Bill:

Thank you for your letter of 20th June. During Sir John's visit here in May, we had the bad news of your illness, but we are delighted to know that you are fit enough to come to Washington.

We will put together a set of documents for your arrival on July 15; please let us know if there is any other help you may require.

With best regards,

Yours sincerely,

John K. Coulter

Mr. W. J. MacNally
International Development Services
(Australia) Pty. Ltd.
P. O. Box 1549
Canberra City 2601
Australia

JKCoulter:apm

File
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INTERNATIONAL DEVELOPMENT SERVICES

(AUSTRALIA) PTY. LTD.

P.O. Box 1549, Canberra City 2601, Australia

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20th June 1975

Dear John,

I shall be arriving in Washington on 15th July to prepare summaries for Sir John of documents for the 10th TAC meeting and also for Centres Week. Sir John will be getting his own copies of these documents but I wonder if I could ask you to have a set of the Centres Week documents made available to me on my arrival. Peter Oram is sending me the appropriate TAC documents directly to the Bank.

The above does not imply that I need any secretarial or other assistance but I expect to be doing a fair amount of work as Sir John is due to arrive in Washington on about the 19th.

With best wishes,

Yours sincerely,

Bill MacNally

W.J. MacNally

Dr J.C. Coulter
CGIAR Secretariat
International Bank for
Reconstruction and Development
1818 H Street, NW
Washington DC 20433
USA

F-2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Via delle Terme di Caracalla, 00100 Rome, Italy
Cables: FOODAGRI ROME - Telex: 61181 FOODAGRI
Telephone: 5797

June 16, 1975

PR 3/10.10

Dear John:

Thank you for your letter of June 3 giving details of the arrangements made for the 10th TAC meeting in July. I am sorry that once again we are going to have to dodge the TAC meetings about between rooms A 1100 and C 1006 and, but for the fact that the interpreters find C 1006 so extremely unpleasant, would have requested you to book that room for the whole of the TAC sessions.

I am much more concerned about the lack of interpretation facilities on July 22. Most of our members are able to cope adequately but I would appreciate it if a contract interpreter could be obtained to sit beside Dr. Sauger to give whispered translation (English/French) as required. I do hope it is possible to find someone even an outsider for this task as Dr. Sauger, although he has made tremendous strides in his English, still requires assistance and is always pretty strong in getting interpretation and translations into French.

Thank you for arranging verbatim reporting of the proceedings in English, but something seems to have gone wrong with the figures. We would require this for all five days (July 22-26 inclusive) and this comes to $4,400 not $3,960 at $880 per day. My estimate of $4,000 was incidentally for this operation alone as I have budgeted separately for interpreters. I note the estimate for coffee and thank you for making this provision for morning and afternoon sessions. Could you also arrange for the normal luncheon for TAC members and Center Directors (24 in total) in a private dining room on Friday, July 25. We will look after invitations in the usual way. I have made budgetary provision for this also.

As time is getting short for the establishment of ad hoc per diem rates, I would greatly appreciate your letting me have a reply as soon as possible to my other question regarding the cost of single rooms and family suite (4 people), at World Bank rates, in the Watergate Hotel.

Dr. John K. Coulter
Scientific Adviser
Consultative Group on International
Agricultural Research
1818 H Street, N. W.
Washington, D. C. 20433
U.S.A.

Reverting again to the compilation of bilateral research data, we are now in process of recruiting a new consultant, vice Howarth who has returned to Thailand, and would very much appreciate a check-note from you and a spare set of submissions if available, from those countries and donors who have responded so far to the Secretariat's request.

I trust you have now received my notes on CIMMYT. I will shortly be pouching you, for internal use only at present, the draft report of the TAC IRRI mission which was completed towards the end of last week and which I am now editing.

I reiterate my intention of bringing to Washington TAC accounts to date and a provisional budget for 1976.

Best personal regards,

Yours sincerely,

B. N. Webster
Assistant Executive Secretary
Technical Advisory Committee

INCOMING TELEX

Jul 7-2

RECEIVED

1975 JUN 25 PM 2:51

COMMUNICATIONS SECTION

FROM: ROME

JUNE 25, 1975

Distribution: Mr. Coulter (E1039)

COULTER

FAO/B 4038 HAVE ALREADY INFORMED TEN HOUTEN AND ARRANGED

BRIEFING ROME JULY NINE=

REGARDS O/RAM+

COL 4038 +

F-2

June 25, 1975

Dear Brian:

Thank you for your letter of June 16. We were unable to arrange the normal trilingual translation for the afternoon of July 22 because of competing meetings. However, we have now arranged for an interpreter to work with Dr. Sauger.

We have calculated the cost of verbatim reporting as 4-1/2 days at $880 per day, i.e., $3,960.

We have booked a dining room for a luncheon for 24 on Friday, July 25. You should note that this is the maximum that this dining room will hold. The Controller's Department will pass the bill directly on to you.

We sent a note on per diem rates on June 11; in case this failed to reach you, I enclose a copy.

Copies of bilateral research data were also sent to you on June 11.

Thank you for your notes on CIMMYT and I look forward to receiving the TAC mission report on IRRI's mechanization program.

With best regards,

Yours sincerely,

John K. Coulter

Enclosure

Mr. B. N. Webster
Assistant Executive Secretary
Technical Advisory Committee
Food and Agriculture Organization
of the United Nations
Via delle Terme di Caracalla
00100 Rome, Italy

JKCoulter:apm

File F-2

F2

June 11, 1975

Dear Brian:

Many thanks for your letter of May 23. We should definitely have a 1976 budget proposal for discussion by the co-sponsors at their meeting on July 21. The Bank is also concerned about the delays in having a statement of expenditure for the past year; if a formal certified statement is not available, then a statement from you will have to serve as a temporary indication of last year's expenditure.

We have written to Peter about the verbatim report for the TAC meeting and given him an estimate of the cost.

The rates at the Watergate are as follows:

Single -- $33.00 a day (if available); otherwise $39.00 and $45.00.

Family -- $55.00 a day (4 people); Jr. Suite.

With regard to your letter of April 29, I am enclosing copies of the reports on bilateral research.

Unfortunately, we have not yet received your note on CIMMYT, so I am afraid that we will have to proceed with the commentary without it as we wish to dispatch our commentaries within the next week or so.

With best regards,

Yours sincerely,

John K. Coulter

Enclosures

Sent:
Canada
Japan
Norway
Sweden
1 BKD
U.K & U.S.

Mr. Brian Webster
Assistant Secretary
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File F-2

F-2

Miss Barbara McLane (Secretary's Department) June 3, 1975

Carlos B. Gavino, CGIAR

Verbatim Reporting for the TAC Meeting, International Centers Week, 1975

1. Based on our discussion yesterday regarding International Centers Week, I confirm our request for verbatim reporters for the meetings of the Technical Advisory Committee (TAC) of the CGIAR for the following days:

Tuesday (afternoon)	July 22	Room C-1006
Wednesday	July 23	A-1100
Thursday	July 24	A-1100 or C-1006
Friday	July 25	A-1100
Saturday	July 26	A-1100

2. The expenditures are to be charged to the Contractual Services budget of the CGIAR Secretariat (311/99). The Secretariat will request reimbursement from TAC after the meetings.

CBGavino:js
File F-2

F 2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

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PR 3/6.2
PR 3/10.10

Carlos

May 23, 1975

Dear John:

Subject: TAC Budget 1976 and 10th TAC Meeting, Washington

1. Thank you for your letter of 14 May. I agree that it would be useful to have a budget for discussion at the co-sponsors meeting at the time of Centers Week in July. This is the procedure I adopted last year although a formal co-sponsors meeting was not held; nevertheless, all were provided with a copy of my first draft.

Regarding the statement of expenditure for 1974, the co-sponsors will receive it as soon as it emerges from our Finance Department. There are, in fact, no procedural difficulties involved in getting this from FAO. The procedures are straight forward and clearly laid down; it is simply a time lag which bedevils us. Again if the formal certified statement is not available, I would do what I did last year and prepare a statement of expenditure from our own files.

2. Further to Peter's letter of 19 May regarding the agenda and arrangements for the 10th TAC Meeting, I should be very grateful if you could organize, on our behalf, verbatim reporting of the whole meeting using your normal reporting company. This will be essential as we have to produce the report much more quickly than usual and cannot indulge the normal two to three weeks required for tape transcription here. I have provisionally budgeted $4,000 for this operation, which Caryl believes will cover this cost. Nevertheless, I should be grateful if you could obtain a tentative estimate from Hovers. We would require the verbatim before Peter leaves at the end of Centers Week. Only two copies (original plus one) will be required, one of which I suggest we return for your future use after preparation of the report. Should you prefer to have a copy immediately, please let me know how much more this would cost.

Dr. John K. Coulter
Scientific Adviser
Consultative Group on International
Agricultural Research
1818 H Street, N.W.
Washington, D. C. 20433
U.S.A.

.../..

Also in connection with the 10th Meeting, I would be grateful for the current costs, at World Bank rates, for single rooms and family (4 members) suites in the Watergate. We need this as we have to establish special ad hoc rates of per diem for our stay there.

3. We are currently seeking another consultant to undertake the compilation of the bilateral research support data, and would be very grateful to receive a note for check purposes as to the countries from which you have received material and, as some of our materials may well need to be cut up in the process of compilation, we would appreciate a spare set if available (please see my letter of April 29).

4. I am hoping today to pouch a preliminary note on CIMMYT's new proposals to Harold Graves, but as I have rewritten all this in a brief form following receipt of the notes on Sir John's visit and the report of the Programme Committee just this week, this may be delayed as I am off to IRRI tomorrow with the TAC Mechanization Review Mission.

5. For your information I am enclosing the TAC budget sheets which we first submitted to you on 8 January, together with the finalized budget sheet from our Accounts Department which I received yesterday with regrets for tardy preparation!

With best regards,

Yours sincerely,

Brian

B. N. Webster
Assistant Executive Secretary
Technical Advisory Committee

Enclosure

TAC BUDGET - 1975 1/

		$	
10.	Personal Services.		
	(Includes salaries, temporary assistance, contracts, consultants and overtime)	165,000	2/
20.	Travel on official business.		
	(Includes honorarium and travel for all TAC members and participants in missions)	259,000	3/
30.	Contractual services.		
	Printing and Xerox contract	25,000	
40.	General operating expenses.		
	Postage, cables, hospitality, office supplies	10,000	
		$ 459,000	

	$
Source of funds, Government of Australia - through CGIAR	150,000
FAO	85,000
UNDP	85,000
World Bank	85,000
IRRI	54,000
	$ 459,000

1/ See Appendix for breakdown.

2/ Includes $ 150,000 contribution from the Australian Government.

3/ Includes $ 54,000 for evaluation mission to IRRI.

APPENDIX

TAC Budget breakdown

		$	
10.	**Personal Services**		
01.	Salaries (P5, P4, P3, G6, G2)	125,000	1/
02.	Temporary assistance (interpreters & meeting staff)	14,000	
04.	Contracts and consultants (to Crawford Consultants)	25,000	
05.	Overtime	1,000	
		165,000	
20.	**Travel on official business**		
	Costs of travel and honorariia, TAC members attending 2 regular meetings, members and non-members attending 4 Working Groups or Sub-committee meetings and 6 individual visits to International Centres.	205,000	
	Evaluation mission to IRRI	54,000	2/
		259,000	
30.	**Contractual services**		
	Translation and printing costs, Xerox copying	25,000	
40.	**General operating expenses**		
	- Postage, cables, hospitality, office supplies	7,500	
	- Contribution to copying machine (to be shared with Secretariat of IBPGR)	2,500	
		10,000	
	Total	$ 459,000	

1/ Australian contribution of $ 150,000 through CGIAR

2/ To be provided by IRRI

TEMPORARY ACCOUNT

Code 9.9100.5549.00

Budget (DPB): TA/75
19 May 1975

Committee of the Consultative Group on International Agricultural Research

Source of Fund: The Government of Australia, UNDP, World Bank, IRRI and FAO

Purpose of Fund: To finance the activities of the Technical Advisory Committee

Funds made available up to 31.12.1974:		$ 590,352
(Balance as of 31.12.1974: $ -12,775)		
Funds made available in 1975:		$ 294,745
(Up to 30.4.1975)		
Funds to be made available:		$ 183,000
FAO:	$ 85,000	
World Bank:	$ 44,000	
IRRI:	$ 54,000	
GRAND TOTAL		$ 1,068,097

Expenditure to 31.12.1974: $ 603,127

Application of Resources in 1975:

1 x D-2
1 x P-4
1 x P-3
1 x G-6
1 x G-2
Consultants
Temporary Assistance and Overtime

Estimated Costs in 1975:

Code 5549.00.10	Personal Services	$ 165,000
.20	Travel on Official Business	$ 259,000
.30	Contractual Services	$ 25,000
.40	Miscellaneous General Expenses	$ 10,000
	Sub-Total, 1975	$ 459,000
Undistributed:		$ 5,970
	GRAND TOTAL	$ 1,068,097

cc: DDF (2)
Mr. Lewin, DPB
Mr. Miocinovic, AFFA
Mr. Oram, DDDR
Mr. Webster, DDDR
Mrs. Taddeini, DDD
Internal Audit
External Audit
Data Plates, AFM (C-094)
AFF Registry (4)
AFP Registry (4)
Budget Branch

Issued by: E.A. Lewin
Chief, Budget Branch
for the Director, DPB

19.5.1975
Date

F 2

May 22, 1975

Dear Vern:

With reference to your letter of May 13, Room C 1006, reserved for TAC on the afternoon of July 22, has been reserved for your meeting for the morning.

With best regards,

Sincerely yours,

John K. Coulter

Dr. Vernon W. Ruttan
The Agricultural Development Council, Inc.
630 Fifth Avenue
New York
New York 10020

JKCoulter:apm

File F-2

CG Files Box 964-06
TAC Meetings 1975/77
Vol. 1 File 2.

yellow

F-2

To: Mr. Peter Oram, Secretary of the Technical Advisory Committee

From: Bruce M. Cheek, Deputy Executive Secretary January 29, 1975

Subject: Working Paper for TAC Meeting, February 1975: Item 25 - Terminology

Attached is a working paper prepared in the CG Secretariat as an input for the discussion by TAC members on Agenda Item 22: "Improved definition (terminology) of program activities of Centers."

BCheek/ms

Attachment

Subj F-2

May 20, 1975

Dear John:

As I mentioned to you the other day, I noted from the records of the Directors' meeting in Ibadan that you would be preparing a paper on terminology. I believe that I gave you a draft of a paper that I was working on, during my visit. A revised version, presented to the February meeting of TAC, is enclosed. This is to be revised for Centers Week. Perhaps we could have an agreed joint revision which both the Center Directors and TAC could discuss.

Any comments on this would be welcome.

With best wishes,

Yours sincerely,

John K. Coulter

Enclosure

Dr. John Nickel
Director General
Centro Internacional de Agricultura
Tropical
Apartado Aereo 67-13
Apartado Nal. 737
Cali
Colombia

JKCoulter:apm

TAC Meeting, Rome, February 1975

Agenda Item 22. Improved definition (terminology) of program activities of Centers

Introduction

1. At the Consultative Group meeting in October, 1974, members took up the problem of classifying and defining the terms commonly used throughout the CG system to describe the various kinds of programs in which the international agricultural research centers are engaged. This discussion took place under Agenda Item 5b, "Structure and Finance of Off-Campus Activities," but it broadened out to cover the whole range of activities of the centers which are most commonly described as core, restricted core and special projects. Earlier discussions took place at TAC meetings (e.g. TAC VII in Rome in February, 1974). Moreover, a paper on the subject is to be presented to the Consultative Group at Centers Week in July, 1975.

2. This note focuses on the present center practices with respect to the classification of the work they actually do and takes up the related questions of the location of activities included in center programs (on and off campus) and the means of financing (core and special project). The note elaborates some of the definitions given in the July 11, 1974 Secretariat paper on "Budgeting and Accounting Procedures and Practices of International Agricultural Research Centers," particularly those activities funded by other than 'core' funds. These definitions are based on the Centers' descriptions of their activities following the Secretariat request for details of their off-campus activities. As background information, the October 9, 1974 paper on off-campus research activities is attached, together with the related section of the Summary of Proceeding of the October CG meeting (Annex I). Similarly, the section of the Draft Integrative Paper of July 24, 1974 is attached, together with the related extract from the 1974 Centers Week Summary of Proceedings (Annex II).

Definitions

3. As given in the Budgeting and Accounting Paper of July 11, 1974 (paras. 3 to 9), center program activities are defined as follows:

> "A program is a set of organized activities designed to progress toward defined objectives.
>
> "A. Core program
>
> (1) The core program of a center or institute is a set of long-term activities designed to progress toward the center's fundamental objectives in research and training, as described in a basic statement approved by the center's governing board (which some centers refer to as their "mandate"). The hallmark of the core program, so far as content is concerned, is that it represents the initiative of the center and carries the approval of the governing board. So far as finance is concerned, the core program is funded by several donors (often eight or more).
>
> "(2) The core program need not be confined to the

headquarters of an institute. A core program may be carried on away from headquarters and even outside the host country, by an institute's own staff, by contract with another research organization or laboratory, or by other cooperative arrangements with national or regional institutes (sometimes called linkages, although this term seems to be obsolescent).

"(3) A core program may consist of a number of different activities aimed at different research questions or action targets. These activities may be referred to as programs or program elements; centers sometimes call them "thrusts." A multiple-crop center, for instance, is considered to have a program for each crop (or group of related crops) with which its activities are concerned (e.g., the Grain Legumes Improvement Program of IITA).

"B. Special Projects

(1) Special projects usually are highly specific in purpose and limited to a definite span of time. They are often financed by a single donor, and may or may not be continued or renewed when the donor's support comes to an end.

"(2) In contrast to the content of a core program, the content of a special project is often stipulated by the donor and/or by the client. The project usually consists, basically, of making practical use of a center's research results or its expert staff in a single country (which may or may not be the center's host country).

"(3) A large class of special projects is composed of outreach programs. These typically are programs of technical assistance by the personnel of an international institute to research or extension efforts in a developing country, carried out under a contract with the recipient country and financed by that country with the help of an outside donor or donors."

4. Whilst core programs and their sources of funding are clearly defined and the activities of all Centers follow a consistent pattern, the work under special projects tends to be more diverse and to cover a wide range of activities, many of which are at the fringe of a center's mandate. The central point is the nature of the activity rather than its location or its funding. There are indeed enough variations in the usage of such terms as 'outreach', 'delivery', 'network' to warrant attempts at better definitions. Whilst 'core' activities may be generally thought of as taking place 'on-campus' and 'special projects' as occurring 'off-campus', the examples to follow will show that both activities take place 'on' and 'off' campus. Furthermore, the same activity may be funded in either way, by different Centers or it may be funded partly through 'core' and partly through 'special projects'.

5. Definitions of Program activities wholly or mainly funded as Special Projects

A. Co-operative 'on-campus' projects

This group of activities may be defined as that in which the Center provides facilities for an activity with an agreed life span, based wholly on the Center.

Examples are:

(1) Specialist documentation services like the Cassava Information Center at CIAT funded by IDRC; Agricultural Economics and Development for Latin America funded by Ford Foundation. Other documentation services are planned at CIAT.

(2) Special development projects such as the machinery project at IRRI funded by USAID and the grain storage project at IITA funded by FAO. The degree of Center participation in these varies from the minimum e.g. provision of land, to close participation and proposals for eventual integration into the Center's program.

(3) Special research projects in which a research institute or university in a ~~developed~~ country sets up a research program on the Center campus. The project provides staff (paid for directly by the sponsoring institute), equipment, etc. The Center provides space and presumably some equipment and assistant staff. The COPR program at IITA is an example of this; the Texas A & M group at CIAT is possibly on the same basis.

(4) Special training courses. IDB has provided additional funds to CIAT to run special courses in animal production. Provision of funding for graduate thesis work is provided at some institutes.

(5) Urgent projects to solve an urgent problem which an international center is particularly qualified to handle and which presumably can be solved in a short time (e.g. IITA's program on bacterial blight in cassava).

(6) Short-term holding operations, pending the permanent assignment of a research problem to the international center which will have the long-term responsibility for it; sorghum research at CIMMYT which will eventually pass to ICRISAT is an example.

B. Contract research in a developed country

This group of activities may be defined as one which is carried on at an institute of advanced study on behalf of a center. These activities may be funded as special projects or as part of the

core program of a center.

Examples are:

(1) Research contracts financed by the Centers at institutes in Europe and North America. CIP has 11 such contracts financed out of its core budget.

(2) Research contracts at institutes financed by the government or a private agency of the host country. Rockefeller funds work at Kansas State and Oregon State of interest to CIMMYT and work at Minnesota linked to CIP. ODM funds work at Birmingham University for CIP.

C. Co-operative research in developing countries

This may be defined as an activity designed to test Center's materials or agricultural systems or to strengthen national research programs to hasten the spread of such materials or modified versions of them. Such an activity is variously described as an 'outreach', 'delivery' or 'network' system. The initiative for these projects may come from the Center, e.g., requests for sites for testing their materials or techniques, or from a host country collaborating with a donor in a relationship in which the Center contracts to provide services specified and funded by the client country and the donor.

Examples of this kind of activity are:

(1) Co-operative nurseries testing new varieties. The host country may receive technical support only in the form of visits from the Center or it may have staff or additional help as in para. 5A(3) above. The nursery testing program is usually core funded.

(2) At national research centers giving general research support; an example of this is the three-man CIAT team at ICTA, Guatemala. Possibly IITA may ultimately do the same under its farming systems program. Research reports state that CIMMYT teams in North Africa, though designated as wheat teams, work also on wheat/legume cropping systems.

(3) At crop research centers working on a specific crop. Teams may vary from one to several scientists. One or more man-teams are provided by IRRI, mostly in the Far East, by CIMMYT, mostly in Africa, and by IITA, all in Africa.

(4) At one center but serving a region, i.e. as part of a network. CIP has developed this approach whereby the 'potato' world has been divided into seven regions: South America, Central America, Tropical Africa, Middle East and North Africa, non-Arab Muslim countries, India, and S.E. Asia. Ultimately 3 scientists will be stationed in each region, some of whom will be core funded, but more financed through special funds.

D. Extension and development programs

This group of activities may be defined as one in which the Center uses farmers' land to demonstate new materials or new techniques or

uses farmers' experience to analyze reactions to such materials or techniques. Demonstration trials may also be described as 'outreach'.

Examples are:

(1) CIMMYT's farmer demonstration plots on maize and wheat in a number of countries where it is operating. Other Centers probably do likewise without specifically reporting so. It would appear that the teams provided under C(3) are mostly responsible for this;

(2) CIMMYT has made a survey of farmer acceptance of new varieties of wheat in a number of countries. IRRI has also studied the impact of new varieties in the Philippines. Some staff in this activity may be core funded and some provided by the host country.

E. Consultants

This activity may be defined as one in which Center staff undertake short term visits to advise national programs. Some Centers, e.g. CIAT, provide teams to act in an advisory capacity to national production programs. CIMMYT staff (core funded) travelled about 2400 man-days in 1973. Much of this appears to have involved advise to national programs.

CGIAR Secretariat
January 29, 1975

Annex I

Off-Campus Programs of International Agricultural Research Centers

1. Secretariat Paper of October 9, 1974
   as prepared for October meeting of CG.

2. Summary of Proceedings of CG, October
   30-31, 1974 (paras. 35-40 of Summary)

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

CG/74/5b

Off-Campus Programs of International Agricultural Research Centers

1. A substantial part of the activities of most international agricultural research Centers is carried out at locations away from the headquarters of the Centers. These activities, broadly speaking, are of three kinds: (a) core activities of research and training; (b) cooperative or collaborative research; and (c) outreach activities. It is the purpose of this paper to describe briefly the nature and the financing of each of the three.

Core Activities

2. The core program of a Center, according to the definition used by the Centers and by the Consultative Group Secretariat, is a set of long-term activities designed to progress toward the Center's fundamental objectives in research and training, as described in a basic statement approved by the Center's governing board (which some Centers refer to as their "mandate").[1/]

3. The core program need not be confined to the headquarters of an institute. Parts of it may be carried on away from headquarters and even outside the host country. Parts of core programs typically conducted away from headquarters are research activities directed to the study of diseases not present at headquarters, or in ecological conditions different from those at headquarters. An example of the former is the work of the International Potato Center in the Toluca Valley of Mexico, directed to the study of blight; and an example of the latter is the work done on wheat and maize in the substations of CIMMYT in different parts of Mexico.

4. The core program represents the initiative of the Center and carries the approval of the Governing Board. So far as finance is concerned, the core program is funded within the procedures of the Consultative Group: that is, by donors sharing the budgetary costs and, especially with regard to new extensions of the core program, acting with the advice of the Technical Advisory Committee (TAC).

Cooperative Research

5. Core research is often done in cooperation with other research organizations, in which case it may be referred to as "cooperative" or "collaborative" research. It may be carried on by contract with another research organization or laboratory, or by cooperative arrangements with national, regional or international programs. The International Potato Center, for instance, contracts for

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1/ Secretariat paper, "Budgeting and Accounting Procedures," July 11, 1974, p. 1.

some of the research work within its core program to be done by university research staffs in economically developed countries. The beef program of CIAT is carried on cooperatively in Colombia with the national Instituto Colombiano Agropecuario (ICA) with the use of staff and facilities provided partly by ICA.

6. Like other kinds of core activities, cooperative research represents the initiative of the Center and carries the approval of the Governing Board. Since cooperative research is done for the common benefit of the cooperating institutions, the costs are usually shared by agreement among them. The part of the cost borne by an international Center is, like the expenditure for other parts of the core program, financed within the procedures of the Consultative Group, by donors acting together with the advice of TAC.

Outreach

7. A third class of activity is one in which the expert staff of the international agricultural research Centers assist in carrying forward national programs of research, production or training. This is one of the principal ways in which the findings of the Centers are given practical application in the field (others: conferences, headquarters training programs and the dissemination of research papers). Both the Consultative Group and the Centers believe that the further growth of outreach activities is essential to the success of efforts to feed the peoples of the developing countries at an adequate standard.

8. Generally speaking, however, outreach activities have not been planned or executed within the framework of Consultative Group procedures. In a typical case, a developing country proposes a research or production program and obtains financing for it from an individual donor country or agency: in addition to employing its own resources, the developing country contracts with an international center to provide needed technical assistance, which is funded out of the bilateral grant. Neither the formal initiative nor the financing arises from within the Consultative Group system; and Boards of Trustees take varying degrees of interest, and exert varying degrees of control, over this type of activity by the international agricultural research Centers.

9. Parts of both core and outreach activities may take regional form. Some of CIMMYT's work on certain diseases, a core activity, is coordinated by a senior scientist posted in the Middle East. CIP's assistance to national programs of research, production and training, essentially an outreach function, is carried out with the help of regional offices in different geographical areas. Regional arrangements of these kinds may make it possible to deal more economically with several countries having similar ecological or other features, and may shorten the lines of communication and supply from a Center to its collaborators and clients.

10. Some Centers observe that the present method of funding outreach programs makes this important type of activity dependent on the vicissitudes of financing by bilateral donors. They say (to quote IRRI) that the "uncoordinated,

short-term, ad hoc nature of programming and support makes it difficult... to recruit good staff or to develop a sensible long-range program to assist the national research organizations."

11. There is therefore pressure to provide continuing support for outreach activities from core budgets. Members of the Consultative Group, however, have expressed concern that the limited funds available for multilateral use through the Group not be made generally available for assistance to national programs, whose potential demand for funds far exceeds multilateral resources. They observe that financial backing for national programs can be given from more plentiful sources: for instance, bilateral funds, national treasuries in developing countries, or credit from lending agencies. The Group has begun to consider ways of creating more effective relationships between bilateral projects and the international centers.

12. The Consultative Group nevertheless has moved some way toward giving core support to staff arrangements which underpin the development and conduct of outreach programs. Three kinds of staffing have been involved, of which one is standard and two seem to be in the process of evolution.

13. It is understood to be standard practice that the international Centers maintain on their headquarters core staffs one or more members concerned with the stimulation, organization and supervision of outreach activities. Most Centers have such a staff member, often with the rank of Assistant Director General. So far as the Secretariat knows, the largest number of senior and support staff maintained at any Center headquarters for this purpose is three. The Secretariat has only fragmentary information, but guesses roughly that total expenditures for this kind of staffing throughout the network may be from 2 to 3 per cent of core budgets and may reach a level between $700,000 and $1 million in 1975.

14. In addition to permanent headquarters staff with responsibilities for outreach, regional staffs exist or are in prospect. The msot extensive is CIP's: in 1975, this staff is to consist of one support scientist in each of 4 geographical areas. The budgeted cost of this regional activity is $270,000, or about 12 per cent of CIP's core budget and is financed as a core expenditure. Depending on advice being awaited from TAC and the Consultative Group, CIMMYT may begin presenting proposals for regional services in 1976 and thereafter which, in 1974 dollars, might grow to a cost ranging between $1 million and $1.5 million a year.

15. A third kind of outreach staffing has been discussed by the Consultative Group: namely, a small complement of scientists (perhaps three) at each Center who would not have long-term duties at headquarters and who would be quickly available for assignment to new outreach projects as such projects arose. It has been suggested that the budget for these scientists would be met largely or entirely out of the funding of the special projects in which they are engaged, and that they might be supported out of some kind of revolving fund created out of the financing of special projects.

16. CIMMYT, however, has been able to develop and conduct a large program of outreach activities without any formal reserve of manpower. It has done so by making flexible use, for staff and outreach purposes, of scientists originally posted at the Center as visiting fellows.

17. On the other hand, the program of ILCA already envisages that outreach staff, presumably including a ready reserve, would be supported from the core budget. The Center envisages a complement of senior and support scientists who are expected to spend extended periods of time outside headquarters in assisting national programs of research and training. The number of scientists would rise from 14 in 1975 to 20 in 1978. Expenditures as a proportion of the core budget would decline from 30 to 20 per cent in those years, but, in 1974 dollars, would rise absolutely, from about $600,000 to about $1 million. This program, in principle, has already been accepted by the Consultative Group.

18. Two conclusions appear to emerge from the present state of off-campus activities. One is that more time and resources, with a larger impact on core staffs and budgets, are being devoted to the planning and conduct of outreach activities than may previously have been realized by members of the Consultative Group and its Secretariat. The other is that the various Centers are not dealing with these activities in a uniform way.

19. Given the differing missions and the differing socio-economic settings of the Centers, some variations are inevitable and desirable. The problems of research on plants propagated from seed, for example, are different from those of research on plants vegetatively reproduced; a form of financing that may be feasible for countries on one level of income may not be feasible for countries on a lower level of income.

20. However, it is not clear to what extent the observed variations conform to a rational pattern or are simply due to historical differences among the Centers. On the premise that a more standard treatment of staffing and funding would be feasible and desirable, the Group may wish its Secretariat to draft guidelines for the consideration of donors; in so doing, the Secretariat would take account of TAC's continuing discussion of the off-campus activities of the Centers.

Extract from CGIAR Summary of Proceedings (October 30-31, 1974 Meeting).

Structure and Finance of Off-Campus Activities (Agenda Item 5b)

35. At Centers Week the Group had discussed the structure and support of outreach programs on the basis of the section in the Draft Integrative Paper (paras. 28-38). The discussion had also covered other activities carried out by the Center outside its headquarters, on the basis of which the Secretariat had prepared the paper on "Off-Campus Activities". The paper therefore opened up the broad questions of what were "core" activities or "cooperative" research Programs or "outreach" activities. The paper concluded that a large part of core staffing and financing was already devoted to "off-campus" activities; that this proportion was expected to increase; and that the structure and financing of "off-campus" activities was not consistently organized or defined by the various centers. The paper therefore concluded that the Secretariat should draft guidelines as a basis for achieving greater consistency and clarity in definitions.

36. One representative stressed the importance of the Centers presenting to the Consultative Group their total program of activities, whether for core, restricted core or special projects, whatever definitions were used. Moreover, presentations should distinguish between programs for which funding was assured and those for which funding was being sought. The Executive Secretary said that the budget and accounting paper now asked for fuller reporting of all center activities and plans; this could be expected in the budgets and programs presented in mid-1975.

37. Attention was called to the importance of the centers developing co-operative research and contract research not only with developed countries but with institutions in developing countries, in part as a way of strengthening national research capacity. In this connection, another representative pointed out that the distinction was not fully covered by the word "off-campus" as the question that was also one of activities crucial to the center's own research program, wherever they were conducted, as against activities designed to improve national programs through cooperative research or training. Centers should not over-reach themselves in such programs, but it was for the center to judge the need for off-campus and other activities in fulfilling its own mandate.

38. It was pointed out that it was not intended to merge for funding purposes all aspects of a Center's program; indeed, for some donors it was easier to provide funds from various sources in their total budgets if there was a split between core programs (usually financed multilaterally) and outreach activities (usually financed bilaterally). In this way the flow of funds could be maximized.

39. The Chairman of TAC said that at its February 1975 meeting attention would be given to trying to understand the terms involved and to restating TAC's philosophy on national research.

40. The Chairman summarized the discussion by saying that donors were interested in having a full record of the proposed activities of each Center presented during the Centers Week, including core, restricted core and outreach proposals. There was a clear need for definitions and guidelines to be established on outreach and it was the responsibility of the Secretariat to ensure that these guidelines were followed. The "off-campus" paper would be annexed to the Integrative Paper, which would also retain the present section in paras. 28-38 on outreach. In addition, the Secretariat would draft guidelines and definitions which would be circulated to members for comment.

Annex II

The Structure and Support of Outreach Programs

1. Extract from Draft Integrative Paper of July 24, 1974 (paras. 28 - 38 of Paper)

2. Summary of Proceedings of Centers Week, July 1974 (paras. 27 - 30 of Summary)

Extract from Draft Integrative Paper (July 24, 1974)

The Structure and Support of Outreach Programs

28. The findings of the international agricultural research centers are given practical application in outreach activities whereby the expert staff of the centers assist national programs of research or production. This is one way in which the "pay-off" from Consultative Group financing occurs (others: conferences, training programs and the dissemination of research papers). Both the Consultative Group and the centers believe that the further growth of outreach activities is critical to the success of efforts to feed the peoples of the developing countries at an adequate standard.

29. Generally speaking, however, outreach activities have not been funded by the Consultative Group acting collectively but have been financed as special projects by individual donors acting bilaterally. In the typical pattern, a donor country makes a grant to a developing country for a research or production program: in addition to employing its own resources, the developing country contracts with an international center to provide needed technical assistance.

30. In 1975, the centers will be spending $6.4 million on outreach activities in 23 countries. Not all of this amount is for services rendered in the countries themselves. If there are costs to a center's headquarters in terms of staff time or use of facilities, these are charged to the special-project funding, along with activities actually carried out in the field.

31. Some centers observe that the present funding of outreach activities makes this important type of activity dependent on the vicissitudes of financing by bilateral donors, and that (to quote IRRI) "this uncoordinated, short-term, ad hoc, nature of programming and support makes it difficult... to recruit good staff or to develop a sensible long-range program to assist the national research organizations." There is therefore considerable pressure to provide core support for some part of outreach staffing in order to provide greater stability. Another effect would be to give the centers a better base from which to negotiate and initiate new outreach programs.

32. Since the establishment of the Consultative Group, new patterns of structure and support have begun to appear, in practice or in proposals. The patterns tend to shade into each other, however, and the boundaries sometimes are not sharply drawn between outreach programs of assistance and at least one other type of cooperation between international centers and national programs. This type of cooperation is the field trial. In a field trial system, seeds from an international program are tested by a national institute, and a process of interaction occurs through several cycles of testing in which both the international center and the national program develop new plant varieties suited to their particular needs and objectives. In the case of field trial systems, developing countries customarily pay their own costs, since the costs are small and the trials are of benefit to them.

33. The classic patterns of financing can still be observed in current proposals by ICRISAT and IRRI. ICRISAT's planned outreach activities in Africa would be financed as special projects apart from core. IRRI's proposed network for the development of cropping systems, apart from work done in IRRI's host country, also would be financed on a traditional special project basis.

34. With the consent of the Consultative Group, however, there has been a movement toward more core support of programs of cooperation between international and national efforts. At a minimum, it is understood that the international centers maintain on their core staffs one or more senior scientists concerned with the organization and conduct of outreach activities. While some part of their salaries and other costs may be offset by charges to special-project funding, this is not indispensable.

35. The International Potato Center has gone a step further. It has a regional system: senior scientists concerned with outreach activities are not only posted at headquarters: senior staff also are posted at regional offices, and they too, are charged to the core program (CIP 1975 budget document, (pp. 11-13), so long as they are truly regional, serving several countries. Staff within this system serving full-time within a particular country, however, evidently would be financed on the traditional basis of special-project funding. Similar arrangements, while not actually proposed for 1975, are suggested by CIMMYT for future years (Secretariat paper on 1975 Program and Budget of CIMMYT, paras. 29-30).

36. Even beyond the CIP formula for regional services, ILCA expects to maintain on its permanent staff a group of "associated" scientists whose purpose will be to assist national livestock programs. IITA requests, as part of its core budget for 1975, funds for a senior scientist who would be on standby for outreach assignments; and something of this sort is also envisioned by IRRI, although no funds are requested for it for the present.

37. A similar movement toward core has taken place even in field trial systems. CIMMYT reports a situation in which it is seeking results from trials which require more work than national systems can be expected to do, and proposes that the extra margin of cost should be borne by CIMMYT's core budget. In fact, the Consultative Group already has taken responsibility for the potentially extensive field trial system of the West Africa Rice Development Association (WARDA).

38. There of course are many arguments for and against a higher proportion of core funding. To mention only a few: on the one hand, more core funding might assure greater continuity, stability and coherence of cooperation between international and national programs, and it would bring within the cognizance (and influence) of the Consultative Group a vital sector of activity now largely omitted. On the other hand, the response of donors to a system of core funding might not produce as much support as the present bilateral system, where donors are identified andgiven political credit by recipient countries. Funding outreach from the core budgets of the international programs of the centers, moreover, might tend to make the centers themselves, rather than the donors, the granting agencies. There is some fear, in addition, that too easy a flow of funds would require less motivation and result in less effective effort on the part of the low-income countries. In any event, the Secretariat believes that it is desirable to achieve as much consistency as is possible in the approaches to the staffing and funding of outreach activities, so that budgets are prepared on comparable bases.

27. Structure and Support of Outreach Programs.[2/] There was extensive discussion of concepts and definitions of core programs, of outreach programs, of programs of research involving collaboration between international institutes and national authorities, and of ways of funding each of these three types of activity. The Chairman described the issues as being whether the Consultative Group wished to support a larger or smaller part of outreach activities with core funding and, if a change is desired, to determine where the line should be drawn between what is suitable for core financing and what is not.

28. Among the points made by various speakers were that:

a. a task undertaken by a Center on its own initiative as necessary for the execution of its mandate should be considered part of its core program, no matter where situated;

b. a task undertaken by a Center at the request of a developing country for the specific benefit of that country could be supported from other sources of finance (e.g., bilateral donors, international agencies);

c. the financing of collaborative research undertaken by a Center both for the objectives of the Center and for the specific purposes of the cooperating country, might be shared between core funding and other sources;

d. a modest amount of core funding might be provided for Center headquarters personnel concerned with management of outreach and for scientists standing by at headquarters to be available for outreach assignments.

29. The upshot of the discussion was agreement that the Secretariat should prepare a more complete paper on the subject in the form of an annex to the revised Integrative Paper which would be circulated before the next Consultative Group meeting.

30. Many speakers emphasized the vital importance of strengthening national research programs. It was pointed out that only a limited amount of funds could be made available for this purpose through the collective arrangements of the Consultative Group. Many donors, however, had bilateral funds available which could be used to support outreach programs carried out by the Centers in individual countries. Smaller donors needed to have more systematic information about outreach programs which might merit their support. It was suggested that the Secretariat might prepare a paper bringing together information on this subject in time for the next meeting of the Consultative Group.

2/ Draft Integrative Paper, p. 7.

F-2

A/D/C

The Agricultural Development Council, Inc.

630 Fifth Avenue, New York, N.Y. 10020

Tel: 212-757-8566 • Cable: Agridevel New York

Established by John D. Rockefeller 3rd

May 13, 1975

Hans Woolf
C 1006

To: TAC Subcommittee on Plant Nutrition
Guy Camus
Hassan L. Togby
M. S. Swaminathan

From: Vernon W. Ruttan

Re: Meeting of the TAC Subcommittee on Plant Nutrition
World Bank, Tuesday morning, July 22, 1975

The purpose of this memorandum is to schedule a meeting of the TAC Subcommittee on Plant Nutrition on Tuesday morning, July 22 at the World Bank. I hope that we will be able to meet in the CG Conference Room. In any event, we should plan to meet at 9:00 A.M. at the CG Secretariat (Room E10-55). It is my understanding that the TAC itself will begin its meeting on the afternoon of July 22.

The purpose of the meeting will be to firm up our recommendations to the full TAC membership.

On Tuesday morning, May 6, Sir John Crawford, David Hopper, and I met with Don McCune, Director, International Fertilizer Development Center. Members of the CG Secretariat and representatives from AID also attended.

It was agreed at the May 6 meeting that by the end of May we would have in hand two papers on which to base our deliberations with respect to International Fertilizer Development Center. First, we will have a revised program proposal and work plan for the International Fertilizer Development Center. Second, we will have from the U.S. AID information regarding their funding committments for the first three years of the Center's activity. I will try to get these materials to you in early June.

In addition to any recommendations we may need to make with respect to International Fertilizer Development Center, there are two other items on our agenda which we will need to give consideration to. One is strengthening capacity to work on fundamental constraints. The other is

village level integrated nutrients supply systems (see my memorandum dated February 7, 1975).

We have already recommended and TAC has accepted the following recommendation: The TAC Subcommittee on Plant Nutrition recommends a modest expansion of capacity to conduct research on biological and organic sources of plant nutrition in association with the varietal development and cropping systems program at the several international institutes. The TAC would welcome proposals from the institutes for the initiation and expansion of such programs. Such proposals should not exceed the $250,000 - $300,000 per annum range and should include funds for contract research with other research centers that have the capacity to work on the more fundamental problems on which information is needed to make the programs of the several institutes effective.

My own feeling, at the present time, with respect to moving ahead in the area of strengthening capacity work on fundamental constraints is that we might want to propose a modest budget. Perhaps also in the $250,000 - $300,000 range per year to support fundamental research in areas that could be expected to have a relatively high pay-off as an input into applied research on the biological and organic sources of plant nutrition. We would need to give consideration to how such a fund might be managed. One possibility is a subcommittee consisting of both TAC and non-TAC members.

Although M. S. Swaminathan and I had visited about village level integrated nutrient supply systems since the TAC meeting, I do not have anything useful to report at this time. Dr. Swaminathan or other members of the committee may want to bring forward suggestions at the July meeting.

cc: J. G. Crawford
Peter Oram
Brian Webster
John Coulter
Donald McCune
Curtis Farrar
Michael Le Jeune

F-2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Via delle Terme di Caracalla, 00100 Rome, Italy
Cables: FOODAGRI ROME - Telex: 61181 FOODAGRI
Telephone: 5797

May 1975

TO: Members of the Technical Advisory Committee
Members of the Consultative Group on International Agricultural Research

FROM: The Executive Secretary, TAC

SUBJECT: Tenth Meeting of the Technical Advisory Committee, Washington, D. C. 22 - 26 July, 1975

The Tenth Meeting of the Technical Advisory Committee will be held at the World Bank Headquarters, Washington, D.C., U.S.A., from 22 - 26 July, 1975.

Members of the Consultative Group are reminded that they are welcome to send an observer to attend any open session of the Committee.

TAC members will be accommodated in the Watergate Hotel unless they indicate their specific requirements to the Executive Secretariat of the Consultative Group, 1818 H Street, N.W., Washington, D.C., 20433, U.S.A.

I attach herewith the Provisional Agenda for the above meeting. Further documentation will follow in due course.

Attachment

RESTRICTED
DDDR:IAR/75/15
May 1975

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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10th MEETING

Washington, D.C. - 22 - 26 July, 1975

PROVISIONAL AGENDA

Tuesday, 22 July [1]

14.30 - 18.00	Afternoon Session OPEN
Item 1	Adoption of the Agenda
Item 2	Adoption of the Report of the 9th Meeting
Item 3	ICIPE: Further discussion of proposal and consideration of International Centres' views
Item 4	IRRI Mechanization review. Report of TAC Mission.

Wednesday, 23 July

09.00 - 13.00	Morning Session OPEN
Item 5	CATIE. Request for Assistance (Dr. Elgueta/BID)
Item 6	Research needs of non-food crops. Discussion of TPI Study
Item 7	Remote Sensing. Discussion of FAO paper
Item 8	National Research. Report of Bellagio meeting and discussion of follow-up action.
	Afternoon Session CLOSED
Item 9	Plant Nutrition Research. Report of TAC Sub-Committee and formulation of recommendations (see footnote)

1/ There will be a meeting from 09.00 - 13.00 on Tuesday, 22 July, of the TAC Subcommittee on Plant Nutrition, for which a separate invitation and agenda will be issued.

Item 10 — Other Ongoing Business. Progress reports and formulation of decisions for future action

a) Tropical Fruit and Vegetable Research
b) Aquaculture
c) Water Buffalo Research
d) Water Use and Management (subject to confirmation by Dr. Hopper)

Item 11 — Preliminary discussion of Programmes of International Centres

a) International Board for Plant Genetic Resources. Discussion with Chairman

Thursday, 24 July

09.00 - 13.00 — Morning Session CLOSED

Item 11 (cont.)

b) CIMMYT
c) IRRI
d) IITA
e) CIAT
e) ICRISAT
f) CIP
g) ILCA
h) ILRAD
i) WARDA

Afternoon Session CLOSED

Item 12 — Formulation of recommendations on Item 3: ICIPE

Item 13 — Formulation of recommendations on Item 4: IRRI Mechanization

Item 14 — Formulation of recommendations on Item 5: CATIE

Item 15 — Formulation of recommendations on Item 6: Non-food crops

Item 16 — Formulation of recommendations on Item 7: Remote Sensing

Friday, 25 July

09.00 - 13.00 — Morning Session CLOSED

Item 17 — Discussion with Centre Directors on 1976 Programmes (IRRI, CIMMYT, CIAT, IITA)

14.30 - 18.00 — Afternoon Session CLOSED

Item 17 (cont.) — Discussion with Centre Directors on 1976 Programmes (CIP, ICRISAT, ILRAD, ILCA, WARDA)

Saturday, 26 July

09.00 - 10.30	Morning Session OPEN
Item 18	Chairman's Summing-Up — Items 3 - 10
11.00 - 13.00	CLOSED
Item 19	Formulation of recommendations on Item 16 — 1976 Programmes of International Centres
14.30 - 18.00	Afternoon Session CLOSED
Item 19 (cont.)1/	

1/ The Chairman will summarize these conclusions in his report to the Consultative Group during the Centres Week meeting.

F 2

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

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Via delle Terme di Caracalla, 00100 Rome, Italy
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Telephone: 5797

PR 3/3 Gen.
PR 3/3.2

April 29, 1975

Dear John:

Subject: Relation of Bilateral Projects to International Research Activities

Thank you for your letter of 16 April addressed to Peter, on the above subject. We also have received documentation from various donors and they are still coming in.

It is true that at the February meeting Peter stated our proposal to hire a consultant to tabulate the information contained in this material, and we had felt that a system of cross references by country of receipt and subject matter would be the best approach. We had selected Fred Haworth, who I am sure you know, for this and other consultant activities in our unit. Unfortunately Fred has informed us today that he is accepting a further engagement in Thailand, where he has been for the last two years, and so will not be able to join us. We have therefore to find somebody else to do this job, hopefully in time for the July meeting, but should this prove to be unfeasible we shall of course let you know.

I am not sure whether all the available materials have in fact been received here, so would be grateful if you would kindly let us know which donors have submitted lists or have promised them and if you have spares we would appreciate a full set!

With best regards,

Yours sincerely,

B. N. Webster
Assistant Executive Secretary
Technical Advisory Committee

Dr. John K. Coulter
Scientific Adviser
Consultative Group on International
Agricultural Research
Room E 1039
1818 H Street, N. W.
Washington, D. C. 20433
U.S.A.

F-2

Form No. 27
(3-70)

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

WVt

OUTGOING WIRE

TO: WEBSTER
FOODAGRI
ROME

DATE: APRIL 29, 1975

CLASS OF SERVICE: TELEX NO. 61181

Ext. 3592

COUNTRY: ITALY

TEXT:
Cable No.:

WOULD BE GRATEFUL FOR COPY OF DRAFT OF MINUTES OF FEBRUARY 1975 TAC MEETING.

WE WISH TO USE THESE AS BACKGROUND WHEN DRAFTING PROGRAMS FOR JULY MEETINGS.

REGARDS

COULTER

COMMUNICATIONS
MAY 29 10 25 AM 1975

NOT TO BE TRANSMITTED

AUTHORIZED BY:

NAME John K. Coulter

DEPT. CGIAR Secretariat

SIGNATURE John K. Coulter
(SIGNATURE OF INDIVIDUAL AUTHORIZED TO APPROVE)

REFERENCE:

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cc G3

Form No. 27
(3-70)

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OUTGOING WIRE

TO: CRAWFORD
MELBAVE
CANBERRA

DATE: MARCH 19, 1975

CLASS OF SERVICE: LT ~~or TELEX~~ RCA (2747)

COUNTRY: AUSTRALIA

TEXT:
Cable No.: REURCAB ABOUT TAC MEETING CIMMYT STOP AGREE DESIRABILITY OF TAC ESTABLISHING CLOSE RELATIONS WITH CENTERS AND OF MEETING AT ONE OF CENTERS FOR THIS PURPOSE FROM TIME TO TIME STOP IN FUTURE THE PROPOSED REGULAR MAY MEETING WITH CENTER DIRECTORS COULD SUITABLY TAKE PLACE AT A CENTER STOP ONLY PROBLEMS RESPECTING OCTOBER MEETING AT CIMMYT ARE THAT IT WILL COST THOSE WHO WISH ATTEND BOTH TAC AND CG MEETINGS EXTRA TIME AND MONEY STOP IT WOULD BE PARTICULARLY DIFFICULT FOR US TO SPARE ANYONE WHO WOULD BE CLOSELY INVOLVED IN PREPARATION OF CG MEETING STOP I LEAVE IT TO YOU TO DECIDE WHERE TO HAVE OCTOBER MEETING STOP REGARDS

BAUM

NOT TO BE TRANSMITTED

AUTHORIZED BY:

NAME Warren C. Baum, VP

DEPT. CPS

SIGNATURE _____
(SIGNATURE OF INDIVIDUAL AUTHORIZED TO APPROVE)

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FR

17 Mars 1975

DESTINAIRES: Membres do Groupe Consultatif, Directeurs des Centres, Membres du Comité consultatif technique (TAC)

ORIGINE: Secrétariat Exécutif

OBJET: Compte rendu sommaire des réunions du Groupe consultatif qui se sont tenus du 29 juillet au 2 août, 1974

Vous trouverez en annexe la version revisée du Compte rendu sommaire des débats du Groupe consultatif qui s'est réuni à Washington du 29 juillet au 2 août, 1974. La première version anglaise de ce Compte rendu sommaire a été distribuee en août et le texte anglais révisé, diffuse le 18 novembre 1974.

Pièce jointe

F-2

1975 MAR 14 AM 7:45

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MR. BAUM
MR. LEJEUNE

ZCZC 248423 RC008 PDF0852 RMD1473 SDU683 CSA811

URWT HL AACA 124

CANBERRAACT 124 13 1214

MARCH 13, 1975

LT

BAUM

CARE INTBAFRAD

WASHINGTONDC

I AM GREATLY CONCERNED SUGGESTIONS FROM MASHLER AND PERHAPS LEJEUNE THAT TAC SHOULD MEET IN WASHINGTON IN OCTOBER IN PREFERENCE TO MEETING WITH CIMMYT STOP I AM ALREADY WORRIED ABOUT OUR LACK OF DIRECT CONTACT WITH CENTRES WHICH COULD REDUCE EFFECTIVENESS OF REVIEW MISSIONS STOP

CCL LT INTBAFRAD MASHLER LEJEUNE TAC CIMMYT

CSA811/BAUM/P2

MEETING AT CIMMYT MAY EVEN INDUCE OBSERVERS TO COME BUT I DO NOT REGARD THIS AS CRITICAL TEST STOP HOPEFUL RESULT WOULD BE THAT TAC VIEWED BY CIMMYT MORE AS LUBRICANT FOR VALUABLE NEW PROJECTS AND LESS AS BUREAUCRATIC BLOCK STOP FRANKLY I WISH TO PRESS HARD FOR THE RIGHT

COL TAC CIMMYT

CSA811/BAUM/P3

TO HAVE OCCASIONAL MEETINGS AT MAJOR CENTRES STOP WOULD BE GRATEFUL TO HEAR IF YOU HAVE ANY OBJECTIONS WHICH I SHOULD CONSIDER REGARDS

CRAWFORD

F2

February 12, 1975

To: Members of the CGIAR, Members of the Technical Advisory Committee, and Center Directors & Budget Officers

From: Executive Secretariat

Subject: Budgeting and Accounting Procedures and Practices of International Agricultural Research Centers

1. Participants in CGIAR meetings in 1974 will recall discussions of a paper entitled "Budgeting and Accounting Procedures and Practices of International Agricultural Research Centers." The paper was circulated on July 11, 1974, and was document ICW/74/3 in the papers prepared for International Centers Week.

2. A new text of the paper has now been prepared to reflect the discussions of 1974, and is now circulated for information. As did the earlier version, it describes the use of funds, the preparation of budget requests, and the accounting for funds by the centers.

3. Paragraphs 19, 32, 38, 48, 52 and 53 represent amendments or additions to the July 11 draft.

F2

Form No. 27
(3-70)

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OUTGOING WIRE

TO: ORAM
FOODAGRI
ROME

DATE: FEBRUARY 5, 1975 RCA

CLASS OF SERVICE: LT
(3454)

COUNTRY: ITALY

TEXT:
Cable No.:

BANK IS PREPARED TO MEET ONE THIRD COST OF PROPOSED THIRD TAC MEETING IN BANKS FY75 ENDING JUNE 30 OR TO INCLUDE IN NEXT BUDGET IF EXTRA SESSION OCCURS AFTER JUNE

REGARDS

CHEEK

NOT TO BE TRANSMITTED

AUTHORIZED BY:

NAME Bruce M. Cheek

DEPT. CGIAR Secretariat

SIGNATURE _____
(SIGNATURE OF INDIVIDUAL AUTHORIZED TO APPROVE)

REFERENCE: BMCheek/ms/F2

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c.c. Mr. Yudelman
Mr. John King

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Document Date	Document Type
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Correspondents / Participants
Vernon W. Ruttan

Subject / Title

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F-2

Mr. Michael L. Hoffman

January 14, 1975

Michael L. Lejeune

Forecast of International Meetings

The January forecast lists three persons from C.G.I.A.R. Secretariat as attending the T.A.C. Meeting in Rome, February 3 - 7. This is incorrect - only one person will attend from the Secretariat, Mr. Coulter.

c.c. Mr. Cheek
Mr. Coulter
Mr. Gavino

MLLejeune/ms