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**Folder ID:** 1759703

**Series:** Central Files

**Dates:** 06/01/1973 - 12/13/1973

**Fonds:** Records of the Consultative Group on International Agricultural Research

**ISAD Reference Code:** WB IBRD/IDA CGIAR-4177S

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A2003-012 Other #: 48 **205538B**

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Revised 13.12.73.

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CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

Seventh Meeting, Rome, 4-8 February, 1974

PRIORITIES FOR INTERNATIONAL SUPPORT TO AGRICULTURAL RESEARCH

IN DEVELOPING COUNTRIES

(Agenda Item 7)

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ROME 1973

WM/E2229

Item 1: PRIORITIES FOR INTERNATIONAL SUPPORT TO AGRICULTURAL RESEARCH  
IN DEVELOPING COUNTRIES

(Chairman's Draft Position Paper for TAC)

1. In accordance with the first item of its terms of reference,<sup>1/</sup> the Technical Advisory Committee was requested by the Consultative Group at its meeting in November 1972, to present to the Group its views on priority fields for support to international agricultural research in or on behalf of the developing countries. It was felt that such a review was needed both to guide the decisions of the Group in the short-term and to indicate for its consideration the probable longer term evolution of the TAC's activities and the implications of this for the CGIAR.

2. This paper sets out the conclusions so far reached by the Committee on priorities, as well as posing some issues on which I believe that further study is merited. Even though certain of these have not yet received detailed consideration at any of its meetings, their clarification may prove valuable in developing a broad conceptual framework within which relationships between national and international efforts, basic and applied research, technical and socio-economic disciplines, will be seen in sharper perspective.

1. First Order Priority: Research on Food Commodities

3. It is very clear from the orientation of the TAC's recommendations to CGIAR so far, both in respect of support to existing programmes and to new research endeavours, that it places the highest importance on research directed to increasing the amount and quality of food produced.

4. This was amply confirmed when the Committee discussed the whole question of priorities at its last meeting. However, as I said then, this does not really take us very far in specific terms, and within this broad guideline the TAC has therefore accorded highest priority to research on the food staples, especially cereals, and to ruminant livestock. I will try and indicate our reasons for this decision.

(i) The cereals

5. In the first place cereals provide the mainstay of the diet in most developing countries, especially for the poorer people, supplying an average 52 percent of the calories and nearly half the total protein. It has been shown that if there is a serious deficit in calories in the diet the body consumes protein for energy. Since cereals generally make the largest single contribution of any commodity to both energy and protein, research to increase their yield and protein content is of crucial nutritional importance. Upgrading their amino-acid composition could, at no extra cost to consumers, make a further improvement in the quality of the diet. Secondly, despite the real successes in increasing wheat and rice output, cereal production in developing countries has barely kept pace with population and income growth during recent years, and experience in Asia in the last two years shows how fragile is the base on which these critical supplies rests. Income elasticity of demand for cereals is still high in the poorer countries, quite unlike the situation for food grains in the developed economies, and an important indication that food consumption levels are

<sup>1/</sup>TAC will, acting either upon reference from the Consultative Group or on its own initiative:

- (1) Advise the Consultative Group on the main gaps and priorities in agricultural research related to the problems of developing countries, both in the technical and socio-economic fields, based on a continuing review of existing national, regional, and international research activities."

inadequate. In a number of countries failure to increase production rapidly enough to meet domestic demand has led to increasing imports, draining foreign exchange required for social and economic development. Third, cereals are the lynchpin of the cropping system in many developing countries and contribute significantly to income and employment. Finally, a faster growth of grain production will be necessary if feed supplies are to become available in sufficient quantity at prices which will permit their economic use in livestock rations. It is relevant to note the rapidly rising demand for feedgrains in the more affluent nations, which has been one factor contributing to the recent stringency and high prices of cereals and soya beans. This has in turn affected the availability of grains on concessional or normal trade terms to developing countries and further emphasises the need to increase output in these countries as rapidly as possible.

6. While these reasons in themselves offer a compelling argument for devoting high priority to research on the cereals, there is another important consideration. In the past many developing countries increased their production largely by expanding the cultivated area. Analysis of the sources of increased output in the last decade show that for most crops, including the cereals, this has been the mainspring of growth in all but a few countries. Certain are still fortunate enough to have reserves of good land which can be brought under the plough, but many are already pressing up against the limits of their natural resources or will be within a measurable time-span; and in some marginal land is already being cultivated with serious backlash effects on pastures, and forests, and consequent environmental degradation.

Although, as I will indicate later, research is required (as well as other measures) to try to prevent further loss of arable land through erosion, salinity, etc., and to identify the restraints on bringing new, potentially arable land into use; the problem facing most developing countries is likely to be one of trying to produce more and more from a finite, or even shrinking resource.

7. It thus becomes increasingly necessary to turn towards raising yields and crop intensities as the major source of future growth, and since cereals occupy the largest share of the arable area in a wide range of environments, they hold the key to the more effective use of land and water resources. Unless their yields can be increased or their time to maturity reduced, it will be correspondingly more difficult to make significant progress with other crops and livestock since more and more land will have to be devoted to satisfying basic calorie requirements. The alternative - increasing imports - is open only to a few countries.

8. Despite the crucial nature of this problem, major international research programmes until recently covered only wheat, maize, and rice, plus the special programme on Triticale being developed with IDRC help. Sorghum and pearl millet have now been added to the list by the establishment of ICRISAT in India, and the TAC has made recommendations to the Board of ICRISAT as to how effort might also be reinforced on these two crops in Africa as part of ICRISAT's overall programme. Barley, which is of particular importance in the semi-arid winter rainfall environment of the Near East and North Africa, is also under our scrutiny.

9. Nevertheless, it is open to question whether even now enough is being done in respect of cereals, and three aspects seem to merit special attention. The first is the adequacy of outreach programmes of the International Centres working on cereals, and whether these might be linked more effectively to national work by closer collaboration with other agencies such as FAO, IBRD, and UNDP. The second is whether enough emphasis is being placed on nutritional quality as against further increases in yield. The third is the degree to which yield stability could be improved, particularly in the more difficult environments, by a better understanding of the fundamentals of plant physiology, disease and pest resistance, and population dynamics, possibly requiring further basic research.

10. Turning from cereals to other key food commodities, the TAC has accorded high priority to those which will improve the quality of the diet, especially in respect of protein. In particular it has focussed attention on the food legumes and on ruminant livestock.

(ii) Food legumes

11. The food legumes are the second main source of total protein in the diet, and, at least for the lower income groups, the principal determinant of dietary quality, because they complement the unsatisfactory composition of most cereals in terms of the limiting amino-acids. They are also a potential source of simulated milk and meat products; soya bean is already being developed industrially for such purposes. Again this could particularly benefit the poorer people, especially pregnant women and infants. It could also help to overcome physiological (milk intolerance), customary, and religious obstacles to the consumption of animal protein in developing countries.

12. There are peculiar difficulties in improving productivity of most grain legumes which make international support for research particularly necessary. Yields in developing countries are generally extremely low relative to those legumes grown in developed countries and to other food staples, especially the high yielding varieties of cereals. Moreover, they have shown little improvement over time. While there are numerous pest and also disease problems of varying location specificity, there also appear to be intractable physiological and morphological problems which might impose a low ceiling on yields even if pest and disease control measures were highly efficient. These include indeterminate flowering habit, high rates of flower drop, photosynthetic inefficiency, excessive vegetative growth, residual toxicity to subsequent crops, and so forth.

13. The combined result of the factors outlined above is poor response to irrigation, fertilizer, and other inputs which renders their use on legumes unrewarding to the farmer. This accounts for the shrinking area of pulses in relation to cereals in a number of developing countries; nutritional value counts less than profit with the producer, and with the advent of the high yielding varieties of cereals - often bolstered by price supports - comparative economic advantage is clearly with the latter.

14. While recognizing the importance of these crops, the TAC has been grappling with the problem of how (if at all) to reconcile the apparent need for centralised basic research on factors holding down yield common to several species of grain legumes, with the large number of species having no ecological common denominator with which any centralised facility would have difficulty in coping. Moreover, even if solutions could be found to this ecological diversity (through the use of controlled environmental chambers, etc.), enabling research on problems of a more fundamental nature to be undertaken centrally, there would still be location-specific pest, disease, parasitic and end-use questions requiring adaptive research.

15. This problem has not yet been satisfactorily resolved. The TAC has recommended support for breeding and applied research programmes on cowpeas at IITA, field beans (Phaseolus species) at CIAT, chickpeas and pigeon peas at ICRISAT. It is examining a proposal from U.S. AID for strengthening outreach programmes and tropical testing on soya beans, using the great United States experience in this crop as a resource base. However, no internationally supported applied research effort is in progress on groundnuts, broad beans (Vicia faba), lentils, field peas, and certain other important or potentially important tropical and sub-tropical legumes. Nor has a decision been reached as to whether a central basic research effort is justified.

16. The Secretariat has been asked to study the state of the art further, with consultant advice, and to report its conclusions to a special TAC sub-committee on food legumes. The latter will also review and recommend on any proposals coming to TAC from the International research Centres or elsewhere for additional applied research on these crops.

(iii) Starchy products

17. The third major group of food crops to which the TAC has accorded high priority is the starchy foods including roots and tubers. These crops, despite their nutritional drawbacks are of great dietary importance in the developing world - they are the basic staple of some 80 million people in tropical equatorial Africa, for example. They have a potential for producing an enormous output of energy per hectare, and their yield, nutritional quality, and range of adaptation all appear capable of improvement. Yet, as was pointed out at the 5th TAC meeting in 1973, they have received much less concentrated research attention than the cereals, since only the potato is of significance to developed countries.

18. The TAC has therefore recommended continuing support for work on cassava at CIAT and IITA, and yams and sweet potatoes at IITA, as well as the expansion of ongoing efforts on potatoes in Peru and Mexico to form a new International Potato Centre with the same broad charter and base of financial support from the Consultative Group as the other International Centres. It is anticipated that their programmes will cover not only production but also storage, conservation, and processing. In this respect further work is required both at the farm and at the urban and industrial level, since some of these crops, although capable of very high production, are poor keepers and suffer serious losses from spoilage.

19. The edible plantain is now the only important member of this group of crops remaining outside any major research programme, despite a proposal by IITA that exploratory work should be included in its programme for 1973.

#### (iv) Livestock

20. In respect of livestock the TAC has taken the view that priority should go to the ruminants. While there are greater constraints on a rapid increase of ruminant production than apply to pigs and poultry, there is also a great potential for better resource utilization by ruminants which conflicts only to a limited extent with requirements for land for direct production of human food. The work of CIAT on developing beef production in the llanos of Latin America suggests that there are major untapped opportunities here. Moreover, ruminants are of dominant social and economic significance in some of the poorest and most backward countries which have little scope for other agricultural development, for example in the Sahelian zone of Africa, and where knowledge acquired in developed countries cannot easily be transferred successfully. There are possibilities for expanding both beef and milk production, and the latter may offer a new cash activity to small farmers as well as having important connotations for the improvement of nutrition. Pig and poultry production can be increased relatively easily by sophisticated, capital intensive methods provided that rigorous control of disease can be achieved and entrepreneurship and sound managerial ability are available. While neglected opportunities also exist for improving small-scale pig and poultry production by labour-intensive methods, most members felt that these could be seized by the application of known methods of disease control, better feeding and management and did not require extensive research.

21. As you know, in respect of ruminants, an important new step has been to recommend support for the establishment of additional facilities to work on certain limiting problems of animal disease in Africa (with priority to Trypanosomiasis and tick-borne fever); and, more or less in parallel, to set up a new institute to work on the improvement of animal production there. A main focus of the latter will be to study the predominant systems of livestock production in Africa as a means of determining the key bottlenecks as well as the opportunities for the introduction of new technology within each system.

22. This approach is to an important extent a reversal of the procedure adopted by some of the older International Centres which started by focussing on achieving a technical breakthrough on a rather narrow front, and have only recently placed greater emphasis on trying to influence traditional systems to accommodate this new technology. There are arguments in favour of both approaches, but that proposed for the animal centre is an innovation which we shall all follow closely.

23. These are the first major livestock enterprises which the TAC has recommended to the Consultative Group for support: they are unlikely to be the last. There are interesting developments in South-East Asia focussed initially on Indonesia, in which Australia, through CSIRO, is playing an innovative role. Similar linkages to institutes or agencies in developed countries might be forged in relation to other regions. In cooperation with CIAT the TAC is examining means of strengthening work on beef in Latin America, and it is probable that the improvement of livestock production through the closer integration of crops and ruminant animals will figure largely in any proposal for work in the Mediterranean/Near East region. Both these proposals of necessity involve improved range and pasture management as of high priority.

#### (v) Aquaculture

24. One other possible means of increasing supplies of protein lies in aquaculture. New and more scientific methods of farming fish and other aquatic creatures are evolving rapidly, although so far these do not appear to have had an impact on domestic food (or feed) supplies in developing countries so much as in increasing export earnings.

25. The TAC sponsored a seminar in July 1973 to try and inform itself on the potential for mass production of cheap food from aquaculture, the state of the art of research, and whether reinforcement of existing efforts might be effective in generating a new breakthrough in productivity. The report of this meeting will be discussed at our next session in February 1974.

## II. Second-Level Priorities for Food Research

26. Having taken a firm position on its priorities for cereals, food legumes, roots and tubers, and ruminant livestock (especially cattle), and placed a temporary questionmark against aquaculture, the TAC has been less decisive on some other foods, in particular oilseeds, vegetables and tropical fruits. This is partly the result of pressure of work related to the commodities listed above, which, it decided in its earliest session, were of highest priority, and where some good projects were already in the pipeline, but it also reflects a lack of sound proposals for research on other food commodities.

27. Another important constraint has been the inadequacy of statistical data concerning production, consumption, and dietary significance to lower income groups of some of those commodities, in particular vegetables and fruits. These are appallingly bad in most developing countries (this is also true in some areas for pastures and fodders), and there is a strong case for more research at the national level to improve the information base on which to judge their nutritional importance and economic value. While this might be supported indirectly by the CGIAR as part of some wider effort in socio-economic fields, it should also be given more attention by international agencies such as FAO and the Bank.

28. This having been said, I am still unsure what rating the TAC would give to a good, well formulated and documented project for research on one or more of such crops. The Asian Vegetable Research Centre proposal was perhaps the first test case, and although there are reasons why this cannot be considered a fair precedent, there were at that time also doubts in members' minds both on the technical feasibility of working successfully on such a wide range of crops as well as uncertainties due to poor information concerning their contribution to the diets of poorer people.

29. In approaching such commodities in future we therefore have in the first place to try and achieve a balanced view as to their importance both globally and in relation to particular regions - since what may be of great weight in one tropical area may be of smaller significance in another. Then we have to assess whether the proposal itself seems feasible and likely to lead to an impact-making result within a measurable period. Here we may have to take into account not only the contribution which such crops could make to domestic food supply, but also their labour intensive nature, relatively high cash value, and the expanding prospects for local processing and for exports of fresh and processed products to developed countries. Both pragmatism and judgement are required and I do not believe the TAC should be expected to go further in relation to this wide group of "other foods" at the moment than saying that while it rates them as of second importance to the food staples and might not initiate research proposals itself, it would be willing to give careful consideration to well prepared specifics.

30. In this connection some members of TAC felt that where a clear research need was identified on some crops or projects before it, but which it did not consider of top priority for Consultative Group support, the Committee might recommend these as deserving of bilateral or other assistance, e.g. from UNDP or the Bank. This is not meant to imply that the TAC can act as a general screening mechanism for bilateral agencies in relation to projects of a purely national nature. While we attach the greatest importance to a strong national research base, other agencies than CGIAR exist to assist here, and any projects submitted to TAC by the Co-Sponsors or members of the Consultative Group must have genuine international or regional connotations.

## III. Research on Other Agricultural Crops

31. A rather similar pragmatic approach to that for some of the less important food crops may have to be taken for the time being to those crops variously described as "non-food", "industrial", or "agricultural raw materials". We do not have a satisfactory generic name for this widely diverse group, some of which (such as cotton) have multiple uses for fibre, food, and feed.



32. So far no specific worked-out requests for support to research on these crops have been submitted to TAC, although mention was made at our last meeting of the need for an internationally backed research programme on jute in Asia. While members regarded this suggestion sympathetically, mainly because of the difficult economic and social problems facing Bangladesh, it was felt that it was more suitable for bilateral funding because of the relatively few countries which would benefit. There were also doubts as to whether the position of jute vis-à-vis synthetics could be restored even if a major investment were to be made in research. It was also felt that the time might not yet be ripe to recommend support for non-food crops while some important food commodities and food producing areas were still not receiving adequate research.

33. At the same time the TAC did not preclude its future consideration of well prepared proposals for priority lines of research on other commodities, provided that the over-riding need to secure the staple food supplies of the mass of the people was first covered by existing or new international and regional research programmes.

34. This seems to me a logical approach, since not only nutrition but also income, employment and foreign exchange earnings are essential goals of developing countries. Lack of purchasing power is as critical a cause of malnutrition as problems of food production, and it must not be forgotten that such commodities provide in some areas the only source of income to many families, while in others they form the major cash component of farming systems in which food is produced largely for subsistence, for example cotton in the semi-arid tropics. Moreover, shortage of foreign exchange may be a key constraint on the supply of inputs required to raise food output.

35. However, there is a large range of such crops and their claims compete with each other and with other priorities, especially food production and nutritional research, for limited funds. There is a real need for an "overview", which takes into account their current economic and social importance, their market potential, the effectiveness of ongoing research, the potential for useful additional research, where the main thrust of this should lie (i.e. in production, processing, or end use), and its probable cost.

36. This should enable the TAC to weed out the more obvious non-starters, e.g. crops with inelastic demand, crops which benefit relatively few nations and/or producers, crops being hopelessly outpaced by synthetics, and those where research is already adequate.

37. In some cases where further research was required it might be shown that appropriate reinforcement and "internationalisation" of an outstanding national institute would yield large dividends at relatively small expense. This, of course, would imply the willingness of the institute and country concerned to share its results and material outputs (e.g. breeding materials), with other countries. This has not always been the case in the past. More difficult problems of choice may arise if costly end-use research is indicated as the real need, since this might have to be done in a developed country with sophisticated industrial resources.

38. I understand that FAO is preparing to undertake such a review from its own budgetary resources during 1973, with the help of consultants, as a joint effort between its Commodities and Trade Division and the Research Development Centre. While we will await the outcome of this analysis with interest and the possibility is not foreclosed of TAC making a recommendation to the Consultative Group on support for research into a commodity which is not produced primarily for food, I must reiterate that this is likely to prove the exception rather than the rule. There could be other means of financing research into non-food commodities which must also be explored.

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1/ For example many perennial crops of the wet tropics - rubber, coconuts, several beverages and spices, tropical hardwood forests.

#### IV. Forestry

39. The only major group of commodities I have not yet mentioned are the forest products. The TAC has so far had no specific proposal to support research in forestry, although the possibility of establishing a tropical forest research institute - probably in South-East Asia, has been mooted. This will be considered on its merits, but members' initial reactions to an outline paper indicated that their main concern related to research on the role of forest cover in the conservation of the environment and to relationships between the use of land for forestry and for agriculture under shifting cultivation and forest fallow, rather than to timber production and processing.

40. Perhaps this may be too narrow a view and research should be focussed on making timber production, forest regeneration, and soil and water conservation more compatible. After all tropical forests represent one of the few promising and relatively untapped sources of economic wealth in a number of tropical countries. This resource will be exploited, but whether the end point is a sound, renewable forest rotation or a ruined watershed may depend on well integrated and imaginative research ex ante.

#### V. Factor-Oriented Research

41. This is perhaps an apt point to discuss another somewhat controversial issue of priorities. So far the TAC has preferred to express its goals largely in terms of commodities, and this certainly has the merit of clarity and easy definition. At the same time it has also had before it certain proposals for research related to what might best be defined as factors of production (water use and management, integrated pest control, pesticide residues, etc.) which have caused it some difficult moments.

42. In general, members have taken the view that such problems are most meaningfully studied in relation to specific commodities rather than as ends in themselves. They have argued that one of the reasons for the success of the rice and wheat programmes has been the realisation by IRRI and CIMMYT of the need to develop and present to the farmer an integrated "package" of technology appropriate to their new varieties, and not just the latter in isolation unsupported by other essential inputs.

43. While there is much merit in this argument there are nevertheless instances which can be identified where it may be an inadequate approach and where it is essential to <sup>1/</sup> move from the study of the commodity or package of technology to that of the system. Except in monocultures, water use and management has to be related to the crop-mix rather than to the individual crop; fertilizer and pesticide residues contributing to environmental pollution again come from the totality of the farm and not just one enterprise. The introduction of small-scale livestock often implies a major revision of an established system. Multiple cropping depending on high output per annum involves radically different management and plant breeding and cultural concepts than systems which depend principally on high yield per individual crop. Inadequate survey and exploration of surface and sub-surface water resources combined with insufficient research on soil/plant/water relationships is frequently a serious obstacle to sound design, good water management and the development of optimum production systems in irrigated areas. Storage; and control of certain causes of crop loss, e.g. rodents, may present problems of a broader nature than a single crop. The recent critical world grain reserve situation has called attention to the need for improvement of storage, and the prevention of post-harvest losses, and while some of the problems may require mainly the application of existing knowledge for their solution, there are undoubtedly crops and situations for which more research is needed - for example, storage of roots and tubers on small farms. However, storage and its related problems may often form only one component of a much larger post-harvest system, and consideration therefore needs to be given to approaching this system in its totality having regard to uses of commodities for food, feed, and technical purposes, along multi-disciplinary lines, in much the same way as we are now attacking the problems of production prior to harvest.

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<sup>1/</sup> There may also be cases where research is necessary to improve an input itself, i.e. design of new types of fertilizer that would lower the cost barrier to use of more fertilizer by small farmers in developing countries. Such research, which may offer considerable potential for increasing food production is often not commodity specific in its initial stages.

44. Some of these issues are important, and I raise them not at all to call in question the correctness of the TAC's approach to date, but as a cautionary note to the Consultative Group that it should be prepared to look sympathetically at departures from the conventional type of commodity-oriented package programme type of research which it has mainly been called on to support so far.

#### VI. Research on Intensification

45. This caution may well apply to the approach required to improve agricultural production in the Near East and North Africa, where the major food crops, except barley and broad beans, are already covered by the work of existing institutes, and where the need is not so much to raise the yield of a single crop as to intensify agriculture and increase productivity through better resource utilization. The concept of high yields per individual crop which has so far dominated the goals of the older institutes may have to be subordinated to one of maximizing the use of scarce resources - in this region generally water.

46. This involves such problems as the better integration of crops and livestock, the substitution of the fallow which now occupies 60 percent of arable area every year by fodders in the wheat-fallow rainfed rotation along the lines followed in the analogous climatic zone of Australia; changes in cropping patterns in irrigated land to optimize income and employment; and the creation of a stratified pattern of livestock movement from rearing on the range to fattening on arable land or in feedlots. Work on individual food crops, especially cereals and grain legumes, will remain important, but the main focus would be on developing more productive systems which might also include livestock, non-food or forage crops.

47. Research on the socio-economic as well as the physical constraints to increasing productivity and developing integrated land use assumes great importance wherever work has to be undertaken on transforming traditional farming patterns and developing complementarities across ecological or social boundaries, whether in West Africa, "upland" cropping areas of Asia, or in the Near East and North Africa, and there may be correspondingly greater difficulty in finding a suitable institutional formula for such studies than for more narrowly commodity-oriented research.

48. But although increasing yields and production of basic staple foods must remain a priority goal, the ultimate objective of agricultural research is development and the economic well-being of people. We must not be so bewitched with the hopes of further spectacular successes with single crops that we fail to recognize that other pathways to growth may exist. In some regions, for ecological, social, or economic reasons, research of a broader nature - even if it appears more complex, may offer the better hope of a solution. Where such an approach seems desirable the TAC and the Consultative Group must grasp the nettle boldly.

49. Before passing to questions of socio-economic research related to agricultural development I should perhaps emphasize that the TAC recognizes that all major regions face difficult technical problems requiring additional research, and that the most important of these in any region are likely to call for attention and possibly for international support, even if the share of the world's population affected may not be as high in one area as in another. We are concerned with low absolute standards of agricultural technology and with strong pressures on resources everywhere, without trying to rank every need precisely in a global sense. Indeed, one of the broader aims of international research should perhaps be to develop theories of technical development which would enable resources to be managed more effectively to meet development goals both regional and nationally: we have given much study to theories of economic development, but perhaps too little attention to how to manipulate technology to achieve socio-economic goals. In respect of the many developing countries with heavy pressure of population on natural resources, an important objective must be to develop labour-intensive technologies suited to application on small farms.

## VII. Socio-Economic Research

50. Discussion of these broader issues leads rather logically to a consideration of socio-economic research. Here the TAC has recognized three levels of action, i.e. :

- (i) research at the micro-level (farm or village community), to identify the socio-economic constraints to the successful adoption of new technology, and to guide scientists at the International Centres and elsewhere as to the types of technology most likely to be acceptable to farmers.
- (ii) research at the level of public policy, e.g. to determine the measures and incentives needed to accelerate the use by farmers of technical innovations, to give early warnings of possible "second generation" effects of such innovations, e.g. on employment or prices, and to illuminate the choice of alternatives.
- (iii) research at the macro-level on broad issues affecting more than one country, or the economy of a country as a whole, e.g. on commodities and trade, some aspects of nutrition, sectoral analysis, etc.

51. The adequacy of current research at each of these three levels was debated at length at TAC's fifth meeting, following introductory papers by economists from the International Centres and from FAO's Economic and Social Policy Department.

### (i) Micro-level research and the role of the International Centres.

52. The Committee was impressed with the general approach at the micro-level being followed by these Centres. This applies both to their socio-economic studies, and to their cooperation with other disciplines aimed at the identification and solution of specific problems not of a purely economic nature, such as improving water management in paddy rice, or mechanization. Members felt that serious consideration must be given during Centres Week discussions to reinforcing the socio-economic staff of the Centres.

53. Members saw the work of the socio-economists at the Centres as having particular value in defining the parameters of a problem in collaboration with other scientists (e.g. with agro-climatologists in identifying the importance of upland rice), in providing guidance as to whether a new technology was likely to be capable of adoption by producers in their existing farm situation, and in helping the programme development and allocation of resources to research at their institutes. Clearly such information would also be of great assistance to the TAC.

54. Doubt was expressed, however, as to whether the results of the micro-level research programmes per se of such Centres could have widespread application because of their location specificity and the impossibility of providing tailor-made solutions to the wide range of situations existing in countries covered in the Centres terms of reference. Members also doubted whether the Centres could play as effective a role in influencing public policy as they could in micro-level research, since their relatively narrow focus, although a source of strength in approaching problems at the farm level, limited their scope for offering guidance on broader issues.

55. Concern was expressed by several members at the disparity which appeared to exist between the rather considerable resources now being channelled to the analytical case study type of socio-economic research being undertaken by the Centres, valuable though this was, and the weakness of national systems which were being expected to undertake complex studies on such key policy issues as optimum size of farm; employment; urban migration; land reform and other problems consequent on the choice of various technological alternatives; investment strategies for agriculture, the mobilisation of savings and capital formation in rural areas, price policies, etc. Attention was also drawn to the need for information on which to assess the results of large-scale development projects, the acceptance of new techniques, reasons for their success or failure; and the impact of different forms of investment, e.g. irrigation,

infrastructure, etc. on agricultural employment, and general economic growth. This was a much broader field of socio-economic research than was currently being covered by the International Centres and it was felt that while the latter were strongly equipped to study individual components of the agricultural structure in a local environment, they could not be expected to provide the integrated approach at the national level which was required for the solution of broad policy issues.

56. There was a strong feeling that this dilemma could only be resolved by channelling more resources to helping the developing countries to build up their own capacity to undertake socio-economic research both at the farm and the policy level.

57. In this process the International Centres could play an important role through the development of generalised methodology (e.g. for the study of production functions) and the construction of flexible models (e.g. on farming systems) capable of wide adaptation by national institutes; in the training of national workers (including scientists and planners) to use and understand the socio-economic technology and to enable them to cooperate in multi-disciplinary research; and in the assembly and analysis of information and the dissemination of the results of socio-economic research to other research workers. The general trends emerging from the Centres' own research might also be of value to policy makers outside their host country, even if the detailed conclusions might have more localised applicability.

(ii) Research in relation to decision-making in public policy

58. Despite the value it placed on the work of the Centres at the micro-level, and its recognition that a number of the macro-level problems were being increasingly well catered for by FAO, IBRD and other international bodies, the Committee was conscious of a gap at the intermediate level of public policy.

59. This takes two forms: first a weakness in communication of the results of micro-level research to national planners and politicians; secondly, a failure of research to cover key policy issues. In some cases the latter concern commodities not covered by any international centre; more often they relate to problems of the type referred to in para. 55, the solutions to which lie beyond the scope and terms of reference of the centres.

60. Because of its concern, the TAC discussed the possibility of establishing some special internationally supported institution to coordinate and stimulate work on problems of this nature, to improve information services to policy makers and to train national cadres. A majority of members was against the idea of any central body, not because they saw no need for reinforcing national action in such matters but because they did not believe it was a workable proposition.

61. An intermediate approach worth further consideration is that of a "travelling seminar" which would be focussed on a problem of known importance identified by the TAC or some other suitably qualified body, and which, after a preparatory period of desk study by its organizers, would examine the problem on the ground and conduct seminars at a number of selected sites. Such a group could be of a multi-disciplinary nature, with representatives from both developed and developing countries, and its conclusions and recommendations would have relevance not only to the work of the TAC and CGIAR, but to the International Centres and Agencies and to policy-makers at the regional and national level. It could be particularly valuable as a means of providing linkages between national centres, especially in the weaker, inadequately equipped, countries.

62. There is clearly plenty to do both in research on policy orientation and in improving the effectiveness of communications on research to the policy makers. The issue is not so much what to do as how best to do it; and here the TAC has so far been unable to make a definitive judgement.

63. However, it is certainly the intention of TAC to resume its debate on these questions, and the ideas indicated in paras. 50-61 should therefore be regarded only as an interim summary of its views. We shall study with interest the report of the CGIAR sponsored seminar, which we hope will take us further along the road towards a positive recommendation to the Consultative Group, at our February meeting.

### VIII. Relations between Applied and Basic Science

64. I should like to turn now to an issue at the other end of the research spectrum, but again one which the TAC had little opportunity to debate so far: is there sufficient interaction between applied agricultural science and basic research? Very few developing countries have the capacity to undertake fundamental studies, and even the international institutes do not claim to be doing so.<sup>1/</sup> This question appears even more pertinent when one considers that a main criticism of the USDA research programme by the recent National Academy of Science policy review committee was that grossly inadequate support was being given in the allocation of resources to the basic sciences which underpin agriculture.

65. At first sight this problem may seem irrelevant in relation to many developing countries, where actual yields and cropping intensities are often so very far below the demonstrated experimental potential, due to a complex of technical, socio-economic, and institutional factors the nature of which varies within and between countries, and which itself requires further research.

66. However, there are some countries, e.g. Egypt, Korea, Taiwan, parts of India, where yields and cropping intensities are outstanding even by world standards, and which are beginning to press up against the limits of their natural resources. Although further increases in average yields are still technically feasible in these countries, additional increments will tend to become progressively more costly. Further substantial progress is likely to depend on deeper knowledge of resource utilization to enable the area of cultivated land to be extended and/or on the development of entirely new techniques of agriculture.

67. In other countries yields may be low because of ecological constraints which might be alleviated by better understanding of the fundamentals of crop physiology; or because transport costs are too high to make the use of fertilizer economically attractive. The transference of the nitrogen-fixing mechanism from legumes to cereals could transform this sort of situation at one stroke!

68. It is increasingly being asked whether, in terms of environmental degradation and the use of dwindling world reserves of fossil fuels and other natural resources (phosphates), the "high yield" technology is the road not to progress but to disaster. However much one might question the validity of this argument in respect of the desperate immediacy of feeding developing countries there is a need to give more weight to biological methods of control of pests, pathogens and rodents, as well as to new approaches to plant nutrition, including recycling of organic human and animal waste products and more efficient and economical methods of formulating and applying fertilizers. Research into methods of monitoring residues, etc. which can be easily applied by developing countries is also needed. The fact that we have so far devised no technology capable of maintaining productivity without high use of manufactured inputs does not mean that we should not search for one.

69. There are in fact two somewhat different, but not unrelated questions to which the TAC may have to address itself in harnessing basic research capabilities of developed countries more effectively to its purposes. The first is how to strengthen the working linkages between International Centres and developed country institutions in a way which can help to reduce problems impeding the impact of the more 'applied' type of research conducted at the Centres, i.e. to work out an appropriate division of labour that helps the Centres to concentrate on what they are best equipped to do while benefiting from outside help in breaking bottlenecks to advances in their work. Links are now in being between institutes in several developed countries and International Centres on a number of agreed lines of research such as Triticale, improvement of nutritional quality of cereals and legumes, plant physiology, (winter hardiness, drought tolerance, mechanisms of nitrogen fixation, nutrient uptake, etc.), plant and animal disease resistance, behaviour of the tropical soils, etc. These indicate that such cooperation offers great potential for the advancement of agricultural science in the developing countries, particularly for the generation of knowledge and the improvement and standardisation of

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<sup>1/</sup> Proceedings of CIMMYT's Board of Trustees, circulated since these notes were drafted, show a similar concern with this matter.

methodologies and evaluation procedures which can eventually have wide application of a practical nature. This form of collaboration is expanding and should be encouraged to do so; it is at present largely on an ad hoc basis, and for the time being more formal and systematic arrangements may be unnecessary, although the TAC and CGIAR should be kept informed by the Centres of such linkages and their progress.

70. It is unlikely, however, that even a greatly expanded and coordinated effort along these lines, could provide answers to some of the more intractable problems touched on in paras 66-68 since these extend beyond the mandates of the International Centres, although the work of the latter might often be advanced by their solution. The second question which we may have to consider, therefore, is how better to organize the strength of the developed countries in collaborative efforts on basic research problems important to the developing countries, but not necessarily central to the specific goals of the International Centres. Some work of great relevance is undoubtedly going on in developed countries; the trouble is we do not know enough about it and whether any action on our part could help with its application to developing countries. At a different level of research the information situation is analogous to the problem referred to earlier in respect of the developing countries. Nevertheless we can say with reasonable certainty that neither the individual research efforts of developed countries nor their links to the work of the International Centres yet amount to the systematic approach on a task force basis which might enable us to achieve a breakthrough on difficult problems by a judicious balance of basic and applied science.

71. A first step might be for the TAC to try and identify some specific objectives aimed at scientific breakthroughs on which "mission-oriented" basic research ought to be focussed on behalf of developing countries. An attempt might then be made with the help of the developed countries on the Consultative Group to identify the actual work in hand on these objectives and the state of progress. If there were any signs of a breakthrough from ongoing research the question would then have to be asked whether it needed reinforcement and, if so, how much it might cost to achieve success in a measurable time and how the necessary funds might be mobilised. Alternatively, if no adequate research was being undertaken, consideration would have to be given to its being sponsored, possibly on contract to an appropriate institute, University, or research team. The extent to which the International Centres participated in such arrangements would depend on the nature of the problem.

#### IX. Institutional Approaches to International Research

72. So far the TAC has adhered rather closely to supporting centres along the classical lines represented by IRRI or CIMMYT, and these are still the model which seems most apt for commodity-package oriented research. Nevertheless it is undeniable that large multi-disciplinary institutes are costly to establish, expensive to run, and hard to disengage from or to alter the course of if they cease to be highly productive. There are also problems of site-specificity in the results, where research is centralised largely at one location. This has led to doubts about continuing to add to their number, and to a search for other institutional approaches to international or regional research which are cheaper or more flexible.

73. There is a need for perspective in this matter. The capital and running costs of the Centres, although high by standards of research establishments in most developing countries, are considerably lower than those in some developed countries. They also compare favourably in cost and (in the case of IRRI and CIMMYT) the speed of flow of benefits, even with fairly small irrigation projects. The newer Centres have not really had time to prove themselves. So we must not hesitate to recommend other large or complex institutes if we believe this to be the correct approach.

74. On the other hand, where alternative approaches have been attempted, (usually involving some kind of research network with several countries cooperating according to an agreed programme), difficulties have sometimes been experienced in coordination and management, as well as in ensuring the freedom of action characteristic of the International Centres. Nevertheless there are some interesting and successful precedents such as the International Biological Programme and FAO's Near East Animal Health Institute which should encourage TAC to persevere with innovative approaches where there seem to offer a viable alternative to establishing some new large institute. Investment in a cooperative research programme has the advantage that it may avoid large capital expenditures on structures, and may entail relatively low administrative costs. It also offers opportunities for the participation of institutes in developed countries with national institutes in developing countries and International Centres to achieve a common goal with mutually agreed responsibilities. All those cooperating in the programme can thus share in the process of planning and decision-making. While informally organized global networks exist, for example on maize and rice, in which International Centres play a leading role, the WARDA programme is the first case of a group of countries requesting direct support from the Consultative Group to a research network. This is why we are devoting such careful attention to its proposals and to measures designed to facilitate its success.

75. Perhaps I should emphasize here that I do not consider it meaningful to attempt to distinguish between a "global" or "international" institute and a "regional" one, in the sense that the former would be valid for TAC/Consultative Group consideration and the latter not. This is mere semantics: IITA and CIAT are both essentially regional Centres although they claim "global" responsibilities for the improvement of certain crops. As I said earlier some "regional" research problems may affect more human beings than others covering a wider geographical area. Provided the programme can be operated through a structure of an autonomous international character so that its content and management are not subject to national policy constraints it is the importance and validity of the research objections which should determine our willingness to support a given proposal with international money within the limits of the finance likely to be available.

#### X. Strengthening National Institutions

76. An institutional and logistical problem with which TAC and the Consultative Group has not yet grappled adequately is how to strengthen national research institutions. This is perfectly understandable in the light of its terms of reference and its heavy workload related to international and regional research. I am not suggesting that TAC could or should be asked to review national research proposals or that the Consultative Group, with certain special exceptions of the type I have indicated in paragraph 79 below, should be asked to support national systems financially.

77. Yet a strong national research capability is essential to the ultimate success of investments in "international" research as well as to enabling developing countries to deal with localised problems not being touched on by the work of international institutes.

I should therefore like to share with you a few ideas on this subject even if they have not yet been discussed in any detail by TAC. Members of the TAC view their role and that of the International Centres as an interim one to identify and help to fill the immediate and urgent gaps in technical knowledge affecting the developing countries. Unless the scientific capacity of these countries can be strengthened to enable them to move ahead the ultimate aim which we have of helping them to achieve **self-sustaining technical growth** is likely to be far removed and the Centres will have to continue indefinitely.

78. What I have to say is not to be construed as a criticism of the **International Centres** which are doing a most valuable job in training, seminars and information, as well as in their outreach work. However, this may not be enough. Already with ICRISAT's work, with WARDA, and in the case of the African Livestock Institute, we are having to face up to questions of how existing stations in developing countries can be used either as part of, outreach effort, or as an integral part of the core programmes of internationally supported research institutes.



79. To further the latter objective the Consultative Group may have actually to put money for specific purposes into national institutes, although this would probably not involve support to their central budgets but rather some kind of cooperative arrangement, for example, with outposted members of international staff working alongside national staff on an agreed programme, or in appropriate cases sub-contract to national institutes from International Centres.

80. The proposal for establishing a world-wide network of international, regional, and national stations working on the collection, conservation and evaluation of genetic resources, which TAC has always strongly supported, will also help to strengthen national programmes; in a few cases by establishing regional genetic resources centres in the regions of main genetic diversity of major crops, but also by enabling countries to participate in exploration and collection missions and to share in the pool of world genetic resources more equitably. It is encouraging that FAO has agreed to support the crucial coordinating centre from its regular programme resources, and that some members of CGIAR are evincing interest in supporting regional centres.

81. Nevertheless while providing important elements of reinforcement to national programmes these measures touch only the fringe of the problem. There are hundreds of agricultural research stations of one kind or another in developing countries, at widely differing levels of excellence. Our knowledge of what they are doing, and how well they are equipped and financed to do it, is weak. This has been an obstacle to the TAC's decision-making process, and even the field missions sent out by it and by the Consultative Group have found difficulty in making an adequate evaluation of what is already going on.

82. This was a main reason for TAC recommending support for a pilot study of FAO's CARIS project; and during our priority discussions several members rated the collection and dissemination of research information as an important item. Support from Consultative Group members in one form or another for the CARIS pilot project has increased and FAO are hopeful of delivering the directory in two languages and based on three different storage and retrieval systems (SSIE, CRIS, and EEC) by November 1973. This will then be subjected to independent evaluation with the help of of IDRC, as a basis for a recommendation to the TAC as to follow-up action.

83. I am not prepared to pre-judge these conclusions, apart from saying that a more comprehensive view of existing research establishments and ongoing research programmes in developing countries ought to be of considerable value to the TAC and the outreach work of the international institutes, as well as providing the basis for exchanges of ideas and materials between the developing countries themselves.

84. Most important of all it should indicate to national governments (by comparative yardsticks) and to aid agencies working with them, where the need for reinforcement lies or how existing resources might be regrouped to work more effectively. In the last analysis this is a national decision, although the International Centres and agencies like FAO and UNDP can offer guidance and help through information, training and other measures designed to build national scientific skills and to improve research organisation and management.

85. It may, in fact, be legitimate to query whether the resources being devoted by FAO, UNDP, and the Bank to this important activity are adequate, or whether sufficient weight is being given to strengthening national research and extension services in the UNDP country programming exercises. In addition, encouragement and support should be given by all donors for the building of working linkages from individual research institutes in developing countries into whatever global networks exist in relation to the problems with which they are concerned. It is important that support being channeled to international research through CGIAR should not lead to any cut-back in support from IBRD, UNDP, and bilateral donors for developing national research capacities, indeed the tempo of financial and technical assistance might well be raised. This matter really falls outside the TAC's competence, but it might be able to help by fielding travelling missions in cooperation with the regional offices of international organizations to look at country establishments and needs, although if it were to do this it would certainly require additional financial resources.

86. This brings me to a further question. How far are the results generated by international research programmes being incorporated into FAO/UNDP or IBRD investment or pre-investment projects? This might not only increase the benefits but also reveal the snags of new technology within a broader environment than the individual farm, and help devise solutions. Put in another way, how can we broaden and accelerate the input of research into the development process? CIMMYT attempted this in their Pueblo project, which is now being phased out, and it is legitimate to question whether such projects really ought to be undertaken by the **Centres** themselves, given that their major task is research.

87. Nevertheless, there does seem to be a real need for projects specifically designed to link research to development (what FAO in its SOFA chapter on research calls "linkage projects"), which would provide an important feed-back to national policy makers and to the **International Centres**.<sup>1</sup> It may be worthwhile TAC discussing this at a future meeting. This is not necessarily to suggest that the Consultative Group would be asked to fund such projects, but to offer guidance to agencies which might, and to provide moral support for their doing so.

#### XI. Financial Considerations

88. Any proposal for international support to research or related activities carries financial implications, usually of a long-term continuing nature, and involving both capital and recurrent expenditure. TAC members have expressed concern at the difficulties experienced by the Consultative Group secretariat in ensuring a smooth cash flow to certain of the existing **International Centres**, and while recognising that this is probably a temporary problem associated with the Group's evolution we hope that means will soon be found to avoid 'stop-go' financing. At the same time the TAC is very conscious that the resources of the Consultative Group are not unlimited, and this has been a main reason for its anxiety to define a framework of priorities.

89. An attempt has been made in Annex I to project the broad financial parameters implied by the recommendations of TAC for support to ongoing and new programmes at the six existing **International Centres** as well as for other possible new ventures within our suggested framework of priorities. **The Annex, of course, should not be interpreted as in any way immutable or precise to the last place of decimals;** this is one of the dangers of presenting any such long-range estimates. However, my hope is that it will at least give to the Consultative Group a sense of the growth in future financing required if **the priority needs we have proposed are to be met, and will allow it in turn to indicate to the TAC whether the growthrate implied is reasonable and feasible.** This should both enable TAC to know the general financial limits within which it must work and at the same time give due assurance of continuity of support for any future proposal which the CGIAR accepts from the Committee.

90. You will see from the Annex that for the continuing support of the core programmes (recurrent and capital) of the six existing **International Centres** plus other new programmes judged by the TAC to be worthy of support from CGIAR, it is estimated that approximately \$54 million will be required circa 1977 and \$70 million circa 1980 as against \$24 million in 1973. Outreach activities have been shown separately since these are normally funded bilaterally under special programmes. They would cost an estimated \$11.4 million circa 1977 and \$17.3 million circa 1980 compared to only \$5 million in 1973. This rather steep rise seems inevitable if the increasing results of core research programmes are to be more readily adapted by national research workers and more speedily **adopted by farmers.**

91. The core estimates are based on the 1973 budgets of the six Centres and their projections to 1977, plus a variable factor for inflation and programme increases from 1977 to 1980. Expansion of their programmes is expected to be relatively small after 1975; the main increase being for the extension of IRRI's activities from irrigated rice to the various types of rainfed rice, and to research on cropping systems built around rice.

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1/ See "The State of Food and Agriculture 1972: Ch.4: Accelerating agricultural research in the developing countries". FAO, Rome.

(ILCA)

92. Major new activities envisaged include the African livestock/and ILRAD enterprises; and a strong research thrust aimed at increasing the productivity of agriculture in the Near East and North Africa. You will have the reports of these missions before you and I do not need to enlarge on the approaches proposed, except perhaps to say that they are both a departure from previous precedents in the sense of being systems and development oriented (across as well as within ecological zones); and not focussed principally on genetic improvement of one or two commodities.

93. In addition to these large-scale involvements further action is envisaged in respect of the plant genetic resources, WARDA and CARTS projects. and in the field of protein production in Latin America. A contingency reserve is proposed to support possible new activities which cannot yet be considered as firm. These might include, for example, aquaculture; research on selected "second-level" priority crops both food and non-food; tropical forestry; pest and disease control; water use and management; crop/weather relationships and so on. It is conceivable that some of this might be supported jointly by the Consultative Group and the Environment Fund. It is also conceivable that TAC might want by 1980 to recommend support for research on some new activity such as unconventional sources of protein, which it is not even thinking about at the moment. However, clearly I cannot give you guidance on matters requiring second sight!

94. Two questions remain. First, would developed countries be spending enough on international agricultural research in support of the developing countries in the light of the tremendous stakes involved, even if their contribution were to be around \$80 million by 1980? Secondly, how do we ensure efficient management of the resources which are put at our disposal?

95. The first question obviously involves political decisions as to the total resources which any developed country can commit to aid, and what share should go to agricultural research and extension within those resources. This judgement is not a matter for the TAC, but I must again stress the need - once resources are committed - for a reasonable assurance of continuity from donors as long as there is a clear indication of a pay-off.

96. This brings me to my second (and final) question: what role could (or should) the TAC play in assessing the continuing validity of the overall research programmes of Centres being supported by the Consultative Group. So far we have mainly been asked to look at additive proposals, but in the last analysis it is the disposal of resources within the whole effort which determines its impact. There is a need to prune as well as to encourage growth, and to maintain flexibility to shift resources both within and between research centres rather than always having to add to the overall programme to meet a new challenge. There is a constant danger of petrification of research unless it is kept under a reasonable degree of independent review.

97. However, if TAC were to have to undertake this task it would mean its accepting executive functions. It might then be regarded as both judge and jury, and the confidence of the Centres in the impartiality of its judgements might ebb. I have reservations about the Committee accepting executive responsibilities, since this would both alter its nature and imply increased staff and commitments, but the members of TAC are not unanimous on this issue. Some feel that the Committee cannot do its job adequately without closer involvement with programme reviews. Possibly some compromise might be arrived at whereby the TAC would indicate the kind of question it would like to have examined by Boards of Trustees and/or independent external review missions.

98. This is still under discussion and I will report our conclusions to you at a later meeting.

ANNEX 1  
(Revised Sept. 1973)

GLOBAL ESTIMATE OF FINANCIAL SUPPORT REQUIRED  
FOR INTERNATIONAL RESEARCH ACTIVITIES 1973-80

	Estimated requirements: US\$ million				
	1973	circa 1977		circa 1980	
	Actual	Constant prices	Current prices	Constant prices	Current prices
<b>A. Core Programmes</b>					
<b>I(a) Recurrent costs existing</b>					
<u>International Centers</u>					
1. CIAT	3.40	5.36	7.14	5.36	9.23
2. CIMMYT	4.93	4.86	5.79	4.86	7.10
3. CIP	1.08	2.03	2.48	2.03	3.03
4. ICRISAT	1.20	4.20	4.86	4.20	5.62
5. IITA	4.80	6.44	7.67	6.44	9.12
6. IRRI	2.66	4.09	4.52	4.09	5.60
<u>Sub-total Recurrent Costs Centers</u>	18.07	26.98	32.46	26.98	39.70
<b>I(b) Capital Requirements Centers</b>	5.65	2.00	2.00	3.00	3.00
<b>I(a+b) Sub-total Recurrent &amp; Capital Costs existing centers</b>	23.72	28.98	34.46	29.98	42.70
<b>II(a) Other Programmes Approved or Under Scrutiny</b>					
7. TAC (Technical Advisory Committee)	.16	.16	.22	.16	.27
8. CARIS Project (Agr. Res.: Inf. System)	.12	.85	1.00	.30	.30
9. ILCA (Int: Livestock Center Africa)	-	2.94	3.23	4.10	6.30
10. ILRAD (Int: Lab. Res: Animal Disease)	-	2.80	3.20	2.80	3.90
11. WARDA (west African Rice Development Assn)	-	.85	.90	.85	1.10
12. ICRISAT Linkage Programmes in Africa	-	1.00	1.00	1.00	1.22
13. Near East/N. Africa Research Proposal	-	1.94	2.08	2.78	3.64
14. Latin America: Bean Network	-	.15	.15	.30	.30
15. INTSOY (Int. Soya Bean Res: Base)	-	.96	1.04	.97	1.27
16. Crop Genetic Resources Network	-	.75	.80	.75	1.00
17. Contingencies (other proposals not yet costed)	-	2.00	2.00	4.00	4.50
<u>Sub-total Recurrent Costs "Other Programmes"</u>	.28	14.40	15.60	18.00	23.80
<b>II(b) Capital Requirements "Other Programmes"</b>	-	4.00	4.00	3.50	3.50
<b>II(a+b) Sub-total Recurrent &amp; Capital Costs</b>	.28	18.40	19.60	21.50	27.30
<b>III Grand Total all Core Programmes (I + II)</b>					
a) Recurrent Costs	18.35	41.38	48.06	45.00	63.50
b) Capital Costs	5.65	6.00	6.00	6.50	6.50
<b>III(a+b) Total all Core costs (rounded)</b>	24.00	47.40	54.10	51.50	70.00
<b>B. Outreach Programmes (Recurrent costs)<sup>1/</sup></b>					
I. Existing international centres	5.00	7.80	9.40	8.40	12.30
II. New programmes	-	1.80	2.00	4.00	5.00
<u>Total Outreach (I + II)</u>	5.00	9.60	11.40	12.40	17.30
<b>C. Total Core and Outreach (rounded)</b>	29.00	57.00	65.00	64.00	87.00
<b>Outreach as % Core recurrent expenditures</b>	27%	23%	23%	28%	27%

<sup>1/</sup> Some capital elements are implied in certain outreach work, but cannot be quantified.

## NOTES ON ITEMS LISTED IN ANNEX I (Revised)

The global estimate shows ALL estimated costs of supporting existing and possible new international research activities; whether these have partial funds "in sight" from members of the Consultative Group or not. Where an advance commitment has been made to provide some of the necessary funding (e.g. USAID to INTSOY, the three co-sponsors to TAC, or FAO to the genetic resources network), this is taken as a normal donor contribution to the project and has not been deducted or identified separately. "Earned income" totalling \$668,000 in 1973, \$920,000 in 1977, and \$1.14 million in 1980, has been deducted from centres' core funding requirements. Outreach costs have been identified under a separate main heading in revising this Annex, as they are funded bilaterally and not through the CGIAR per se.

### A. Core Programmes

#### I. Existing Centres

Item I(a) - 1-6: Recurrent Core costs include "restricted and unrestricted", and are taken from the 1973 budget submissions of the centres as summarized in the CGIAR review reports. Inflationary allowances are as indicated in those reports. The same rates have been used for projecting inflationary increases between 1977 and 1980. These are CIAT 9%, CIMMYT 7%, CIP 7%, ICRISAT 5%, IITA 6%, IRRI 7½%. (An assumption of a steady level of inflation may, however, be optimistic on current trends).

Item I(b): Capital requirements taken from budget figures for 1973 and centres' projections for 1977. No figures are available for 1980 but the figure has been raised over 1977 to allow for some recapitalization. No attempt has been made to allow for inflationary costs.

#### II. Other Programmes (mainly coming into operation after 1973)

It is sometimes difficult to assess what is core expenditure and what might be classed as outreach. In some cases, e.g. ILCA, ILRAD, Near East, a normal type of outreach which could be bilaterally funded has been identified under heading B.II. In others, e.g. INTSOY and genetic resources, there are also identifiable components of core and outreach, although the latter might be funded either bilaterally as with the six existing centres or through the Consultative Group. Others, e.g. CARIS, the ICRISAT African linkage proposal, WANDA and the Latin American network, although mainly decentralized in nature are programmes for which central funding would probably be sought and are therefore considered here as core activities. We nevertheless realise that this is a somewhat arbitrary definition.

Item II(a): Item 7: TAC increases based on 7% compound annual rate of cost inflation from 1973 expenses of around \$160,000.

Item II(a): Item 8: The CARIS "pilot" project already being supported by CGIAR is expected to complete by November 1973. On the basis of an independent evaluation a decision will then be made as to whether to recommend support for the global project or not. The estimate for 1977 shows partial costs of undertaking this project (estimated \$2½ million over 3 years); 1980 costs would be for updating.

Item II(a): Item 9: Assumes an 8% inflation rate from 1974 onwards.

Item II(a): Items 10-18: All assume a 7% rate of cost inflation on recurrent costs, additional to any programme increases.

Item II(a): Items 9, 10, 11, 12, 13: 1977 figures are taken from project documents as submitted to TAC/CGIAR.

Item II(a): Item 14: Very provisional initial estimates by the Latin American Regional Working Group on legume cooperative programmes.

Item II(a): Item 15: 1977 and 1980 core budget and training figures calculated from cost estimates supplied in USAID submission to TAC. Linkage and outreach teams are included under Item B(II).

Item II(a): Item 16: 1977 figures taken from FAO submission to TAC and represent Item 2 in the budget Appendix, i.e. the proposed central fund. Regional centres are included under outreach.

Item II(b): Item 17: A number of suggestions for new research initiatives, generally without detailed cost estimates, is before TAC. These include a tropical fruit centre in Asia; further studies in depth on food legumes; aquaculture; a tropical forest institute (also possibly in Asia); water use and management, etc. It is impossible at this stage to estimate which will be recommended to and accepted by CGIAR for funding between 1975 and 1977, or thereafter, but it would be unrealistic to assume that none will. The estimates therefore allow for start-up and initial running expenses of one major new programme in the period 1975-1977, and an additional one for 1978-80.

Item II(b): Capital Requirements - "Other Programmes". Proposals approved by TAC or under serious consideration, which would require capital expenditure during the period 1974-77 include ILCA, ILRAD, the research needs of the Near East/N. Africa ecological zone, INTSOY, and the Genetic Resources Proposal. Assuming that ILCA (\$3.84 million) ILRAD (\$3.37 million) INTSOY (\$30,000) and the Genetic Centres (\$310,000) were to be funded in full and that two-thirds of the needs of the Near East Centre were to be covered then, the total capital required would be of the order of \$14.5 million. A pro-rata estimate has been made for 1977 of \$4 million. For the period 1977-80 no data are available; but assuming the balance of the funding of the Near East Centre had to be completed, one more genetic resources centre established, and one new research centre comparable to existing ones to be initiated, an order of requirement of \$12 million could be envisaged. A pro-rated figure of \$3½ million has been assumed for 1980.

## B. Outreach Programmes - Recurrent Expenditures only

I. Existing Centres. Figures are taken from 1973 budget statements for CIAT (\$480,000), CIMMYT (\$1.64 million), IITA (\$913,000) and IRRI (\$1.96 million), equivalent to respectively 14, 33, 19 and 74 percent respectively of those centres' core recurrent budgets in that year. Projections have been made by CIMMYT, IITA and IRRI to 1977, with no programme increases for CIMMYT and IRRI, but a substantial one to \$2.3 million at constant prices for IITA. The overall amount for outreach at existing centres has been raised in our estimates from the equivalent of 27.5 of core recurrent expenditures in 1973 to around 29 and 31 percent respectively by 1977 and 1980 to allow for inflation, and programme increases in outreach for CIAT, IITA, CIP and ICRISAT.

II. New Programmes. 1977 estimates taken from ILCA, ILRAD, INTSOY and genetic resources proposals. That for INTSOY (\$800,000) is the sum required from CGIAR over and above core requirements for the resource base and training. 1980 estimates are taken from the same reports, plus an addition for the Near East Centre. The INTSOY requirement would rise to \$1.00 million. The genetic resources estimate allows for the costs of running regional centres.

STRENGTHENING NATIONAL AGRICULTURAL RESEARCH -

THE BANK GROUP'S ROLE

I. INTRODUCTION

- 1.01 This paper is concerned with the need to strengthen national agricultural research in the developing countries, and with the Bank Group's role in this. It is assumed that the Bank intends to step up its support for national agricultural research projects in its member countries. Some priorities and criteria are suggested.
- 1.02 What the Bank does should be related not only to its own capabilities but also to what is done by other agencies; and national research needs can be looked at against the background of the international research now being supported by the Consultative Group on International Agricultural Research.

II. THE NEED

- 2.01 The TAC paper on priorities (1) emphasised that "a strong national research capability is essential to the ultimate success of investments in 'international' research, as well as to enabling developing countries to deal with localised problems not being touched on by the work of international institutes". During the Consultative Group meeting, November 1-2, 1973, one member noted an apparent falling-off of financial support for national research and called for donors to promote linkages between centres of excellence (in developed and in developing countries) and national agricultural research programs. Another member pointed out that international centres were being faced by rapidly growing demands from national authorities and were finding it difficult to decide in which cases and to what extent they should get involved.
- 2.02 The SOFA 1972 review of agricultural research (2) pointed out that the resources available to developing countries for agricultural research were far below what was required; neither in terms of money nor of scientific manpower did it seem possible that adequate resources would be mobilised; scarcity of resources made it necessary that priorities should be carefully selected, but "priority-setting in research, where .... risk and uncertainty are high, is one of the most difficult tasks facing both planners and scientists".
- 2.03 Strengthening national institutions was a subject of discussion at the sixth meeting of TAC, 25 July - 2 August, 1973. It was concluded that "it was of the utmost importance to strengthen national research establishments and scientific capabilities" and "there was a wide measure of agreement on the importance of better coordination of national research programs with those of the International Centres, with identified centres of excellence in developing countries, and where appropriate with developed country institutes to form genuinely international programs of networks aimed at the solution of major agricultural problems". (3) It was suggested that a serious problem stemmed from past failure of donors to pay enough attention to the building of scientific skills in developing countries, so that national research programs were now in the hands of relatively junior and often inexperienced scientists. There was a consensus that TAC and the Consultative Group should not become involved in reviewing or financing research proposals. These had to be dealt with by other means. It was noted that there were encouraging signs of interest on the part of multinational bodies and some bilateral aid donors.

### III. PRIORITIES AND CRITERIA

- 3.01 The 1972 SOFA review (2) lists a number of general criteria for consideration of agricultural research proposals; e.g. the relative importance of agriculture in the national economy; contribution to food supply; impact on foreign exchange earnings or savings; identification of beneficiaries especially in relation to income distribution; the time horizon; the resources available, especially in terms of trained manpower; probability of successful outcome from research; probability of effective implementation of research results. These criteria are likely to be acceptable to most donors.
- 3.02 Each donor, too, is likely to have criteria of his own. Bilateral donors, for instance, may be able to assist some regions or countries but not others; one donor may prefer to provide assistance for one or more kinds of agricultural science, e.g. dairy science; another may be more concerned to help socio-economic than biological research. Because of the need to make the best use of scarce resources, to avoid overlapping, sometimes perhaps to facilitate "joint ventures", it would be helpful if the special criteria of each donor could be made better known to other donors.
- 3.03 In addition to the general criteria mentioned in para 3.01 there are perhaps others which ought to be of concern to all donors:
- a) Assuming agriculture is accorded sufficient priority within a country's national economic plan, does the particular research proposal merit priority over alternative claims on available resources, e.g. alternative agricultural projects? (Beware the "criteria of readiness" - i.e. doing the project simply because it is ready to be done). Too seldom unfortunately, have options been identified or alternatives evaluated.
  - b) Particular weight ought to be given to research proposals aimed at building up scientific skills at the national level. (This may require a two-way traffic in scientists on a massive scale; in one direction, scientists from the developing country going to work under experienced leadership in a research institute in a donor country or in an international centre; in the other direction, experienced scientists from a donor country going to work in a national program - and staying long enough with it not only to make a valuable research contribution but also to help build scientific and leadership skills within the national cadre).
  - c) Since, in the long run, the benefits of the Consultative Group's investments in international centres and programs depends upon improvement of national research capabilities, members of CGIAR, when designing their aid programs for research, might give preference to national research projects which are connected with international centres of excellence rather than to those which are not; and to national research programs which are inside some regional or international research network or linkage system rather than outside it.



IV. PAST AND PRESENT BANK SUPPORT FOR AGRICULTURAL RESEARCH.

- 4.01 In addition to its support for international agricultural research through its sponsorship of the CGIAR, the Bank has given limited support to national research. Since 1967, and particularly since 1970, loan funds provided by IBRD and IDA for agricultural development projects and education projects have in some cases included funds for so-called "research components"; some \$27 million have been provided in 76 projects in 54 countries (4). The "research component", usually representing only a very small part of the whole project, is designed to stimulate production-oriented adaptive work at farm level, or sometimes to generate an improved technological package for a longer, follow-up project (the so-called "repeater loan").
- 4.02 These small "research components" have included research on livestock, food crops, and export crops in all cases closely related to the objectives of the particular development project of which they are a component. Aid of this kind may be expected to continue and increasingly efforts ought to be made to relate this kind of research to the work of international centres; for instance a "research component" of an IDA project in Liberia is associated with IITA's outreach program. It is suggested that UNDP and IBRD might consider whether UNDP could share the financing of some of these "research components".
- 4.03 The Bank has also been prepared to consider loans wholly devoted to national research programs. One such loan, of \$12 million, has been made to Spain. About half of the funds are allocated for physical assets such as buildings and equipment, and half for building up national research capabilities; funds cover the provision of 200 fellowships for Spanish scientists to work in several different countries and of 50 senior international scientists to work in Spain for short or long periods. The loan funds are restricted to specific parts of the national program - namely six commodity-oriented centres - which were judged by the Bank and the Spanish authorities to have priority. Relatively large loans for national research programs have been or are under consideration for a number of countries, including Indonesia, Brazil and Malaysia.

V. A ROLE FOR THE BANK

- 5.01 Agricultural research is capable of producing high pay-offs. Bank investment in well-conceived research may have at least as high an economic justification - even if it is not normally so susceptible of formal quantification - as in any other form of agricultural development; and the results of a successful research project - e.g. one that produces an improved crop variety or an improved "package" of technology - may be nationwide, reaching far more people, including large numbers of small farmers, than can be benefited by a project concerned with one particular area (e.g. a land settlement or irrigation project).
- 5.02 The fact that almost every developing country may need more and better agricultural research does not mean, unfortunately, that the situation in many of them - especially with regard to the availability of experienced scientists - would be appropriate for a Bank financed research project. It is likely that much national agricultural research, and much foreign aid for it, is relatively ineffective. This is due to a variety of causes, of which the commonest are probably (i) the tendency to research over too wide a field, instead of concentrating on a few clear objectives, and (ii) the failure to recognise that inexperienced researchers inadequately led, are

not capable of effective research. Unfortunately the typical request from a Bank member country has been a request to finance the whole or a large part of an unfocussed program which it is proposed should be carried out by academically qualified but inexperienced scientists.

5.03 There is something of a dilemma here, but the need for well conceived national research efforts is so clear that the Bank ought to be prepared to increase its lending in this sphere, under safeguards such as the suggested guidelines in Section VI of this paper would provide. After all, the Bank's lending for all agricultural development is already on a massive annual scale - \$938 million in FY 1973 in projects in which the total investment was probably about \$2,000 million - and is expected to grow still further. The technological base for this development is in need of significant improvement. It is urgent that the essential contributions that can confidently be expected from the international centres should be complemented by effective research at national level.

5.04 It is arguable that the Bank should, in fact, begin to force the pace in this field; and be prepared in appropriate cases to take the lead. The Bank could do more than it does in economic and agricultural sector missions to identify research gaps, priorities and institutional constraints; and be ready to coordinate the efforts of donors prepared to support national agricultural research programs. (This might mean including research expertise in economic or sector missions). The Bank should also be prepared to go in with other donors into joint projects (para 6.13).

5.05 Bank lending for national research should be seen as a logical part of the Bank's whole agricultural operations. In the context of a country program, support for agricultural research should be part of a strategy that would include the promotion of well focussed research on high priority objectives and the building of indigenous scientific skills; this would be paralleled by the strengthening of management and farming skills, improved credit facilities, efficient organization of agricultural inputs and marketing and other services necessary for sound rural development.

## VI. OPERATIONAL GUIDELINES

6.01 It is clear that, like a country planning its research program, the Bank must seek the right focus and avoid dispersing its effort over too wide a field. It will be helpful if operational guidelines can be stated in positive and in negative terms - "this is the kind of thing we can do, this we cannot".

### 6.02 Countries

Bank support for research projects would normally be confined to countries in which agricultural priorities had been recognised and agreed; the country and the Bank would have had a dialogue extending over several years about policies and priorities; usually the Bank would have carried out an agricultural sector mission; the country would be one in which the Bank had a substantial ongoing agricultural lending program.

### 6.03 Scope of project

The project would not normally embrace the whole of a country's agricultural research effort; it would be selective, focussing on research in fields accorded priority in the national agricultural plan. Requests to support research into subjects of questionable priority would be refused.

6.04 System of Research:

The research would normally be "mission-oriented", devoted to researching one or a few priority crops or classes of livestock, and focussed on solutions of specific problems. Research projects designed to set up or strengthen a "discipline-oriented" institute or department, such as a soils department or a microbiology laboratory, would not normally be supported by the Bank; such projects, in fact, often attract support from UNDP/FAO or bilateral agencies.

6.05 Research Targets:

Targets should be clearly defined, within an estimated time frame; progress and achievements should be measurable in terms of production objectives.

6.06 Identification of beneficiaries:

To attract Bank finance a research project would be expected to benefit large numbers of farmers, including small farmers.

6.07 Relation to other Bank operations:

Research relevant to crops or stock or subsectors in which production projects in the country are already being supported by Bank loans would be particularly appropriate.

6.08 Relation to international research centres:

Priority should be given to projects which are linked in some way with the work of an international centre; and/or to projects which are part of an international or regional network. A project of the "Plan Puebla" type would be attractive, where a technological package of practices designed by an international centre is to be tested amongst thousands of farmers, with effective feedback to the centre.

6.09 Institutional arrangements:

Mediocre, inexperienced or badly led scientists may work for years but produce no worthwhile results. In more orthodox types of agricultural project mediocre leadership and personnel results in below optimum production or delay in reaching targets; in research, mediocrity of personnel results in failure. No research project should be supported by the Bank unless arrangements can be made to mobilise high-calibre, well-motivated researchers under able direction. Personnel policies should provide for selection and promotion merit; for full, not part-time employment; for adequate remuneration and conditions of service. Where national talent is inadequate in numbers or experience, foreign scientists will be needed and must be accepted for an initial period during which they can transmit skills and experience and provide training in leadership. The research organization should be such as to ensure control of objectives by policy makers, insulation from political interference, scientific leadership by research directors and senior scientists.

6.10 Building indigenous skills:

To be supported by the Bank a national research project should be designed as much to improve a country's research capabilities as to provide solutions to specific technical problems.

6.11 Form of Bank finance:

It is assumed that all Bank Group financing of research will be by loans (or credits), with the single exception of its contribution of grant money through the CGIAR for international research.

6.12 Use of Bank loan:

A loan could be used for buildings, equipment, or land development; a substantial part of the loan should normally be available for investment in people - for training, within the country and outside it of national scientists, perhaps through a system of fellowships; and the loan should be available to cover the cost of foreign scientists to provide special skills, leadership and training.

6.13 Cooperation with other donors and joint financing:

Except where only small loans are involved, the Bank should welcome opportunities for cooperating in research projects with other donors. Otherwise its lending for agricultural research, at least in the near future, may be restricted by reason of its rather scanty research-oriented staff compared with other donors. In cases where large amounts of money are required, joint financing with, say, a Foundation and a bilateral donor might be appropriate.

References:

- (1) "Priorities for international support to agricultural research in developing countries" - Technical Advisory Committee (1973).
- (2) "The State of Food and Agriculture" - FAO (1972) - (Chapter IV - "Accelerating Agricultural Research in the Developing Countries").
- (3) Report of the Sixth Meeting of TAC, section IX.
- (4) "Bank Group Support for Agricultural Research Component in Development Projects" - tabulated data accompanying J. Fransen's paper submitted to IRBD Advisory Panel on Agriculture, October 31, 1973.

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**CONSULTATIVE GROUP  
ON INTERNATIONAL AGRICULTURAL RESEARCH  
TECHNICAL ADVISORY COMMITTEE**

**Sixth Meeting, Washington, D.C., 25 July - 3 August 1973**

**REPORT OF THE RESEARCH REVIEW MISSION  
TO THE NEAR EAST AND NORTH AFRICA**

Item 5

**TAC SECRETARIAT  
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
Rome, 1973**

RESEARCH REVIEW MISSION

TO

THE NEAR EAST AND NORTH AFRICA

Report to the Technical Advisory Committee of the  
Consultative Group on International Agricultural Research

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G. Barbero  
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Rome, June 1973

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SUMMARY

1. At the April 1972 meeting of the Technical Advisory Committee to the Consultative Group on International Agricultural Research, it was decided to commission a team which would (i) review the research needs and priorities of the countries of the Near East and North Africa, (ii) assess the adequacy of ongoing research programmes to meet these needs, and (iii) if considered necessary, recommend measures to reinforce research on the main problems. The Mission, whose terms of reference are detailed in Chapter 1, was in the Region from 4 March until 28 April 1973 and visited seven countries (App. III). Its main conclusions are summarised below.

2. As a result of its visits, discussions, and literature review, the Mission is unanimous in concluding that there are a number of priority research problems common to several countries of the Region, which can most effectively be tackled by the establishment of a major, internationally supported, multi-disciplinary research centre there. It recommends the establishment of such a centre in full awareness of the considerable capital and recurrent costs, after a careful consideration of the adequacy of current research, and of possible alternative approaches. It envisages the centre as primarily serving the needs of the Region defined in its terms of reference, but also as having "global" responsibilities for improvement of certain crops, e.g. barley, and wider linkages in its methodological and farming systems research to other countries in the "Mediterranean" and semi-arid climatic zones, e.g. Australia, Greece, Spain, Turkey, Sahelian Africa, Ethiopia, Chile, and North-East Brazil.

3. The reasons for making this recommendation stem from the specific and relatively homogeneous ecological conditions of this geographical region, which give rise to unique structural and land use problems; the extreme pressure of human and animal production on its natural resources and consequent difficulties of environmental management and socio-economic development; the potential identified by the Mission for improvement of resource utilization and agricultural productivity; the relative weakness and lack of cohesion of its current national and international research efforts; and the absence of any strong focal point for research and training which could act catalytically to complement and reinforce such efforts. While the latter does not constitute a prima facie case for establishing an international research centre, it is, in the Mission's opinion, a factor which cannot be ignored. Its recommendation, however, was primarily based not on the absence of such a centre, but on the need for one.

4. Since this was the first inter-disciplinary review of the problems and research priorities of this Region undertaken on behalf of the TAC, they have been dealt with at some length in Chapters 2 and 3; but will be re-emphasized briefly here to clarify the need for a centre and the main focus which is proposed for its initial thrust.

5. The harsh facts facing the development of agriculture in the Region are often obscured by romantic notions of its climate - a tourist's Paradise; its history - the granary of the Roman Empire; and its present riches - oil. In fact, its climate is harsh for agriculture, even if benign for tourism, relative to the humid tropics or the cool temperate region; its rainfall is erratic, often torrential, and confined to the winter/spring season, and its summers are hot and arid. As considerable areas suffer severe winters, the effective growing season for rainfed crops and pastures is short, while summer cropping depends heavily on irrigation.

6. The ratio of cultivated land to total land area is lower than in any other developing region (only 6 percent), and the area of totally useless desert and waste is nearly twice as great. However, the potential for bringing new land into cultivation is low except in Afghanistan, Iran, and the Sudan, and the average availability of arable land per caput



for the Region as a whole is the lowest in the developing world next to South Asia and Java. All land useable for agriculture - arable, grazing, and forest is therefore under unremitting, increasing, and often competing pressure, and, as a result, the pace of erosion, both wind and water, is accelerating. This is having far reaching consequences: it has been estimated that 100,000 ha of rangeland are being lost annually to desert, and the pace of development of new irrigated land is barely keeping pace with land going out of production due to salinity, flooding, and silting. The latter is particularly serious, since although the Region has the highest proportion of arable area under irrigation of any region (nearly 30 percent), the best land has already been developed and costs per hectare of new development are extremely high.

7. The overall result has been a slow growth of agricultural production (especially cereals and livestock), which has failed to meet the demands of high population growth and urbanisation, leading to escalating food deficits (cereal imports have risen 36 percent in five years).<sup>1/</sup> Agriculture has thus failed to act as the motor for generating economic growth often envisaged by national planners.

8. Even if its purely economic role may be less crucial in certain oil-rich countries, the contribution of agriculture to social objectives may nevertheless be extremely important. At present some 65 percent of the active population is in rural areas, and with the 1973 population of nearly 250 million expected to increase nearly 1½ times in the next thirty years, the agricultural sector - at least in absolute terms - will have to employ an even larger number of people.

9. While grim, this picture is not without hope. In its visits and discussions the Mission formed the opinion that there is a considerable potential for "vertical" expansion through increasing yield per hectare and productivity per unit of time which can be exploited by the development and application of improved agricultural technology and more efficient resource utilization. This optimistic conclusion is based on five factors. These are:

- (i) The substantial under-utilization of the cultivable land even in irrigated areas; about half of the arable area being fallowed every year.
- (ii) The low yields, particularly of the major food crops (wheat, barley, grain legumes, and oilseeds), which several authorities believe could be trebled in the better rainfed and the irrigated areas through improved varieties, better use of inputs and improved cultural practices.
- (iii) The even lower production per caput and high losses of ruminant livestock which are maintained largely on natural grazings in a high-risk environment. Feed is the main constraint, and there are challenging opportunities for overcoming this through the cultivation of leguminous fodder crops instead of fallow, and use of crop by-products. Better crop-livestock integration, both within farms and between eco/land use zones (range steppe/rainfed arable/irrigated land) could improve crop yields, increase ruminant productivity and reduce losses, provide more employment, and open the door to more rational management of resources, particularly the range.
- (iv) Water, the scarce resource over much of the Region, is nevertheless inefficiently utilized. Scope exists both for less wasteful on-farm use of water, and for the development of more intensive farming systems. The latter could provide a most important means of raising employment and foreign exchange earnings from agriculture, both directly and through agro-industries.
- (v) The human capital of the Region is inadequately utilized. As will be seen from Chapter 4, this applies to its scientists and research workers, who are often hampered by poor organization, lack of facilities, and deficiencies in training and information. It also affects the sector as a whole, partly because of weaknesses in services and infrastructure, but most particularly because of the failure of efforts so far to reduce competition and develop complementarities between land use zones.

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<sup>1/</sup> Average 1962-66/1967-71.

10. To remedy these weaknesses and to realise the potential within a measurable time horizon will require a greatly strengthened research effort, aimed not merely at improving yields of individual crops (this has too often been the limited objective in the past), but at developing guidelines for new and more productive systems of farming and related policy measures, applicable over wide areas of the Region. There are indeed important technical research objectives, but the Mission stresses that no narrowly crop or discipline oriented approach is likely to prove adequate to the complex and often strongly inter-related agricultural problems of this Region. This is well illustrated by reference to Table 1, which shows the extremely important role played by horticultural<sup>and</sup> "industrial" crops, and by livestock in the agricultural economy.

11. In this light the Mission foresees the main research tasks of the proposed new International Centre in the Region as follows:

- (i) To improve utilization of land and water resources by research to improve basic data and to identify and remove the major constraints to intensification.
- (ii) To increase or stabilise yield per hectare of the major food commodities, especially wheat and barley, grain legumes, and annual oilseeds, by the development of improved varieties and related packages of inputs and cultural practices, including research into the role and value of fallow.
- (iii) To develop more productive farming systems with special emphasis on
  - (a) crop-livestock integration and the introduction of fodders into arable rotations;
  - (b) encouragement of inter-zonal complementarities;
  - (c) multiple cropping systems in irrigated areas;
  - (d) the creation of employment opportunities.

12. The staff proposed in Chapter 6 would be programmed horizontally and vertically to meet these broad research goals; IITA and the African Livestock Centre offer certain parallels, as does the new cropping systems proposal being developed by IRRI.

13. In addition to developing its own research programme, it is also envisaged that the Centre would play a major catalytic and coordinating role, both in relation to cooperation with "outreach" efforts of other international centres (CIMMYT, ICRISAT, IRRI, etc.) in the Region, and in working with indigenous national or regional programmes on methodology and in developing research networks. A major aim would be to encourage "human capital formation" by training research workers, seminars, workshops, information and documentation services, and bringing together scientists, extension workers, planners, and representatives of the private sector.

14. The Mission attaches the very greatest importance to these aspects of its work, not only because they would give the Centre a visible presence and output even before its research programmes began to have an impact, but because there is a real need for a "Centre of Excellence" in the Region to complement and help to strengthen national research capabilities with particular reference to multi-disciplinary development-oriented studies.

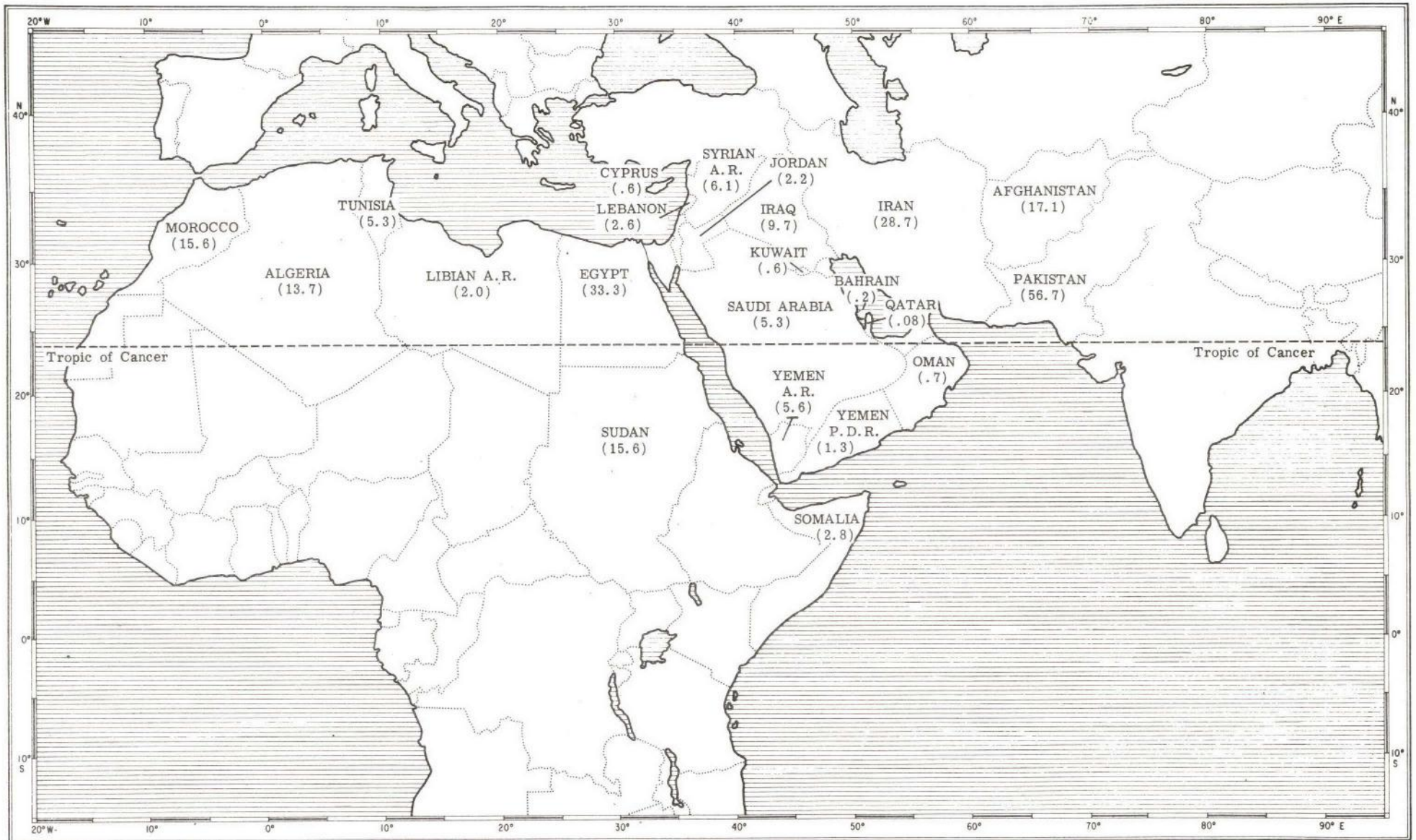
15. Questions of a possible site are discussed in Chapter 6, and the Mission had considerable difficulty in making a definite recommendation in view of the lively interest shown by all the countries visited in hosting it. In the event Lebanon is suggested as first choice, either Syria or Tunisia might be suitable alternatives; the exact site should be explored further if a decision is taken by the Consultative Group to go ahead with the project.

16. Nor was a final decision reached on a title for the proposed centre or institute. "Centre" seemed to have more positive connotations; on the other hand, it was more difficult to fit euphonicly than "institute" with the rest of the initials suggested to describe its functions, i.e. "Research for Mediterranean Agriculture". ("Mediterranean" as a widely accepted generic term for its environment seems more positive and less confusing than "arid" and less cumbersome as a description than "Near East and North Africa".) Either IRCMA (International Research Centre for Mediterranean Agriculture) or IRIMA (International Research Institute for Mediterranean Agriculture) are suggested for consideration.

17. In conclusion the Mission would like to emphasize a concept which it believes to be fundamental. Both the multiple agricultural goals and problems of the Region, and the nature of the constraints require a broad and imaginative inter-disciplinary research approach, with strong socio-economic and technical components feeding into the development of more productive systems of land and water use. In theory this might seem likely to yield slow dividends; in practice it offers the only chance of achieving more rapid adoption not only of new technologies developed by the Centre or elsewhere, but also of known technology which works well in comparable conditions elsewhere but not, so far, in the Region. There are a number of interacting research problems and development objectives to which widely applicable solutions might be found, but no single commodity or problem on which all the attention of an international centre could be concentrated.

18. To be successful the proposed new Centre must therefore be fully development-oriented from the start. This would represent a challenge not only to the vision of its staff, but also to international donors in supporting a programme aimed not simply at producing more food (although this would be a major objective), but at achieving wider social and economic goals, including the reversal of environmental degradation.

NORTH AFRICA AND THE NEAR EAST (Population 1971 225 million)



CHAPTER 1

BACKGROUND AND TERMS OF REFERENCE

1. In recent years there has been increasing concern at the deficit in food production in the countries of the Near East and North Africa despite the national agricultural development programmes and the considerable aid which has been forthcoming from bilateral and multilateral agencies.
2. In 1969 at an International Conference on Mechanized Dryland Farming convened in Moline, U.S.A., there was a request for FAO to create an Institute for the Development of the Semi-Arid Zones. At the 10th FAO Near East Regional Conference held in Islamabad in 1970 particular stress was laid on the need for intensified agricultural research on the major food crops of the Region. Further resolutions were passed relating to the need for intensified research on food crop production and on the more efficient use of water resources at the 11th Regional Conference held in Kuwait in 1972.
3. At that Conference the following resolution (No. 8/72) was recorded:

"(The Conference) recommends the Technical Advisory Committee Mission to determine the necessity of establishing an internationally supported research institute in the region to carry out basic research on some important food crops in the region, with greater emphasis on rainfed areas as well as to provide training facilities for young scientists of the region."
4. The problems of the Near East and North Africa had already been brought to the notice of the Technical Advisory Committee of the Consultative Group on International Agricultural Research at its first meeting in 1971. This Mission has its origin in the TAC meeting of April 1972 when the problems and prospects of the agricultural sector of the Near East countries, together with gaps and priorities in agricultural research, were reviewed and the broad terms of reference for a Research Review Mission were agreed. Later these terms of reference were broadened to include both the Near East and North Africa. See Figure 1.1/
5. During the 1972 meetings of TAC there was general agreement that the research needs of the Near East and North African countries, most of which form part of the Mediterranean climatic and ecological zone were receiving insufficient international support in agricultural research by comparison with other developing regions. Therefore TAC agreed to field a mission with the following terms of reference:
  - (i) To review pertinent literature related to agricultural development in North Africa and the Near East, in particular results of past research undertaken by national and international programmes, and reports concerning current effort and research establishments.
  - (ii) To visit the authorities responsible for research planning and implementation in appropriate countries of this Region, representative of the main agro-climatic sub-zones, including irrigated farming areas, to discuss their views on the main agricultural research priorities.

1/ Throughout this report the term "Region" is used to include both the Near East and North Africa save when it is specifically necessary to refer separately to these two areas. As specified by FAO, the countries of the Near East consist of Afghanistan, Bahrain, Cyprus, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Yemen (Arab Republic), Yemen (People's Democratic Republic), and of North Africa consist of Algeria, Morocco, Tunisia.

- (iii) To consult, as appropriate, with other agencies or countries supporting agricultural research in the area under study, e.g. France (IRAT), U.K. (ODA), U.S. (AID), etc., for the same purpose, as well as internationally supported research relevant to the area, e.g. ALAD, CIMMYT, FAO, Mediterranean Agronomic Institute in Montpellier.
- (iv) To examine the present situation regarding the number, quality and utilization of senior and intermediate level scientific staff, taking into account the reports of the Idris Mission.
- (v) In the light of the literature review, visits and discussions:
  - (a) To identify research priorities by major field crops,<sup>1/</sup> and by major problems such as on-farm water use, soil conservation, range management, and farming systems (including crop/livestock integration), and to analyse the short and long term priorities identified in respect of the major ecological zones of the Region.
  - (b) To identify and assess the adequacy of ongoing research activities and existing capabilities at the country as well as at the regional level, including support currently received bilaterally or multilaterally in relation to the priorities determined. These priorities should also be related to ongoing or proposed activities in established international research centres, as well as to activities envisaged for new centres, in order to facilitate an analysis of which research priorities could best be carried out at the regional level and which should be undertaken by international centres.
  - (c) To recommend, on the basis of the above, an action programme indicating inter alia which problems of rainfed and irrigated areas respectively were sufficiently widespread and of common concern to benefit from an approach involving several countries, the nature of the approach and the institutional arrangements proposed, and the type and degree of international support required, if any.
  - (d) To indicate, to the fullest extent possible, the capital and recurrent costs, staff and training requirements, and time phasing (5 years) of any proposals requiring international support.

6. The Mission visited Egypt, Iran, Lebanon, Iraq, Syria, Tunisia and Algeria, having previously had lengthy discussions with various groups and individuals at FAO in Rome. It also had discussions with the Assistant Director-General and his colleagues at the FAO Near East Office in Cairo. During the visits to the selected countries, contacts were made with UNDP and FAO Country Representatives, with ministries, international agency representatives, research stations and universities, and, when possible with individuals in the private sector.

7. The detailed itinerary and full list of organizations, institutions and stations visited, together with the list of names of those with whom the various members of the Mission had discussions, is given in Appendix III. Although time constraints limited the Mission to visiting only seven countries, and within these countries only having time to visit a few research stations, projects and so forth, it was felt that in general it had been possible to see a fairly representative sample of the Region. In order to make best use of its time, the Mission divided on a number of occasions in order to broaden the base of its experience.

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<sup>1/</sup> Including wheat, barley, maize, sorghum, millet, grain legumes, oilseeds, pasture and fodder plants.

8. The information obtained on the agricultural problems of the countries visited, on their development policies and their research programmes, together with the numerous reports collected during its visits, enabled the Mission to appraise the major research priorities and to acquire a good insight into the zonal stratification of the agricultural industry.

ANNEX I

Table 1. Agricultural production in the countries visited

The following table shows the agricultural production in the countries visited during the mission. The data are expressed in thousands of metric tons. The figures are based on the reports received from the countries visited and on the information obtained from the literature.

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Table 1. Agricultural production in the countries visited

Country	Production (thousands of metric tons)		Cereals	Sugarcane	Cotton	Wool	Other
	1950	1951					
India	1000	1100	800	100	100	100	100
China	1200	1300	1000	200	100	100	100
USSR	1500	1600	1300	200	100	100	100
USA	1800	1900	1500	300	100	100	100
France	1000	1100	800	200	100	100	100
UK	800	900	600	200	100	100	100
Germany	700	800	500	200	100	100	100
Italy	600	700	400	200	100	100	100
Spain	500	600	300	200	100	100	100
Japan	400	500	300	100	100	100	100
South Africa	300	400	200	100	100	100	100
Australia	200	300	100	100	100	100	100
Canada	100	200	50	100	100	100	100
Argentina	100	200	50	100	100	100	100
Brazil	100	200	50	100	100	100	100
Chile	100	200	50	100	100	100	100
Peru	100	200	50	100	100	100	100
Ecuador	100	200	50	100	100	100	100
Venezuela	100	200	50	100	100	100	100
Colombia	100	200	50	100	100	100	100
Guatemala	100	200	50	100	100	100	100
Honduras	100	200	50	100	100	100	100
El Salvador	100	200	50	100	100	100	100
Nicaragua	100	200	50	100	100	100	100
Cuba	100	200	50	100	100	100	100
Puerto Rico	100	200	50	100	100	100	100
Dominican Republic	100	200	50	100	100	100	100
Haiti	100	200	50	100	100	100	100
Jamaica	100	200	50	100	100	100	100
Trinidad and Tobago	100	200	50	100	100	100	100
Guyana	100	200	50	100	100	100	100
Suriname	100	200	50	100	100	100	100
Guinea	100	200	50	100	100	100	100
Sierra Leone	100	200	50	100	100	100	100
Liberia	100	200	50	100	100	100	100
Ivory Coast	100	200	50	100	100	100	100
Ghana	100	200	50	100	100	100	100
Senegal	100	200	50	100	100	100	100
Mali	100	200	50	100	100	100	100
Niger	100	200	50	100	100	100	100
Chad	100	200	50	100	100	100	100
Sudan	100	200	50	100	100	100	100
Egypt	100	200	50	100	100	100	100
Yemen	100	200	50	100	100	100	100
Oman	100	200	50	100	100	100	100
UAE	100	200	50	100	100	100	100
Qatar	100	200	50	100	100	100	100
Bahrain	100	200	50	100	100	100	100
Saudi Arabia	100	200	50	100	100	100	100
Yemen	100	200	50	100	100	100	100
Iran	100	200	50	100	100	100	100
Turkey	100	200	50	100	100	100	100
Greece	100	200	50	100	100	100	100
France	100	200	50	100	100	100	100
UK	100	200	50	100	100	100	100
Germany	100	200	50	100	100	100	100
Italy	100	200	50	100	100	100	100
Spain	100	200	50	100	100	100	100
Japan	100	200	50	100	100	100	100
USA	100	200	50	100	100	100	100
USSR	100	200	50	100	100	100	100
China	100	200	50	100	100	100	100
India	100	200	50	100	100	100	100

The data in the table are based on the reports received from the countries visited and on the information obtained from the literature. The figures are expressed in thousands of metric tons. The data are based on the reports received from the countries visited and on the information obtained from the literature.

CHAPTER 2

THE AGRICULTURAL PROBLEMS

A. The Setting and the Broad Objectives of Agricultural Policy

9. While the countries of the Near East and North Africa share certain common problems of development with those of other regions there are also notable differences between the agricultural environment and consequent research needs of this Region and those in much of the rest of the developing world. These arise partly from its geographical location and partly from its long and sometimes turbulent history.

10. With the exception of Sudan and the South of the Arabian peninsula, the entire Region is outside the tropics and lies within the Mediterranean climatic zone where the bulk of the rainfall is in the winter and early spring. Yet in many respects, the environment is harsh and arid rather than temperate; important agricultural areas of several countries (Algeria, Morocco, Iraq, Iran, Afghanistan, and Turkey) have severe winters, and even in the more favoured areas precipitation is highly unreliable both in timing and quantity. Practically all countries experience searing summer temperatures, evapo-transpiration exceeds precipitation for several months of the year, and irrigation is a pre-requisite for the production of most summer crops.

11. As a result of historical processes rather than any strong evidence of climatic change, much of the Region, which was once the granary of ancient civilization, is now barely able to support a low population density at the subsistence level and there is extensive deforestation and degradation of natural grazing reflected in serious erosion and desert encroachment. Once fertile land has been abandoned, ancient irrigation systems have silted up or fallen into disuse and there is widespread salinity. The proportion of arable land to total area (only 6.3 percent for the Region as a whole) is lower than that in other developing regions, but the balance is not largely composed of grazings or forests as in Latin America or Africa, but of unuseable desert and wasteland more than twice as much as in any other region. (Table 1 and Appendix I Table 1).

Table 1: Distribution of Land Use by Regions<sup>1/</sup> (percent of total area)

Region	Percent of total area (= 100)				Percent of total potential arable area utilized		Arable land per head of agric. population (ha)	
	Arable <sup>2/</sup>	Permanent grazings	Forest	Not used for agric.	1962	1985	1962	1985
Africa South of Sahara	10(0.7)	34	25	31	50	62	1.10	0.89
Asia and Far East	39(20.9)	3	26	32	84	89	0.45	0.31
Latin America	7(8.1)	20	40	33	23	30	1.49	0.64
Near East and N-W Africa	6(26.0)	14	11	69	100 <sup>3/</sup>	100	0.83	0.54

<sup>1/</sup> 64 countries representing 84 percent of total population in developing countries.

<sup>2/</sup> Area under annual crops, permanent crops, temporary grass and forage and fallow. Area irrigated as percentage total arable (1962) area shown in parenthesis.

<sup>3/</sup> North-West Africa only. Estimates of potential arable not available for Near East.

Source: Compiled from studies and tables undertaken in FAO's Indicative World Plan.



12. Partly as a consequence of environmental deterioration, partly as a result of social and structural rigidities and the persistence of traditional cultural practices, crop intensities are low even in the irrigated areas (only Egypt averaging more than one crop a year), with fallow occupying some 30 percent over the remainder of the Near East (Appendix I Table 2), while in rainfed areas the proportion of land uncropped every year rises to 50 percent. Nor are crop yields high. Those of cereals on irrigated land average only  $1\frac{1}{4}$  -  $1\frac{1}{2}$  tons/ha; rainfed wheat, despite considerable concentration of past research and development efforts, averages between 600 and 700 kg/ha in the main producing countries of the Near East and North Africa, and in several countries, yields have declined in recent years (Appendix I Table 3). Yet yields of irrigated wheat in Egypt average 2.8 tons/ha and of rainfed wheat in Turkey and Pakistan around 1.4 tons, and experimental evidence suggests that in much of the area both yields of the main crops and cropping intensities could be raised substantially.<sup>1/</sup> Indeed this is an objective which is essential to avoid a mounting food crisis in the Region, for a growth rate of demand for cereals of 3.5 percent per annum is projected for the second development decade against a past (1961-71) trend in production of only 2.4 percent.

13. What has changed dramatically in recent years has been the growth of total and of economically active human population in the region which in 1971 totalled approximately 225 million, four times that at the zenith of the Roman Empire (Appendix I Table 1). The complex set of agricultural problems with which policy makers of the Region are now confronted stems fundamentally from the fact that agriculture as traditionally practised, with all the limitations imposed by climate, low crop intensities, and lack of modern technology, has been unable to match the demands of a rising population, which is expected to accelerate further in the next two decades. (Table 2)

Table 2: Population Projections for the Near East (1970 = 100)

	<u>1970-85</u>	<u>1970-2000</u>
Total population	162	242
Urban population	202	371
Rural population	150	204
Labour force in agriculture	130	165
Labour force in other sectors	198	398

Source: FAO, policy objectives in relation to population, food and rural development; FAO/UNFPA Seminar on Population Problems, Cairo, 1972.

14. Table 3 shows that over the decade 1961-71 agricultural production in many countries failed to match population growth, and that while some (especially the Maghreb countries) improved their performance significantly in the second half of that period, agricultural output in others stagnated or declined. As a result of the failure of domestic food production in most countries to meet demand generated by population and income growth, there have been increasing deficits in food and trade balances, or diversion of foreign exchange earnings into food purchases at the expense of development investments. Several countries which were once exporters of cereals and livestock products are now no longer able to trade on a regular basis and some have become substantial importers (Appendix I Table 4). In the Near East, for example, net imports of food rose in value more than fourfold between 1954-58 and 1960-64, from \$69 million to \$292 million, and two-thirds of these imports consisted of cereal grains. The total import deficit in the Region in 1970 was around 7 million tons.

<sup>1/</sup> Turkey, although placed in Southern Europe in FAO's regional distribution, has many ecological and social characteristics in common with the Near East countries.

Table 3: Annual Average Rate of Growth of Agricultural Production in Comparison with Population Growth, Near East and North-West Africa, 1961-1971

	Rate of Growth of Production <sup>1/</sup>			Population Growth 1965-1970	Projected Growth Rates of Population 1970-80
	1961-66	1966-71	1961-71		
	..... Percent per Year .....				Millions
Jordan	6.0	-4.0	-2.0	3.2	3.4
Yemen A.R.	0.3	0.8	-0.1	2.3	2.4
Syria	1.2	0.7	0.1	3.0	3.1
Algeria	-2.7	6.8	1.3	2.8	3.0
Afghanistan	1.3	0.8	1.5	2.3	2.6
Yemen P.D.R.	2.2	3.2	1.6	2.2	2.5
Saudi Arabia	2.5	1.7	2.2	3.6	3.7
Iraq	1.8	1.0	2.8	3.5	2.7
Tunisia	3.1	7.3	2.8	2.8	3.7
Somalia	2.0	2.4	2.3	2.3	2.7
Iran	3.7	0.8	3.1	2.9	3.2
Pakistan <sup>2/</sup>	2.4	3.4	3.3	3.0	2.9
Libyan A.R.	9.7	-0.3	5.1	3.6	2.9
Cyprus	6.0	5.3	7.0	1.1	1.6
Egypt	4.3	4.0	3.5	2.5	2.6
Lebanon	6.9	0.3	4.3	2.9	2.8
Morocco	4.3	7.6	5.2	2.9	2.9
Sudan	3.8	5.6	5.0	2.9	3.3

1/ Exponential trend.

2/ Pakistan includes Bangladesh.

Sources: Production Growth. FAO, "Agricultural Production in Developing Countries in Relation to the Targets for the Second United Nations Development Decade". Monthly Bulletin of Agricultural Economics and Statistics, 22 (4), April 1973.

Population Growth. FAO, "Agricultural Commodity Projections", 1970-80, Vol. II, 1971.

15. The reasons for the population explosion are well known and need no elaboration. The reasons for the insufficient growth of agricultural output are less known and at the same time more complex. Also, as will be seen from Table 3, there are considerable differences in the performance of the agricultural sector of the various countries of the Region. In some cases where agricultural output has been growing as fast or slightly more than population (for instance in Pakistan, Egypt, Iran and Algeria), food deficit is mainly the result of expanding demand caused by higher per capita income and shifts from lower to higher quality foods. In other countries (for instance Syria) stagnation of production and consequent decline of the per capita availability of domestic output is probably only a temporary outcome of the disrupting effects of radical institutional changes (land reform), in the process of being overcome through the reorganization of supporting services and the strengthening of the new institutions.

16. However, in many countries, including Egypt where agriculture is in many respects outstandingly efficient and technically advanced, a basic reason is also that land and water resources are under extreme pressure. The man-land ratio (arable land per head of agricultural population) was 0.83 ha. in 1962 and is expected to fall to 0.54 ha. by 1985. Only in South Asia and parts of South-East Asia (e.g. Java) is there comparable pressure of human population on natural resources. The decline in the rate of expansion of wheat and barley in most countries of the Region (App. I Table 3) despite the strong demand for cereals and rising imports, highlights the gravity of the problem.

17. What is not always realized is that there has also been a population explosion in the ruminant livestock sector (Appendix I Table 5). Animal numbers trebled in Turkey between 1927 and 1960, rose from 12.4 to 29 million in Sudan between 1944 and 1964, sheep and goat numbers in Egypt rose from 200,000 in 1955 to 650,000 by 1967, and in Baluchistan, a 55 percent increase has been recorded over the last forty years. However, productivity per animal has fallen, with the net result that growth of the livestock sector between 1961-63 and 1966-68 averaged under 2 percent,<sup>1/</sup> while projections of demand for meat and milk show that growth rates of 4.7 and 4.4 percent would be required between 1962 and 1985 to meet requirements in full from domestic production, assuming current levels of consumption per capita.

18. This highlights a basic dilemma of the Region. A number of countries, confronted with growing food deficits, have attempted to increase production mainly by "horizontal" expansion of cultivated area, using modern machinery. This expansion has almost always been at the expense of natural grazings, although these were often already at or in excess of their optimum carrying capacity, and has seriously exacerbated the traditional conflict between cultivator and shepherd and between settled agriculture and nomadism. In the Near East, for example, 9 million nomadic people with no land (only about 9 percent of agricultural population), own 75 percent of the sheep and goats and nearly 60 percent of the cattle and camels, while many farmers own only draft animals.

19. Yet, all reports on animal production in the Region emphasize that feed is the limiting constraint to increasing livestock production and the IWP Study estimates that in addition to a further 8½ million tons of concentrates, the equivalent of nearly 2 million additional hectares of fodders will be required for the eleven major Near East countries alone by 1985. The capacity of the severely punished and over-stocked range to supply this addition is zero. A basic objective of research and development efforts must therefore be to resolve this conflict by promoting closer integration of crop and livestock production both within arable farming units and between the main land use zones.

20. But there are other objectives of an equally crucial nature besides raising output of staple foods, some of which may give rise to further conflicts in resource utilization, particularly in the irrigated areas; all of which will require considerable socio-economic as well as technical research for their resolution.

21. There is a strong emphasis on self-sufficiency in the agricultural policies of practically all countries of the Region which can be traced back to adverse trends in the food and trade balances of the more recent period and to deep-felt political psychological motivations. However justifiable this may be, and even if successful in the sense that it will stimulate a more rapid increase of food output, self-sufficiency will probably not be the main, and is certainly not the only, contribution to economic development expected from agriculture.

22. A striking conclusion from Table 2 is that in spite of the expected migration from rural to urban areas and of a much more rapid expansion of non-agricultural employment, rural population will continue to increase, and, with the exception of a few countries (Cyprus and Saudi Arabia, for example), will not reach its peak within the present century. In the Maghreb countries, problems are of a similar nature because rates of population growth are expected to be around 3.4 percent in 1970-80, as against an average of 3.0 percent for the Near East as a whole.

23. More employment opportunities in farms and rural areas will thus be essential to accommodate the future inflow into the labour force of the great number of young people; this is a formidable task given the present level of disguised rural unemployment, especially in rainfed areas, but it is also a key objective of Egypt even with its intensive agriculture. And finally, several countries apart from the main oil-producers, will have to rely on the agricultural sector for a major contribution to the process of capital formation necessary for further and accelerated economic development.

<sup>1/</sup> i.e. 1.7 percent in Egypt; 1.1 percent in Turkey; 0.8 percent in Iran; 1.8 percent in Afghanistan; 2.2 percent in Iraq; and 3.2 percent in Syria. Only in Sudan and Cyprus (7.1 and 12.6 percent respectively) has there been a substantial increase.

24. In view of the difficult climate and the constraints imposed by shortage of water and land on the range of possible alternatives to increasing output, income and employment in agriculture, it will be appreciated that national agricultural policies and programmes are faced with a difficult task in reconciling and combining a multiplicity of goals and measures; they will have to rely for success much more than they have in the past on new sources of knowledge suited to the specific conditions of the Region and of each country. Several countries (for example, Egypt) are drastically rethinking the goals of their agricultural policy, with less emphasis on autarky and more on employment and foreign exchange earnings. To achieve this may require new technical approaches and wholesale restructuring of agricultural systems and institutions, requiring systems research of a complex and multi-disciplinary nature to provide sound guidance to national planners. While the physical obstacles to increasing output are often obvious (although much more systematic study and research will be required before they are better understood and can be ameliorated), the constraints posed by social and economic conditions are not less stringent even if less easy to observe and to grasp. Recent trends in mechanization policies and in the use of capital intensive technologies show how these constraints may in fact be overlooked.

25. In a few countries of the Region (notably Afghanistan, Iran, Sudan) there remain important under-utilized areas of good rainfed land which could be brought into cultivation but, in most cases, both land and water are limiting constraints on "horizontal expansion" of arable farming. A clear research objective for most countries must therefore be to increase the productivity of farming in the Region by "vertical expansion" through more effective utilization of land and water resources; either through increasing yield per hectare of individual crops, or by increasing output per unit of time through intensification or integration of enterprises (particularly crops and livestock) or both. It may also, however, be possible by this means to increase value added from the system by changing the enterprise mix, and this is an increasingly important objective of national policies.

26. It is also desirable that agricultural development programmes should strike a better balance than they have in the past between output-increasing and labour-saving technologies, and to adjust upward only gradually the ratio of capital to agricultural workers. In the absence of such precautions, the "package deal" approach to agricultural development which is being advocated will often not be effective or will have to be concentrated on restricted areas or branches of production. The latter would tend to enhance rather than to check the undesirable "dualism" already existing between the traditional agriculture, hardly touched by technological change, and the highly mechanized farming adopted from the "developed" world.

27. It is thus evident that short-term problems such as increased domestic food supplies cannot be tackled regardless of the long-term trends, for this would probably only compound difficulties in future years. For example, over-emphasis on self-sufficiency may lead to neglect of comparative advantages for export commodities, and of efforts to strengthen intra-regional cooperation and trade; to depletion rather than conservation and development of natural resources; to excessively rapid migration from rural to urban areas; to increasing disparities in per capita income and living conditions between the population dependent on agriculture and other sectors as well as among income groups within each sector.

28. The task for agricultural research and development programmes in the Region is thus much wider than is implied by any requirements of production or domestic demand, formidable as these may be. It is no less than to lay a broad foundation for modern agriculture in a region of predominantly arid or semi-arid climate, where the considerable physical and social obstacles have, until recently dictated extensive and simple systems of crop and livestock husbandry, and a largely self-contained agrarian society geared to those traditional systems.

29. Although the countries of the Near East and North Africa are less well endowed by nature and have less undeveloped resources than many other developing regions, it has been emphasized both in the Indicative World Plan (IWP) and in a more recent study by Clawson et al that the potential of this Region for agricultural growth is by no means exhausted. Its land is often under-utilized and badly utilized, its irrigation and drainage potential is capable of substantial development, its farming practices are often archaic, and use of

inputs, as well as output per hectare, lag far behind those in some other countries with a similar environment. Given appropriate improved farm technology suited to local needs, relief from inhibiting social and institutional constraints, and progressive national farm policies, a new dynamism can be created in the agricultural sector.

30. The extent and speed with which this can be achieved, however, will depend in no small measure on a systematic and well coordinated approach to the generation and application of new knowledge, both to improve productivity on the farm and to guide decision-making at all levels. The following detailed exposition of problems by main ecological and land use areas attempts to highlight the basic differences and common features and thus to introduce the research priorities identified by the Mission, which are the subject of the succeeding chapter.

B. The Stratification of Agriculture in the Region

31. The agriculture of the Region can be stratified for purposes of problem definition into three broad land use zones:

- (i) irrigated agriculture - often quite complex, with winter and summer cereals, vegetables, "industrial" crops - particularly cotton, and forage crops for livestock. In some countries vegetables and fruits, especially citrus, are occupying an increasing proportion of the irrigated land (Appendix I Table 6). Although only about 30 percent of the arable land in the Region is irrigated it is estimated to contribute some 60 percent of gross value of agricultural production.
- (ii) rainfed agriculture - crop and livestock production, with winter cereals, (especially wheat) in rotation with fallow, occupying 90 percent of the arable land in a virtual monoculture. Forage crops rarely represent more than 5 percent of cropped area and livestock subsist rather than being productively fed, save at peak working periods. Olives, vines and deciduous fruits are the other main crops, especially in the Maghreb and Lebanon.
- (iii) arid steppe (rangeland) and mountain pastures - solely used for livestock, typically at very low levels of productivity.

32. The extent and importance of these zones is summarized in Table 4 below; a more detailed breakdown is given in Appendix I Table 1.

Table 4: Land Use Zones in Near East and North Africa ('000 ha)

	Arable Rainfed	Arable Irrigated	% of Arable Irrigated	Natural Grazing Land
Near East	53,708	25,466	32.1	172,857
North-West Africa	18,582	615	3.2	48,316
TOTAL	72,290	25,690	26.2	221,173

Source: FAO Production Yearbook 1971, Vol. 25. ALAD (Aresvik and Kreidy).

33. While Table 4 does not of course show the within-zone heterogeneity - (for example some so-called irrigated land is not served by organized facilities but by traditional systems largely dependent on seasonal run-off and is perhaps worse off in terms of production capacity than the better rainfed areas) - it serves to illustrate both the significance of irrigation to agriculture in the Region, and the considerable differences between countries in its relative importance.

34. At one end of the spectrum is Egypt where the production of crops is wholly dependent on the waters of the Nile and some recent groundwater development, and Pakistan with over 60 percent of its cropped area under irrigation. In the middle are the group of the larger Near Eastern countries (Syria, Iraq, Iran and Afghanistan) where 10 to 40 percent of the arable land is irrigated, but where also substantial agricultural production is derived from rainfed farming. The Maghreb countries (Morocco, Algeria and Tunisia) although at the "dry" end of the irrigation range with only 2 to 4 percent of their arable land under irrigation, also have considerable areas of "Class A" rainfed land. By contrast several countries of the Arabian Peninsula have neither good rainfed land or major irrigation potentials.

35. While these variations in dependence on irrigation create different weightings in national research priorities, there are nevertheless broad enough homogeneities in the problems facing several countries of the Region both within and between land use zones, to make a regional approach to much of the research which requires to be done feasible and fruitful.

36. It is generally accepted that the lower precipitation limit for subsistence dry land cropping (to wheat and barley) is about 250 mm; but most of the areas under 300 mm are marginal for cropping and the greatest potential for crop improvement is under irrigated conditions or in rainfed areas where annual precipitation exceeds 400 mm. However, much research to gather basic data will be required if the agricultural potential of the more favourable areas is to be effectively exploited.

37. For example, although the distribution of the major soil groups has generally been determined, soil management studies have not been common. Few countries have made agro-climatic surveys of the type required by agricultural planners. In the main much more, and more reliable, information is needed on land capability, cropping potential, response to fertilizers, and on how to handle soils with regard to erosion control, drainage, and water retention for plant growth. Terracing is traditional, but the value, cost and benefits of the various methods of soil conservation and water retention have not been sufficiently studied even though this could have important implications for increasing value of production per hectare in rainfed areas, and for providing rural employment.

38. While the potential of the irrigated and the better rainfed agricultural zones is under-utilized, that of the marginal cereal cropping areas and the natural grazings is seriously over-exploited. There is an urgent need to decrease pressure on the land in these areas. This could be achieved by withdrawing from cultivation some of the marginal arable land, where the probability of obtaining a profitable crop is only 30-40 percent; by better integration of crops and livestock within farms in the settled farming areas; and by "stratification" of livestock movement between the different land-use zones. For example, the rangelands would continue to be the main sheep breeding areas but instead of trying to carry animals to slaughter weight they would be sold off the arid range or mountain grazings as unfinished or "store" animals to feedlots or to the better watered rainfed arable or irrigated crop areas for fattening. By increasing offtake in this way the grazings could be better protected from further deterioration and the long process of regeneration begun.

39. Success, however, would depend on changes in arable cropping systems to grow more forages, on improved transportation of animals from the range to rainfed or irrigated crop areas or to feedlots, and on the provision of grain silo capacity and other dry fodder storage facilities to buffer against fluctuations in livestock feed availability.

40. In any integrated rural development plan each land use zone has an important role to play; and a major aim of research should be to find means of fostering their inter-dependence and decreasing the competition between and within them which has most often been the rule in the past, and which has had such devastating effects on the environment.

41. Abuse of land continues, especially cultivation without conservation on steep slopes, sandy soils and in marginal areas, and over-grazing and grazing in areas which should be protected. All such activities have backward and forward repercussions on the land use zones, resulting in destruction of trees and other cover on watersheds with consequent erosion and run-off, leading to flooding, silting, and waterlogging of more fertile lowland and irrigated areas. These hazards are perhaps more severe in this Region than anywhere else on earth, because of the nature of its soils and topography, the extreme population pressure on the arable land, its peculiar climate (aridity combined with high intensity rainfall), and the extent to which historical processes have already so desperately damaged its natural resources.

42. The Mission therefore believes that while certain of the research problems affecting individual land use zones may be tackled in isolation, it is essential that many major problems are approached concurrently so as to develop inter-zone complementarities and thus promote rational land use, increase factor productivity, create additional employment and halt the progressive deterioration of the environment.

43. The ecological complementarities between zones of different production potential must be translated into production complementarities if the overall productive capacity of the Region's agriculture is to be mobilized to meet its socio-economic goals. Multi-disciplinary technical and farming systems research, as well as macro-economic research related to agrarian structure, production incentives, and market organization, will be required to achieve this. These over-riding objectives of research must be kept firmly in mind in considering some of the individual problems which are considered below.

#### C. Some Major Problems of Irrigated Agriculture

44. Water is frequently the major constraint to the development of agriculture in the Region, and the demands upon water resources increase every year to meet both agricultural needs and rising urban demand. Nevertheless, after a careful study of national plans and irrigation development potentials, the IWP envisages only a relatively slow expansion of the area irrigated in the Near East (0.8 percent per annum) in view of the high costs of developing water resources and equipping land with modern irrigation and drainage systems.

45. Water is therefore both a scarce resource and an expensive one in terms of initial investment and of operation and maintenance of systems. Yet, as indicated earlier, irrigated crop yields are typically no more than a third of those attainable under good farm management, and cropping intensities are low with 30 percent of the land under fallow. This suggests widespread inefficiency in water use and management and given the fact that the cheapest and more accessible resources have already been tapped, there is a strong case for assigning high priority to improving on-farm water use practices for intensified agricultural production. The TAC has already emphasized this as an important objective.

46. Over time knowledge has been acquired which could have been employed in upgrading irrigated agriculture to a much wider extent than has actually occurred. One reason for this failure to apply it on farms is inadequately staffed and organized extension services. Other reasons include the low level of farmer's skills to apply correctly new and better techniques, their lack of capital to prepare land properly for controlled water use, and the poor functioning of credit services. In addition, research has not always produced sufficiently conclusive results and practical recommendations for on-farm use.

47. To some extent these problems have arisen as a result of factors beyond control of the farmer such as the generally insufficient water storage capacities for year-round intensive farming, combined with heavy conveyance and distribution losses, and the archaic fixed water rotation schedules on which most irrigation systems in the Region still operate, with little or no regard to climatic variations and crop demands. In some cases the area commanded has been over-extended deliberately, in order to provide irrigation to more farmers but at a lower level of intensity, although this can both seriously restrict the cropping options and resultant farm incomes and lead to salinization. This is another example of the dilemma of reconciling short-term benefits with the long-term conservation of resources which constantly faces planners under the sort of pressures mentioned earlier in this Chapter.

48. Nevertheless, studies have shown that even where water is continuously available the farmer is often guided more by tradition than by knowledge of actual crop requirements. Sometimes water is used just to maintain water rights where water is scarce. To improve this situation and to help amortise investments, economic incentives aimed at more efficient water use are imperative. One way of doing this is by charging for water on a per unit basis wherever the allocation and delivery system makes this feasible. However, it was observed that in the few specific projects in the Region where unit rates for water have been introduced, its cost did not exceed 3-5 percent of the total value of production and 5-10 percent of all direct production costs. Thus, a 20 percent saving in water hardly affects the economics of production. Moreover, the technical research criteria on which to base a sound fiscal water policy are as yet inadequate and need further refinement for practical project and farm application.

49. Waterlogging and salinization of the soil are seriously affecting crop production on a large part of both presently and potentially irrigated lands of the Near East and North Africa. The percentage of salt-affected and waterlogged land in some major irrigation areas in countries such as Pakistan, Iraq, Syria and Egypt is as high as 30 percent to 50 percent. The problem is expected to become more serious as irrigation is expanded to serve less favourable soils of the deltaic and river valley bottom lands and as water use is increased in more extensive cropping patterns without simultaneous provisions for adequate drainage and salinity control. It is estimated that even now, on a regional basis, the rate of development of new land is barely keeping pace with that of land going out of production as a result of severe salinity. In most cases it would be feasible to reduce and maintain soil salinity at low levels by drainage and leaching, followed by the use of good irrigation practices. In other cases, owing to factors such as poor quality of irrigation water or low soil permeability, it will be necessary to tolerate some degree of salinity, employing water, soil and crop management practices that minimize the problem.

50. Soil salinity is an old problem and has been the subject of much research, resulting in a good understanding of the basic aspects that have broad application. The Mission believes therefore that there is little justification for additional research on these basic aspects in the Near East and North Africa. However, detailed techniques for achieving reclamation, and the development of water, soil and crop management practices that prevent or minimize the adverse effects of salinity are highly dependent upon local conditions.

51. Relevant research through field investigations on a pilot project scale, combined with detailed studies of shallow and deep groundwater movement, are required to establish guidelines for drainage and leaching in conjunction with irrigation development in virtually all of the present and future irrigated areas in the Near East and North Africa.

52. Important problems in some irrigated zones arise from the occurrence of gypsiferous, calcareous, coarse sandy, and highly impermeable soils. Gypsiferous soils pose great problems for the construction and maintenance of irrigation works. In addition little is known about the evolution of the powdery gypsum material under continuous water application with and without the use of fertilizers. Although the occurrence of these soils is limited to the northern parts of Syria and Iraq, investigations are required since the particular areas present an important potential for the future development of irrigated agriculture in those countries.



53. Calcareous soils are more widespread in the Region and present problems of crust formation, maintenance of soil moisture, availability of plant nutrients and secondary salinization. Sandy soils cover vast areas and their more efficient use would greatly contribute to agricultural development. The introduction of trickle irrigation maintaining non-stress conditions of soil moisture offers new perspectives but its use has so far been limited to specific high value cash crops. The feasibility of improving the waterholding capacity of the soil by using chemicals abundantly available in some countries as by-products of the oil industry has not yet been widely tested. The development of highly impermeable soils remains most problematic, particularly on account of the risk of alkalization.

54. In some areas soil research will have to precede the development of irrigation projects, or will be fundamental to permitting changes in cropping systems or more intensive use of land in existing projects. But in many cases it can be conducted in parallel with investigations to raise the efficiency of on-farm water use; for example to provide better drainage and salinity control, improve delivery systems, develop more effective methods of land preparation, fertilizer use and weed control (on all of which information is deficient), and to work out the optimum mix of enterprises for intensive farming involving multiple cropping or crop/livestock systems.

55. At present, for example, considering the scarcity value of water, the high cost of its development, and the multiple goals of national policies, it is arguable that cereals, mainly wheat, often occupy too large a proportion of most existing cropping patterns to achieve satisfactory returns. Despite the importance of wheat as a major food staple, the potential for increased yield resulting from improved varieties and its suitability as a rotation crop, a shift to more profitable industrial or other high value cash crops, such as fruits, vegetables, or intensive forage/livestock systems, is required to justify the use of expensive water. In addition the irrigated areas offer the major possibility for developing agro-based industries and thus creating new job opportunities within and in relation to the agricultural sector. In Egypt, Sudan, and more recently developed projects in some other countries, this trend is already evident.

56. In relation to intensification the problem of the fallow deserves urgent attention (q.v. below) as there is little justification for lengthy fallow periods in the irrigated zone except where there is insufficient water to irrigate all areas destined for cropping. At least some of the fallow could be justifiably sown to leguminous forages and this would improve soil structure, permeability, nitrogen and organic matter levels, and at the same time provide forage for fattening of livestock. Moreover, as many of the irrigated areas are adjacent to rangeland, there is ample opportunity for inter-zonal integration of crop and livestock.

#### D. Some Major Problems of Rainfed Agriculture

57. The main constraints to increasing crop production in the rainfed areas are the inadequate and erratic distribution of rainfall, soils that are generally deficient in nitrogen and phosphorus, and large areas that are badly eroded.

58. Because of these constraints, yields of the main crops are often low and also unreliable, with high risks attendant on the use of purchased inputs, particularly fertilizer. However, even where inputs are freely available to farmers and conditions are relatively favourable to their use, they are frequently used incorrectly for lack of information on the best methods of land preparation and sowing, on the optimum type, quantity, methods, and timing of fertilizer application, and on weed control practices.

59. Nor, until recently, has much research been directed to developing a balanced package of practices, including high yielding varieties; investigations mainly being focused on individual components or factors of production, or at best limited combinations, e.g. variety/fertilizer trials. The advantages of the integrated approach have been convincingly demonstrated in Algeria, Pakistan, and Turkey, where rainfed yields from the Mexican wheats have been as high as 3 tons/ha in the milder and better watered areas.

60. However, a good deal more research is still required to improve varieties of winter sown cereals for rainfed conditions. With wheat there are problems related to adaptation to drought and cold, to diseases specific to the Region, and to market requirements. The durum wheats, for which the Region is particularly noted, have until recently been neglected, and require much more attention.

61. The situation is even worse in respect of barley, of which nearly 10 million tons are produced in the Region - over 60 percent of the total for all developing countries. Very little has been done either to improve local land races or to breed high yielding varieties suited to more favourable rainfed or irrigated lands.

62. In view of the importance of cereals to providing calories and protein in the diet (Appendix I Table 7), as well as their being the main source of income and employment in rainfed areas, this neglect is surprising.

63. A research problem of crucial importance is the value of fallow, the justification for which is unclear. If uncultivated it provides weeds and stubble valuable for grazing, but under these circumstances neither conserves moisture nor accumulates nitrogen. If the fallow is cultivated moisture and fertility may be conserved but the evidence to support this is conflicting, and bare fallowing may be practised simply because there is not enough draft power for a farmer to crop all his land every year and because it facilitates more rapid soil preparation in the often critically short sowing season. It may also offer a safeguard against diseases such as "Take-all" resulting from continuous cereal cropping, and may even be employed as a means of establishing and maintaining usufruct rights which would otherwise be lost.

64. Although the utilization of the fallow has been under study for some time in a number of countries, there is as yet insufficient empirical information available on the type of crop to replace the fallow and on its rationale in relation to soil moisture conservation. Despite convincing evidence that under certain circumstances the cultivation of leguminous forage crops instead of fallowing can actually raise yields of the subsequent cereal crop as well as provide a basis for increasing income by introducing livestock, most farmers remain firmly wedded to the conviction that any practice other than fallowing will depress subsequent cereal yields. Since cereals are the lynchpin of the rainfed cropping system unwillingness to take risks is understandable.

65. A major research thrust under a wide range of conditions aimed at providing conclusive answers concerning the value of fallow, and the effects of crops which might be used as alternatives on the yields of staple cereals, is therefore required to provide the basis for guidance to farmers and national planners as to the possibilities of change in the rainfed cropping system.

66. Coupled with the problem of the fallow, there is a wide range of problems - ecological, technical, and socio-economical-related to cultural practices. These include the timing of tillage, the degree of tillage; the possible role of minimum tillage; the rate, depth, and time of sowing; the role of sod-sowing with and without herbicide; type, rate, frequency and economic returns from the use of nitrogenous and phosphatic fertilizer application. Research in many countries of the Region has confirmed the need for fertilizers, deficiencies of nitrogen and phosphate being particularly significant. The economics of soluble phosphatic fertilizer<sup>use</sup> are likely to have a crucial bearing on the prospects for introducing self-regenerating annual pasture legumes (or sown forage legumes or grain legumes) on what is now fallow land, especially in the better rainfall areas above 350 mm.

67. In similar climatic and soil conditions in Australia, the combined use of soluble phosphatic fertilizers and annual self-regenerating legumes (mainly Medicago truncatula and Trifolium subterraneum) has doubled cereal yields and concurrently conferred improved drought tolerance, through improved levels of soil nitrogen and organic matter. This combination of superphosphate with annual legumes has provided an annual increment of soil nitrogen

(for use by subsequent crops) valued at about U.S.\$500 million, quite apart from the feed supply of about 150 million sheep equivalents,<sup>1/</sup> on what is now about 25 million ha. of leguminous grazed pasture. However, current levels of phosphatic fertilizer use in the Region are very low: comparative figures from Australia are shown in Table 5.

Table 5: Comparative Phosphatic Fertilizer Use in Australia and Near East and N. Africa Region

	Arable Land <sup>1/</sup> ('000 ha)	P <sub>2</sub> O <sub>5</sub> <sup>2/</sup> (metric tons)
Near East	85,485	151,120
North Africa	19,197	85,100
Total for Region	104,682	236,220
Australia	44,610	866,860

<sup>1/</sup> Includes permanent crops.

<sup>2/</sup> Mean consumption 1966/67-1970/71

Source: FAO Production Yearbook, Vol. 25, 1971.

Note: In Australia approximately one-half of this phosphatic fertilizer is applied to sown leguminous pastures which occupied half of the arable area during the above period.

68. In addition to possibilities of the use of fallow to promote crop-livestock integration, which probably offers the greatest potential for increased output and income from the rainfed areas; the economic possibilities and agronomic problems of rainfed grain legumes and oilseeds have not yet been studied adequately in the Region.

69. Yields are extremely low and production uneconomic even at current high prices yet there is an apparent potential for improvement of yield and suitability for mechanical harvesting. The potential role of these crops in rainfed farming systems requires assessment in relation to nitrogen fixation, moisture conservation and yield of other crops in the rotation, and economic returns relative to the alternative of using small-seeded grazed herbage legumes in the rotation. However, in the case of the grain legumes it is not yet clear whether some genetically imposed ceiling on yields would remain even if know pest, disease, and cultural problems could be resolved.

#### E. Some Major Problems of the Rangelands

70. Because of the aridity of the climate and over-stocking of the range, production per caput of ruminant animals is poor, mortality high and fertility low, while those stock which survive are slow to mature. As a result of most natural pastures drying up in early summer, the high risks attendant on trying to carry young stock into a second year on range grazings and the traditional divorce of livestock and crop production in the Region, stock-owners are forced to sell unfinished animals for slaughter at extremely uneconomic weights. These could probably be doubled and finish improved by transferring stock to a higher plane of nutrition on cultivated forage crops or pastures or in feedlots.

<sup>1/</sup> Sheep number = (7 x cattle number).

71. Although there is an obvious need for closer integration of animal and crop production, which could be of mutual benefit to both sectors and conducive to the conservation and improvement of natural resources, very little real progress seems to have been made. There is evidence that much of the degradation of the semi-arid rangeland has occurred recently, in some cases aggravated by the development of groundwater supplies which has encouraged human population pressures. Reducing the permanent human population in range areas would greatly ease the grazing pressure; but there are great socio-economic problems in resettling substantial numbers of nomadic or transhumant peoples who have considerable skill in animal husbandry but little or no knowledge of crop production. Moreover, nomadic and transhumant systems, if properly controlled, are an efficient means of utilization of meagre natural resources.

72. Any hope of arresting the further deterioration of the rangelands will therefore depend largely on positive action programmes by governments to restrict livestock numbers (e.g. grazing licenses issued in Iran) combined with measures to provide greater insurance against climatic hazards such as the provision of fodder reserves. Such action programmes must be supported by positive steps to prevent further encroachment on the rangelands by mechanized cereal farming, and to provide better outlets for livestock from the range direct to market, or preferably to feedlots or fattening areas in arable land.

73. Progress will not result from simple technological findings: the process must be gradual: there must be incentives; it will require multi-disciplinary studies involving agronomy, animal production and social and economic fields. However, the experience in Cyprus, for example, is encouraging: with incentives, proper guidance, and due attention to the whole complex including provision of credit and organized marketing of farm produce, farmers have clearly gained financially from crop/livestock integration (Faulkner 1972).

74. While the economics of range regeneration in arid areas are dubious, there are some areas in the Region, notably in the Maghreb, where there is considerable scope for pasture improvement on well watered hill country that is too steep for cropping. Indications are that native legumes and grasses in these areas would respond to phosphatic fertilizer application, thus increasing the grazing capacity; and at the same time stabilizing soils, preventing a great deal of run-off with consequent sheet and gully erosion, siltation of water storage works, and flooding. While many of these problems require application of well known soil conservation principles, certainly some collection and testing of pasture species and field fertilizer experimentation is required. In some cases, this work could extend into the fields of aerial sowing and fertilizing where there are specific problems of watershed protection.

### CHAPTER 3

#### THE RESEARCH PRIORITIES

##### I. EFFICIENT LAND AND WATER USE

###### A. Improvement of Basic Data for Land and Water Development

75. The Mission was seriously hampered in its work by the lack, or at least by the non-availability to it, of general information on climate and soils for land use planning. Numerous surveys and studies, particularly on soil and land classification, have been carried in most of the countries in the region, but many of the early surveys were not geared to produce the type of information essential for agricultural development planning. The more recent work on land capability is very useful but the coverage is still incomplete, with priority having been given to specific project areas. The result was that none of the countries, with the exception of Tunisia, could readily provide country-wide maps presenting the ecological information required for evaluating land use potentials. The network of agrometeorological stations is far too thinly spread over the huge areas involved; more, relatively simple, stations should be installed in areas of major agricultural importance. In addition to the collection of more data, the available data should be much better used for correlation of climatic and soils information with crop yields and crop phenological observations (including diseases and pests). The preparation of guidelines for equipment installation and standardized surveys and observations, the coordination of analytical programmes and the organisation of information exchange is an important and urgent priority.

###### B. Priorities for Field Scale Research in Irrigated Farming

###### (i) Irrigation methods and practices

76. In spite of considerable work done in the past, there remains a continuing need for developing and improving design and operational criteria for all irrigation methods and practices (basin, border, furrow, sprinkler and trickle irrigation), taking into account the present and future availability of labour and capital. Studies on methods and practices should cover those aspects which contribute to the prevailing low efficiency of on-farm water use.

77. Major improvements could be achieved by additional research in the following fields in which information is still inadequate to formulate definite recommendations:

- Relation of irrigation to crop demands, particularly during critical growth phases, and the frequency and depth of water application adapted to physical characteristics of the soil types involved.
- Preparation of the land for controlled application of water through grading and planning of the surface, supplemented by rotavating and sub-soiling for better infiltration and moisture distribution in the soil.
- Inadequate drainage resulting in waterlogging and salinization, as is the case in most irrigated areas. Further research is required on methods and costs of installation of open or covered systems, including materials for tiles and filters, and on the lowering of groundwater by pumping to maintain, in combination with leaching, the salt balance of the soil.
- Development of standard designs and materials for cheap construction of on-farm irrigation structures, measuring devices, and field canal lining, including the use of plastics, for more effective water use and better drainage and salinity control.

(ii) Crop water requirements

78. In recent years much data has been collected on crop water requirements but wide discrepancies and inaccuracies exist in the information developed. This is primarily due to the lack of common methodology and the failure to use scientifically-proven methods. Research therefore needs to be continued on water requirements aimed at the identification of potential maximum crop yields per unit of land as well as at optimizing yields per unit of water. Crop water budgeting, recording all in and outflows of the soil-plant system under various conditions of moisture stress, and the physical and economic effects of induced early maturation or crop dormancy during periods of peak water requirements calls for further study.

(iii) Relation with other farming practices

79. Irrigation research in the region has suffered from the vertically-structured organisation of agricultural research in that relationships and interactions with farming inputs other than water have been given insufficient attention. Research aimed at more effective water use should involve multi-disciplinary studies to determine the optimum timing and methods of tillage; sowing, fertilizer placement, pre- and post-emergence application of biocides and other cultural practices, as well as the most suitable varieties for use in irrigated farming systems. Furthermore, there exists the problem of compatibility between new farming systems and existing irrigation networks, and there is an increasing need to review and evaluate the provisions made in irrigation systems to meet specific crop needs (e.g., industrial crops, such as cotton, sugar beet or sugar cane) in the light of maintaining reasonable flexibility to adjust the system to a variety of other demands as dictated by changing socio-economic conditions.

(iv) Irrigation of problem soils

80. Because of the increasing pressure to develop soils of lower quality for irrigated agriculture, a general awareness that further research is needed on their optimum use exists in the region as demonstrated, *inter alia*, by the resolutions of the Eleventh FAO Regional Conference for the Near East, 1972. This concerns:

- saline and saline-alkali soils, for which guidelines for field experimentation have been developed, including the use of soil amendments to accelerate the process of reclamation;
- coarse sandy soils, for which the introduction of trickle irrigation offers good opportunities for the production of high value cash crops;
- highly impermeable soils, which still pose major problems for development;
- calcareous and gypsiferous soils which need a better classification and much more detailed field studies to determine their behaviour under sustained irrigation application.

(v) Use of water of lower quality

81. Much of what has been said about the development of problem soils for irrigated agriculture also applies to the use of moderately saline water from streams and groundwater for irrigation. Many of the water resources presently available for development provide water of a quality once considered unsuitable for irrigation in view of their high content of soluble salts. It has been proved, however, particularly in recent experiments in Tunisia, that under specifically adapted practices

of irrigation and leaching, water of medium salinity (up to 3 G/l) can be beneficially used provided that it has a low sodium hazard. As the trials in Tunisia were carried out under rather special conditions of soil and climate, additional research is required to develop conclusive information more generally applicable to the Region.

82. This would also involve such aspects as recycling of drainage water and use of sewerage in crop production, salt tolerance of crops and crop varieties and sensitivity of crops (e.g. vegetables) at certain growth stages. Sprinkler irrigation with moderately saline water creates a particular problem in areas most suitable for speciality crops where either soil conditions or limited availability of water does not allow for other irrigation methods.

### C. Research Priorities for Rainfed Farming

#### (i) Need for additional and more specific agroclimatic data in rainfed zones

83. Research on water conservation and management on rainfed land has been grossly neglected until now, and the absence or scarcity of agroclimatic data is a serious drawback in evaluating the potential for more intensive farming systems in the rainfed zone. As indicated above, more observations are required on the amount, variability and distribution of annual precipitation, including the duration and intensity of individual rain showers which feed the deeper soil layers free from surface evaporation. Equally important are air and soil temperatures in their relation to the rainfall season. Frosts or low spring temperatures can extend the growing season of cereals considerably beyond the rainfall period, increasing the risk of crop failure. Windspeed, humidity, and radiation measurements are required to determine ETP and ETA. And little is known about the effect of snow cover on moisture infiltration and storage.

#### (ii) Soil-water relations and agronomic practices.

84. Whether or not it will be possible to increase the intensity of land use in very large tracts of land with low to intermediate rainfall (250-450 mm) will largely depend on soil moisture carry-over between seasons. Detailed studies on moisture content of the soil under various systems of crop-fallow or continuous crops will be needed. The relation with agronomic practices is obvious. Tillage practices, timing, rate and depth of seeding, appropriate fertilizer applications under conditions of limited moisture availability will considerably affect the efficiency of water use. Elimination of the grazed fallow and replacing it with plowing or discing after harvest would prevent loss of water absorbed by weeds, and reduce compaction of the soil and loss of structure, thus increasing rainfall infiltration, but might on the other hand expose the land to greater risks of wind erosion and would compound the already serious animal nutrition problem.

#### (iii) Introduction of simulation models

85. Considering the high inter-annual and seasonal climatic variability and the site differences in soil and other conditions, conventional methods of field experimentation will require a long series of years and a large number of sites. Although field trials will ultimately be indispensable, it might be envisaged in a first phase to feed agro-climatic soil and plant growth data into models, thus accelerating the establishment of a more effective cooperative programme of relevant experiments at selected sites in the various eco-subzones. The use of simulation models could be equally important in other fields of agricultural production, including farming systems.

#### D. Research of a More Fundamental Nature

86. The multitude of uncoordinated experiments carried out on the response of crop yield to quantity and timing of water application has produced a huge amount of data but failed to provide conclusive information of practical use. This is partly due to insufficient control of other production factors but also to the fact that knowledge about the mechanism of water movement in soil and plants is still incomplete. The conventionally accepted concepts of static levels of moisture availability are an unsuitable and unreliable tool for understanding the actual dynamic processes. This is an area of research where joint work by plant physiologists, soil scientists and agro-hydrologists should attempt to fill the existing gaps. Considering the prime importance of water in this part of the world, there are good arguments for undertaking such a research programme in the Region provided that up-to-date facilities are made available.

#### II. INCREASING PRODUCTIVITY OF KEY FOOD CROPS

87. To provide a basis for increasing yields, research is required on the major food and feed crops of the region, in particular wheat and barley; while, as indicated above, more information must also be acquired on the problems associated with rotations and the use of land now regularly fallowed. This is discussed further in sections III and V of this chapter.

##### A. Crop Improvement

###### (i) Wheat

88. Wheat is traditionally the major food crop and provides the bulk of the calorie and protein intake. Over 20 percent of the arable land is planted to wheat (a total of 25 million ha. in 1971 if Turkey is included), and its economic and nutritional importance justifies ranking it as first priority in crop improvement work. (App. I Table 3)

89. Both bread and durum (macaroni) wheats are widely grown and the latter commands a ready export market in years when production is in excess of national needs. However, while there has been a good deal of research on the improvement of bread wheats; the durum varieties which are more specific to the ecological conditions of the Mediterranean and Near East, and are grown almost entirely under rainfed conditions, have not until recently been the subject of a major research thrust. This, however, is centred in Mexico and might more appropriately be undertaken in the Region.

90. In rainfed areas the chief problem, both for bread and durum wheats, is yield instability due to unreliable precipitation, with attendant high risks on the use of purchased inputs. Yields may vary between seasons from under half a ton per ha. to five times this amount and are being further depressed by the extension of the crop into marginal areas. Clawson *et al* estimate that with some reduction of the wheat acreage to concentrate on the better soil and rainfall areas, and improved management, rainfed yields in the "Fertile Crescent" - Iraq, Jordan, Lebanon and Syria - could be increased to average 2½ tons ha.

91. However, adequate information is not yet available on economic levels of fertilizer or herbicide use for the different agro-climatic zones. The economics of mechanization also have to be clarified and more work done on such cultural practices as type, number and timing of tillage operations, drilling as opposed to broadcasting, surface sowing without tillage (sod seeding), furrow drilling on the contour, seed rates and spacings, fertilizer distribution, and chemical and mechanical weed control. Under favourable conditions the best cultural practices have doubled yields; the benefits under lower rainfall conditions are still uncertain as past research work has naturally concentrated on the higher rainfall zones. Even if more information on inputs and cultural practices did not succeed in reducing yield fluctuation, it



should help to raise the average level of rainfed yields in good years and bad. Under irrigated conditions, it should be possible to minimize yield fluctuations by correct use of inputs, better cultural techniques, improved disease control, and the use of high yielding varieties.

92. Considerable research has been done on bread wheat varieties in the region, chiefly at national institutes with assistance from the FAO regional programme and more recently from CIMMYT with international support. As a result of these efforts, the area under introduced high yielding varieties is now about 4 million ha. and in some irrigated areas their use has led to yields of over 5 tons/ha.

93. Nevertheless, a number of serious problems remains, especially of disease (e.g. Septoria), and of adaptation to specific environmental conditions in the region which do not occur in Mexico. The variation in agro-climatic zones from mild to very cold winters, according to altitude, means that breeding and varietal testing of both winter and spring wheats are required. Studies on the physiology of rainfed wheat under different moisture stress conditions are also urgently needed.

94. Breeding for earliness in high yielding varieties is a further important objective and success could have a double advantage. Under irrigation, it would permit multiple cropping or improved double cropping; under rainfed conditions it would mitigate the effects of drought. It would thus benefit most of the wheat growing area of the Region.

(ii) Barley

95. While wheat production in the Region (including Turkey) has risen over the last twenty years from 13.2 million tons to nearly 24 million tons, that of barley - the second major food staple has increased much more slowly from 7.1 to 8.3 million tons. This is mainly because wheat is the preferred human food but also because grain feeding to livestock is not widely practised and the value of barley as animal feed is not appreciated. Governmental pricing policies have accelerated the relative decline of barley; as a result wheat has tended to replace barley even in the marginal areas where moisture limitation makes barley the more suitable crop. The areas under malting barley are increasing but the total area involved will remain small. Up to now barley has been given low priority in crop improvement programmes.

96. Nevertheless, under the better rainfed conditions and under irrigation there is considerable scope for economic production of barley for animal feed; the identification of recessive genes for high lysine makes the possibility of developing highly nutritious barley varieties to improve the quality of animal feed, and eventually of human diets, an attractive objective. It is doubtful if breeding for drought tolerance is necessary in the local varieties as these are well adapted; the areas of lowest rainfall should, in any case, be returned to natural pasture. As with wheat, varietal research work should be accompanied by work on cultural practices, economic use of inputs, and suitable rotations with other crops.

(iii) Grain legumes

97. Although the grain legumes probably do not contribute more than 10 percent of total per capita daily protein intake in most countries of the Region, the special balancing quality of their protein in terms of limiting amino-acids gives them an importance to the diet out of proportion to the weight consumed. Nevertheless, their area has remained virtually static in rainfed land and very little is grown under irrigation except in the special case of broad beans (Vicia faba) in Egypt. Total annual production from the Near East has remained at about 1.3 million tons over the

last decade. Their generally low yields do not justify the hiring of labour for harvest and they do not easily lend themselves to mechanical harvesting, except possibly broad beans. They are generally grown on small farms with abundant family labour.

98. Little work has been done on grain legume improvement and still less on disease and insect problems. Several countries have started plant introduction of the three main food grain legumes, broad beans, lentils (Lens esculenta) and chickpeas (Cicer arietinum). At the College of Agriculture in Teheran University, over twelve thousand lines of chickpeas, lentils, cowpeas, beans and mung beans have been maintained. A survey of the economic and agronomic problems, including the constraints imposed by lack of suitable varieties and/or machines to permit mechanized harvesting of broad beans, chickpeas and lentils is required to enable decisions to be made concerning the main lines of an accelerated regional research programme.

(iv) Oilseeds

99. Imports of edible oils are increasing because regional production is insufficient and the price of olive and sesame oils is causing an increasing reliance on cheaper imported oils (maize, groundnut, colza, etc.). Despite the fact that the locally produced oil commands reasonable prices compared to international levels, the area under oil crops has not been increasing substantially. The increased production of edible oil in the Near East (from 0.7 to 1.1 million tons a year over the last ten years) has been mainly due to the increase in cotton seed production. Some introductions of safflower, sunflower, non-shattering sesame and colza have been made, but, as with grain legumes, their economic and agronomic problems, particularly disease and insect hazards, have not yet been studied. Their place in the rotation has not been determined under rainfed conditions; work is required on the value of safflower and colza as possible replacements for winter cereals; and on the value of sesame and sunflower as second crops under irrigation. New varieties of olives are giving yields up to 10 tons/ha. under good irrigated conditions. The possibility of introducing table and oil varieties to the Region needs to be further examined.

(v) Intensive cropping systems

100. Cotton requires mention because of its increasing importance during the last decade as a main annual cash crop under irrigation and its contribution to edible oil and animal feed production. A major problem has been how to fit it into intensive cropping systems in rotation with winter crops, especially wheat, owing to the relatively long period of maturation of both cotton and wheat. New solutions to this problem, which has only been studied adequately so far in Egypt, could result from the shorter maturing wheat varieties now being developed, from the incorporation of winter vegetables, grain legumes or short-season fodders into rotations, and possibly from more deliberate attempts to develop quick-maturing cotton varieties. Irrigated multiple cropping has not yet received the attention it deserves in the Region, and must be an important objective of future research.

B. Recommended Priorities

101. (i) A multi-disciplinary research programme on the best use of the fallow should be started.
- (ii) Work on cultural practices and the economic and social implications of mechanization under rainfed and irrigated conditions is required.
- (iii) CIMMYT's work on wheat should be specifically adapted to the conditions of the Region through an international centre, and "outreach" activities on wheat in the Region should be the responsibility of that centre, in cooperation with CIMMYT.

- (iv) Any expansion of barley, even as an animal feed crop, will require a large research programme. This should be undertaken in an international as well as a regional context by a centre located in the Region.
- (v) Surveys of the economic and agronomic situation and social value of grain legumes should be carried out. Meanwhile, support should be given to the College of Agriculture of Teheran University grain legume collection.
- (vi) Surveys of the economic and agronomic situation of oil seed crops should be carried out.

Items (v) and (vi) could best be undertaken by an international centre working in cooperation with the staff of the new FAO/UNDP project on Improvement of Field Food Crops.

- (vii) Breeding materials and information derived from other international institutes e.g. CIMMYT (maize), IRRI (rice), ICRISAT (sorghum and millet) are likely to become available on an increasing scale, and there is a need for a coordinated programme of adaptive testing of these materials to determine their relevance to the needs of the Region. No major regional breeding programmes on these crops are envisaged by the Mission, but multi-cropping studies designed to fit them into the most profitable rotations are considered to be of major importance. In this context, the development of quick maturing varieties should be an important aim of all adaptive breeding work.
- (viii) Because of the need to develop more intensive systems of land use in irrigated areas, the place of cotton and other long-season crops in rotations must be re-examined.

### III. INCREASING RUMINANT LIVESTOCK PRODUCTION

102. The production of meat, milk, wool and mohair from grazing ruminants is a function of yield, percentage utilization and the within-animal efficiency of conversion of pasture or forage. In the region embracing the Near East and North Africa, the outstanding constraints to increasing production/head, and production/unit area/unit time, are the generally low yields of pastures and forage crops and the relatively poor efficiency of conversion of feed into animal products by many of the native breeds.

103. Shortage of grazed pasture or forage is frequently aggravated by specific shortage of dietary energy in winter and dietary protein and energy in summer. Also there is the overriding problem of lack of reliability and continuity of supply of pasture or forage, or stubble grazing, or conserved supplementary feed. As indicated earlier, one obvious way of improving the feed supply in both quantity and quality is by the introduction of leguminous pastures and forages into the crop rotation in both the rainfed and irrigated crop zones. This improved crop/livestock integration should lead to a substantial reduction in the fallow, improve cereal yields, and at the same time provide a more stable and improved farm income.

104. A major factor relating to the efficiency of conversion of feed within the animal concerns the age at time of marketing: a high priority in research is to examine systems that ensure that animals reach an adequate bodyweight at a younger age. This will involve not only better feed supply but also attention to general livestock husbandry practices, animal health and, in the long run, selection within existing native breeds and cross-breeding with exotic breeds. This links with studies on pasture and forage crop productivity insofar as nutritive value, particularly digestibility, and the general and specific role of fodder conservation and supplemental

feeding are concerned. For example, the supplemental feeding of underfinished lambs to ensure earlier offtake from rangeland has biological, economic and ecological implications. Though feed may be relatively expensive, the cost of this supplementation has to be assessed against the alternative of having to retain the lambs for a longer period thus aggravating the pressures on and deterioration of the rangelands.

105. For the Region as a whole, the six broad research topics listed in order of priority below are the most urgent ones related to increasing production from ruminant livestock. All involve multi-disciplinary studies and are to a considerable extent interlinked. The first three topics on the ecology, production, management and utilization of sown pastures and forage, together with the role of fodder conservation and supplementary feeding (including feed lots) involve the crucial problem of increasing feed supply for ruminant livestock. As the plant introduction and testing programme will need to be orientated mainly toward pasture and forage legumes (particularly within the genera Medicago, Trifolium, Vicia, Pisum, Lathyrus and Onobrychis) this will involve cooperative studies on production from the fallow area and the general integration of crop and animal husbandry practices. It is envisaged that these studies will be concentrated in the main within rainfed agricultural areas with mean annual rainfall not less than 350 mm.

106. The fourth research topic on rangeland ecology and management is envisaged as part of the overall plan of multidisciplinary studies to facilitate inter-zonal movement of livestock to alternative fattening areas, or feed lots, with the aim of reducing grazing pressure on the rangelands and concurrently to seek ways and means, by research on management procedures, to arrest further decline in the productivity of the rangelands. The revegetation of denuded steppe would seem to be economically impracticable unless for a very specific purpose when well-known pitting and furrowing techniques to catch seed and water may be feasible. On mountain pastures there may be justification for revegetation if there is a problem of protecting watershed areas and for limited research related to applying accepted principles of soil conservation.

107. The fifth and sixth research topics, concerning the improvement in potential productivity per head of ruminant livestock, though of considerable importance, must be subsidiary to the main problem of ensuring more and better feed on a continuing basis. However, because of the long term nature of animal selection and breeding programmes, it is desirable that these studies should, after a careful survey of the Region to assess problems and prospects of ensuring the most benefit in relation to research effort, proceed as soon as practicable after the research programmes on pasture and forages are initiated.

(i) The Ecology and Production of Pasture and Forage Species

108. Of high priority is the evaluation by botanical survey, of existing native and natural pastures in some of the higher rainfall areas (e.g. hill pastures of the Maghreb countries) to assess the likely role of fertilizers to encourage pasture growth, especially annual legumes, for increasing livestock feed supply and for protecting the soils from erosion. This would be followed by fertilizer experiments, with and without the sowing of additional seed, in the following autumn to assess potential dry matter yields in various agro-climatic zones.

109. A major research programme should involve the collection and evaluation under various fertilizer and grazing management systems of both indigenous <sup>1/</sup>

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<sup>1/</sup> Including re-introduction of species originally from the Mediterranean Basin.

and introduced pasture and forage legumes and, to a lesser extent, grasses including salt-tolerant species. Methods of establishment, and the persistence, seed production and self-regeneration of these species require study. As light competition, and/or moisture stress, will determine potential dry matter production in most situations (i.e. total yield of dry matter will be correlated with density) the main emphasis should be on ease of establishment, seed production, re-establishment and persistence in the annual legume species. These studies should extend to dormancy and hard-seededness in relation to persistence through the period of cropping. Fertilizer and plant protection requirements will also need assessment. (This research topic is linked to topic ii).

(ii) The Management and Utilization of Pasture and Forage Species

110. Research is needed on the soil-plant-animal interrelationships of stocking rate, grazing method and type of livestock on both sown pastures and forage crops; also on the manipulation of potential annual dry matter production by use of special-purpose pastures and forages, by fertilizers, by supplementary watering, etc.; and the utilization of the pasture or forage by in situ grazing, zero-grazing and other methods. (This research topic is linked to topics i and iii).

(iii) Fodder Conservation and Supplementary Feeding

111. The biological and economic advantages of conservation and feeding of pasture and forage crops, also grain and crop residues, needs careful assessment in many environments. The comparative advantages of feedlot finishing of sheep and cattle using green forage or dry fodder versus in situ grazing on green pasture needs careful study. This research will involve the compounding of feed rations from local feedstuffs. (This research topic is linked to topics ii and iv).

(iv) Rangeland Ecology and Management

112. The dynamics of plant species and the methods for soil protection and erosion control need detailed study in relation to nomadic and transhumant grazing in the arid steppe, highlands and mountain pastures. The important need to reduce grazing pressure is closely linked to the provision of alternative outlets for young and older animals, in fattening areas or feedlot facilities. While improvement of communications to facilitate animal movement could play an important role, the development of "stratification" is likely to involve the whole socio-economic complex. (This research topic is linked to topics ii and iii).

(v) Sheep and Goat Selection, Breeding and Management

113. While the greatest constraint to increased sheep and goat production is the deficit in feed quantity and quality, there is scope for improvement by selection within existing breeds. With the anticipated provision of sown pasture and forage in the cereal zone (and to a lesser extent in the irrigated zone) hopefully there will arise a settled sheep industry in many areas. This will require a more productive animal to utilize the improved nutritional environment. Hence there will also be scope for cross-breeding with exotic breeds. The potential quantity and quality of meat, milk, wool and mohair production will need evaluation for the various selections and cross-bred flocks.

114. Though animal health facilities are well established in the Near East and North Africa, the husbandry and management aspects of livestock production have been neglected. With increased feed supplies, better animal offtake at a younger age will be possible but will require improved management which in turn will require research, involving minimum and optimum age of weaning for sale or transfer of range-bred lambs to fattening areas or feedlot. (This research topic is linked to topics ii, iii and iv).

(vi) Cattle and Buffalo Selection, Breeding and Management

115. With the dual-purpose cattle and buffalo herds in the Region feed quantity and quality are again the main constraints to milk and meat production. Similarly, selection within existing breeds and the up-grading by use of exotic breeds has considerable potential for increasing production providing the quantity and quality of the feed supply is ensured. This problem of increasing the efficiency of conversion of grazed pasture or forage, or zero-grazed forage, or conserved fodder, into meat and milk is a subject for long-term research. (This research topic is linked to topics vii, iii and iv).

IV. SOCIO-ECONOMIC STUDIES

116. A number of research topics which normally fall within the scope of economics or sociology have already been mentioned in the previous sections thus underlining the need for a multi-disciplinary approach to development-orientated research. It seems, however, appropriate to list the main priorities in economic research as applied to agricultural problems in order to stress its fundamental role in providing economic operators, in both the public and private sectors, with operational answers.

117. Attention will be focussed on research needs stemming from the goals of more rapid productivity increases, with particular reference to the use of scarce resources (water, good soils, trained manpower, capital); and to the fostering of technological progress as a major source of changes in productivity, together with greater use of certain inputs and the alleviation of socio-economic constraints. There is also a need to analyse the economic and social implications of technological change, with a view to avoiding the undesirable effects which have not infrequently followed technical innovations.

118. Corresponding research priorities are described under three main headings covering both micro and macro problems. The Mission believes that the problems at the micro level, that is to say, those affecting directly production units and families, cannot be viewed independently of the larger political, social and economic systems of which they are part. Consequently, studies aiming at describing and analysing these systems at various levels of aggregation provide the necessary information for placing production and consumption problems in their proper framework and perspective. Ultimately, they are instrumental in increasing the social productivity and impact of research findings in the biological and physical fields.

(i) Economics of input use and production techniques

119. Most field experiments and trials concerning soils and water management, crop and livestock production aim at determining yield responses to input application, at improving quality of inputs and outputs, and at deriving more efficient production techniques. These findings must eventually be translated into money terms, compared with current practices in specific environments and tested for their superiority.

120. The Mission had frequent occasion to observe that in the countries visited hardly any economic evaluation of research trials is currently carried out and that where it was being attempted it was either done with insufficient knowledge of principles of economic analysis and farm planning or had met with great difficulties due to research designs being unsuited for meaningful economic evaluation. The collaboration of scientists with economists and statistical analysts is essential in the planning of those research projects leading hopefully to "final" answers for practical on-farm application, and as such acting as "intermediate research inputs" in farm programme planning involving the choice of the optimum "mix" of crops and livestock enterprises and corresponding production techniques from a set of alternative possibilities.

121. It must be demonstrated through actual research projects that the operational definition of economic relevance to farmers and managers, of such concepts as the optimum amount of water, fertilizers, feeds, mechanical power etc., cannot be determined without reference to the specific structural conditions of the production units into which they are supposed to fit. It is necessary to take into account the availability of resources (land, water, capital, labour) the agronomic, behavioural and institutional constraints as well as the risk elements (in yields and prices) which are typical of the different ecological-land use zones.

122. The identification and impact of institutional constraints (for example of those at present discouraging a higher land use intensity on irrigated areas, or stimulating socially undesirable farmers decisions, such as ploughing of unsuitable lands), by itself represents a valuable contribution toward explaining farmers actual behaviour and provides useful information for normative action, including agricultural research planning. Clarification of concepts and demonstration of analytical methods as applied to representative situations therefore deserves high priority.

(ii) Impact of the socio-economic infrastructure

123. The economic analysis of problems of direct relevance to farmers' decisions needs to be accompanied by timely studies and an adequate flow of information related to the performance of the socio-economic infrastructure on which those decisions and their outcome ultimately depend.

124. Unfortunately, even in the countries of the Region where the State or public agencies play a leading role in development investment, in price fixation and administration, in input delivery, in storing processing and marketing, the present state of economic information is extremely scanty. Agricultural plans and large development programmes have apparently been drafted with little or no support of economic research; and oddly enough, training in agricultural planning often with international assistance, has been given priority over training in economic research and its application to the analysis of agricultural problems.

125. The result is that pricing policies often bear little or no relation to production targets; deficiencies in marketing facilities and outlets defeat extension and credit campaigns; inputs (for instance fertilizers) are sometimes available but not demanded by farmers, whose decisions thus seem to be in contradiction with the general interest.

126. More accurate and detailed information on the basic structural conditions, (resource distribution and control, marketing, financing) are obviously needed, but above all there is an urgent need for demonstration and training in most appropriate methods and approaches to the economic and social analysis of agricultural problems. Methods can best be tested and demonstrated by actually carrying out research projects on the problems which are shared by several countries or apply to the most typical situations in the three major land use zones defined in Chapter 2.

127. Studies on costs and returns of different patterns of water allocation, on manpower requirements, on the optimum size and location of feedlots and other agro-allied industries, on efficiency of marketing practices, on credit needs, on factors affecting consumption trends, on foreign market outlets and so forth, must be considered as complementary to biological and physical research in crops and animal production. Even if for some time, due to lack of sufficient information it will not be possible to use advanced techniques, such as simulation, in testing alternative policies and programmes, it is nonetheless essential that planning and supervision of socio-economic research should be carried out by highly competent and experienced social scientists.

(iii) Economic and Social Implications of Technological Change

128. Recent experience in the rapid spread of modern technologies in some of the developing countries following the introduction of high-yielding varieties has drawn attention to the impact of technological changes on the economic and social structure of rural areas.

129. The "package deal" type of approach required if substantial short term production increases are the main goal, implies a high concentration of financial means and technical manpower, and therefore exerts a strong influence on the pattern of resource allocation, not only between agricultural regions and production sectors within countries but among production units and social groups. Income distribution and social stratification, ownership or tenure of land and other means of production, the amount and patterns of employment, levels of nutrition and general well-being can as a result be altered in directions that may be contrary to wider social interests.

130. It is therefore essential to combine research on new technologies with studies on their potential social and economic impact, bearing in mind the fundamental aims and multiple objectives of agricultural and rural development, the degree of consistency among those objectives, and the adequacy of control variables in achieving the desired goals and avoiding or limiting undesirable effects.

131. There is an urgent need for better systems of social accounting and for decision making frameworks capable of giving out the right kind of signals and ensuring a resource allocation more in line with present and future availability and real costs of all resources. Socio-economic research cannot set the goals of agricultural policies but can provide the information needed for more consistent policies and for continuous evaluation of on-going programmes.

V. FARMING SYSTEMS

132. The research priorities outlined in the previous sections as potentially providing answers to the main agricultural problems of the Region, all converge on the development and testing of new farming systems capable of making more intensive use of available resources, both in rainfed and irrigated areas. In the former the proposed goals represent a sharp departure from the dominant traditional systems, geared as they are to the cereal/fallow rotation and the separation of land and animal ownership. These goals can be summarized as follows: on-farm integration of crops and livestock where rainfall and other climatic conditions so permit; exploitation of complementarities between farms and between zones in order to increase the annual flow of livestock products and preserve or restore soil fertility. In the irrigated areas, the goal is to ensure continuous cultivation by developing products, production techniques, combinations of enterprises and forms of organization capable of greatly increasing return per unit of water and of providing more employment opportunities.

133. As the research topics and the disciplines involved have already been described it is only necessary in this section to stress the outstanding aspects of the multidisciplinary approach which is proposed, with regard both to the planning and implementation of research projects and to integrating the information thus gained into workable farming systems. Attention is called first of all to the necessity of ensuring that the range of new farming systems taken into consideration be large enough to accommodate a variety of policy objectives which may vary considerably from country to country or even within the same country. For example, under irrigated agriculture, one or more of the following objectives may be relevant: increasing the supply of food for domestic consumption, increasing the value of output per unit of land, earning more foreign exchange, providing additional and more stable employment opportunities, stabilizing farmers' income.



134. The potential contribution of the new systems can thus be assessed in terms of each objective or of a combination of them. As to the methods that seem appropriate for meaningful preliminary testing of enterprise combinations, a variety of farm programming models can be called into use.

135. Under highly variable conditions, farm models incorporating uncertainty of events are likely to be important analytical tools as well as instrumental in focussing the attention of the various specialists on the strategic elements. For the more complex systems at the area and at the regional levels, however, where multiple objectives are involved and interdependence of various sub-systems cannot be overlooked, systems research and simulation techniques command careful attention. The Mission sees the main priorities as the following:-

(i) Crop/Livestock Integration within Farms in the Rainfed Areas

136. In indicating this as a research priority, it will be appreciated that in the past two decades there has been much discussion in the region about the necessity of expanding the number of integrated crop/livestock enterprises as a solution to many of the problems of the rainfed areas; however, the scale of achievement so far has been very limited, in spite of the fact that the rationale of the dominant traditional cereal/fallow system is becoming less and less acceptable under the impact of the population explosion and of technological change.

137. The difficulties to be overcome stem not only from lack of technical information specific to the prevailing ecological conditions, and from the absence or deficiencies of infrastructures, but also from the long standing traditions, social customs and beliefs strengthened by the generally low level of education and adaptability of the farming communities. Given the broad spectrum of variables involved, the close collaboration of agronomy, animal husbandry and social science is essential. The basic aim is to outline, test and demonstrate the overall feasibility of new farming systems. A logical approach involves the following sequence:

- (a) Identify and outline a limited number of possible forms of crop/livestock integration suited to the main ecological and socio-economic conditions. As part of this exploratory work a systematic survey and comparative analysis of recent successful attempts or failures of crop/livestock integration in various countries (e.g. Cyprus, Turkey, Syria, Tunisia) could yield highly valuable information on the pre-requisites for success.
- (b) Identify the missing information necessary to describe in detail and to test the proposed systems from the technical, economic and social viewpoints. This evaluation would provide guidelines for designing specific research projects.
- (c) Test economic feasibility under different sets of conditions and constraints (size of production units, inputs and product prices, yield variations, family/farm relations etc.).

(ii) Integration between Farms and between Zones

138. This involves developing forms of organization and contractual arrangements aiming at achieving crop/livestock integration among farms whether in the same area or of different zones rather than on each individual farm. Sheep or cattle fattening in feedlots, with the use of feeds or green fodder or by-products supplied by surrounding farms, are pertinent examples. Enterprises of this kind are already in operation in various parts of the Region, under the direct initiative of Development Agencies, commercial operators or livestock owners. The "trial and error" approach being followed, contrasted with the wide scope for expansion of these forms of

integration, justifies an inter-disciplinary research effort, the main aspects of which have already been outlined. Together with the definition and testing of the technical alternatives available, the economic and social aspects of integration require careful study in order to provide basic guidelines as to the choice of the various elements and their optimum combination (location, size, financing, and other contractual arrangements, farmers' participation and benefits).

139. Integration between zones is but a variation of the form described above, and is complementary to it. It is also a field in which little experience is as yet available apart from the traditional forms of transhumance or nomadism. The gradual expansion of irrigated agriculture, the prospects of intensified land use in the rainfed areas, especially in zones of intermediate and higher rainfall, and the urgent need for a better management of the pasture and steppe lands exposed to over-grazing and desertification, all point to the necessity of new and more varied integration systems between the various ecological and land use zones.

(iii) Intensive farming systems in irrigated areas

140. Livestock production in irrigated areas is and is likely to remain of secondary importance owing to the competition arising from alternative food, truck and industrial crops, for internal as well as foreign markets; livestock may, however, have a place in the enterprise mix as converters of waste, by-products and soil-improving forage crops.

141. The development of more intensive farming systems in these areas must therefore be based primarily on "multiple cropping", i.e. on a combination of crops and corresponding cultivation practices which allow for two or more harvests during the year. The range of possible alternatives is obviously very large and so is the quantity of technical and economic information required to develop and test the enterprise combinations best suited to the variety of conditions typical of the Region.<sup>1/</sup> Advanced farm planning techniques and computer facilities will, therefore, be necessary not only to integrate the needed information, as it becomes available, into workable farm plans, but also to identify areas where additional research is essential before those plans can be proposed for on-farm application. Also the reasons for the present very low land use intensity under irrigated conditions, and the role that irrigated agriculture is likely to come to play within the context of accelerated economic development, demand to be carefully investigated.

142. In other words, research cannot be confined to farm planning explorations only, taking as given the present "external" conditions, (infrastructure, price policies, credit and other services). but must explore also how farmers' decisions are affected by different sets of external conditions. There are, in fact, many reasons to believe that without a better institutional framework to guide resource allocation, decisions at the farm level may well lead, as they have so often in the past, to substantial waste of resources and contradictory outcomes; of which low land use intensity, wastage of water, soil salinization and misuse of mechanization are pertinent examples. Research must therefore aim not only at establishing broadly applicable and technically feasible principles for developing new cropping systems, but also at identifying the incentives and other policy measures needed to make such systems acceptable to producers.

<sup>1/</sup> Recent work at IRRI suggests that interactions between crops, especially where intensive successive cropping and inter-cropping is practised, can have important effects on yields and on pest infestation. Much remains to be learnt about such inter-relationships.

#### CHAPTER 4

##### THE CURRENT STRUCTURE OF RESEARCH AND RELATED TRAINING PROBLEMS

143. It will be appreciated that the limited time available to the Mission, involving but brief visits to seven selected countries, did not permit a comprehensive view of the adequacy of current research activities. Nevertheless, we were enabled, both in discussions with government officials and by visits to research laboratories and projects, as well as through the study of supporting reports and memoranda, to formulate some general views in respect of the present situation; particularly in regard to how far current work in progress appeared to match up with our assessment of the major research priorities of this region.

144. Considerable strides have been made in the development of agricultural research work throughout the Region over the last 25 years; and, more particularly, during the past decade in which the impact of technological development has so greatly accelerated. As is to be expected, the advances made in agricultural research vary widely from country to country; for instance, Egypt has a long and distinguished record in this sphere and the Maghreb countries have also made considerable progress; some of the more recent research developments in Iran, too, must be given great credit and the research achievements of Pakistan are outstanding in many sectors.

145. While it is difficult to make any valid regional generalisation in regard to the qualities of on-going agricultural research, many of the difficulties being experienced throughout the Region are, in fact, common to many, if not most, developing countries. Although considerable progress has been made in tackling these problems, there is still room for substantial improvement and for the better use of scarce resources.

146. In all the countries visited, it was very noticeable that socio-economic research as applied to agriculture is far less advanced than research in the natural and physical sciences; it is indeed very often non-existent. From further study of many reports, it would seem that this situation is common throughout the Region. The little work which is being done is almost exclusively associated with UNDP/FAO projects or with bilateral assistance. The best examples of on-going economic research were found in Iran in the Ministry of Land Reform and Cooperation, in Tunisia with CATID, and in the Egyptian work on agricultural perspective planning. This general weakness is due not only to the lack of trained research workers and means for carrying out field surveys, but is also a question of attitude: the usefulness of economic research is hardly yet appreciated, particularly at the policy formulation level. The concept of development-orientated research is entirely new; the traditional bias in favour of agronomic research per se continues as though the problems were of a purely technical nature to which exotic technological solutions can provide virtually all the answers. This attitude no doubt stems to some extent from the emphasis so often placed on the short term outlook (both in national and in some external assistance programmes), from the desire to achieve some immediate results.

#### A. National Research Capabilities

##### (i) Research organization

147. In 1964, J.M. Watson prepared a report entitled "Comparative Study of Agricultural Research Organization and Administration in the Near East Region" and in 1971, at the initiative of the FAO Assistant Director-General of the Near East and the Rural Institutions Division of FAO, a Mission under the leadership of Hussein Idris visited ten countries of the Near East to update Watson's report and to compile a list of research institutions, their major activities and their technical staffs. Both these reports, and particularly the very comprehensive Idris Mission reports, give excellent background information regarding work in progress a decade ago and the

more current situation. Very recently, J.W. Cowan has made an invaluable comprehensive and critical summary of the Idris reports in which he has highlighted many of the weaknesses of the current research programmes and stressed the need for improved and better coordinated efforts.

148. These reports show, as the Mission also noted, that many of the difficulties in national programmes stem from organizational constraints. Agricultural research is frequently conducted by several independent Ministries and specialized institutions, thus militating against multi-disciplinary research and leading to the proliferation of isolated, disconnected programmes and efforts. As exceptions, the accelerated wheat improvement programmes of Pakistan, Algeria and Tunisia may be quoted as excellent examples of what can, and has been, achieved by an interdisciplinary national effort on a very major and urgent issue.

149. More recently, there have been tendencies to set up specialized Ministries or other autonomous bodies within the public sector to coordinate research. This is to be welcomed, but though such efforts may sometimes have produced an increase in research output, the problems of coordination have often become even more complex due to the addition of yet another organizational body.

150. There are many examples of research coordination at the national level, amongst which may be noted the Central Agricultural Research Council of Pakistan, the Agricultural Research Centre of Egypt, which administers all agricultural research stations, and the Higher Agricultural Council of Iraq which acts as a coordinating body. Such bodies have an important role to play, but without adequate autonomy and restricted by organizational constraints, they can scarcely hope to achieve their potential impact. The Agricultural Research Institute of the Lebanon may be quoted as an interesting example of an organization working within the autonomy of its own governing body which has considerable responsibility for its associated research stations. It is also interesting to note the plans being formulated in Algeria to establish three research institutes, one to deal with cereals; one with grain legumes and vegetables, and one with arid zone and desert problems. These three institutions are to be set up in order to assist in the better coordination of adaptive research.

151. Research coordination at the national level, if functioning properly, is very valuable in achieving integration of programming and budgeting at the top. But what is often conspicuously missing and seriously affecting the efficiency of research, are horizontal links at lower levels to break through the typically vertically structured research departments.

(ii) Links between on-going research and its application

152. It is generally agreed that it is vital to achieve close coordination between the research and extension services, yet little seems to have been accomplished in developing organizational structures to this end. Formal links between the services are usually regrettably lacking and much effort is required to build up closer contacts in order that satisfactory inter-communication can be established.

153. Another important link which is frequently inadequate is that between research workers and the planners and administrators who depend on their products for policy formulation.

(iii) Training of research workers

154. The research services must look to the universities of the Region for their supply of scientific workers and, to an ever-increasing extent, for those trained to the higher levels of M.Sc. and Ph.D. or their equivalents; but this can only be satisfactorily achieved if the universities are themselves producing the right sort

of human material. Too frequently the universities, embarrassed by the rapid expansion of student numbers and ill-equipped to give sound basic training, are unable adequately to develop their own research work. Contacts between university faculties of agricultural and non-university research institutions are usually woefully inadequate and the universities own research facilities are often at a depressingly low level. The lack of contact of the universities with on-going agricultural research is exacerbated by the poor contacts which exist between Ministries of Education and Agriculture.

(iv) Motivation

155. Fundamentally, the quality of research work in any country depends on the quality of the research worker, who must be both well trained and properly motivated. Much more emphasis needs to be given to post first degree training and, insofar as it is possible, to candidate selection for research posts. The further need for regular in-service training is vital if research workers are to be given full opportunity to keep abreast of developments and to "recharge their batteries".

156. It is scarcely surprising that motivation often leaves much to be desired. Salary scales are generally exceedingly poor, working conditions, facilities and equipment are often primitive and there is too frequently a lack of drive and inspiration coming from senior research workers on whom the young research worker must expect to rely so much in his formative years. In particular, there is a great lack of understanding of the importance of development-orientated research. The combination of these factors is not conducive to the production of good work.

B. Regional and International Research Efforts.

157. Cooperation in research at the regional level is still very limited, though the pace is accelerating through the out-reach programmes of the international research organizations, particularly for example, CIMMYT, and through the Ford Foundation, NEAHI, ALAD, etc. The work undertaken by the UNDP/FAO on the improvement and production of field food crops in the Near East and North Africa is another example of a regional project which has both research and training components. An FAO regional project in applied research for land and water development (MLD/GO/25) started operations in 1970, since when a number of seminars and surveys have been carried out. Guidelines have been set for the reclamation of saline soils, the management of reclaimed soils and the leaching of soluble salts, and some work carried out in problem identification and exchange of information. A request has been made to establish a regional UNDP project for a Near East Applied Research Programme for Land and Water Use; a decision regarding this project is still pending.

158. Another potentially promising regional research initiative is the Arab Arid Zone and Dryland Research Centre (AADREC) at Damascus which has only very recently been established under the Arab League. It has an ambitious programme of research, covering the improvement of the use of the rangelands by control measures, by the introduction of forage crops into rotations, by improving traditional methods of animal husbandry and by infrastructural developments to serve the needs of the nomadic peoples. Its soil and water division plans a study of the better exploitation of land under arid and semi-arid conditions, and its statistics section is to undertake the analysis of data related to the experimental work of the Centre.

159. It follows on, and plans to develop further, the work of the UNDP/FAO projects with the Syrian Government for the stabilization and development of the nomadic people and their animal husbandry in the Syrian Steppe. Its programme envisages the establishment of its own servicing research laboratories in Damascus and the development of cooperative research in Syria and in other Arab countries of the Near East.

160. Bilateral aid is also making its contribution to the development of research; for example, the French bilateral aid (INRA and AERAC) is closely integrated throughout the Maghreb. However, the quantity and impact of bilateral assistance varies widely from country to country and not infrequently its value (and that of some multilateral aid) is reduced by the limited period for which it is available or by the non-availability, or transfer to other work, of local counterparts.

161. Despite the increasing national, bilateral and multilateral support to research and the growth of projects at the regional level, the Mission concluded that the magnitude of research efforts in the Region is still inadequate to the task required of agriculture outlined in Chapter 2; as well as being limited by the quality of the trained research workers available, by their lack of experienced direction, by inadequate coordination of effort, with consequent wasteful repetition, and by lack of information about research in progress between and even within countries. Furthermore, in almost all research work there appears to be an urgent need for a more systematic methodology in order that the results of work in comparable fields may be collated, analysed and used synoptically.

162. It is for these reasons that the Mission recommends the establishment of an international research and training centre to complement, inspire and aid in the coordination of all that is currently being undertaken at the national and regional levels, assisted by multi-lateral and bilateral aid. In the following section, plans are developed for the type of centre envisaged.

## CHAPTER 5

### THE NEED FOR AN INTERNATIONAL RESEARCH CENTRE

163. As will have been gathered from the previous chapter, the Region as a whole, despite what has already been achieved, stands in great need of a new approach to the solution of its complex and pressing agricultural problems.

164. So far relatively few attempts have been made to develop an integrated attack on its major research priorities, which are as much socio-economic as they are purely technical, involving participation between a range of disciplines over a wide front.

165. The requisite knowledge and understanding, however, is not produced solely by research programmes of highly specialized workers and their institutions; it is also the product of the activities carried out by many other groups in both the public and private sectors. The interaction between these broad categories is in itself a source of knowledge which helps to identify and formulate development problems calling for research, to establish priorities, to coordinate efforts and to translate into operational answers the results of research activities. Production techniques, material means of production, forms of organizational structures, price policies, development programmes and so forth are all inextricably involved in the solutions sought. Ensuring this type of interaction is, therefore, an essential component of all development-orientated research, which calls for a very high level of expertise if it is to be effective, and demands freedom to pursue its objectives untrammelled by the constraints of external pressures.

166. The Mission is of the opinion that this much needed independent multi-disciplinary approach cannot effectively be achieved by any other means than by the establishment of an international research centre specifically staffed and equipped to tackle the regional problems. No such institution exists at present nor do we believe that any current programme is capable of being upgraded to take on this task. The Mission therefore recommends that such a centre, the organizational plans for which are expanded in the next chapter, be established at the earliest opportunity.

167. It has in mind the over-riding need for a centre of excellence, not so much specifically to fill the numerous gaps in the spheres of basic and applied research but rather to aid in the up-grading of the whole approach to, and the quality of research work; to give a sense of focus; to establish high standards of work; to complement existing research work at national and regional levels.

168. It envisages the main functions of this centre to be:

- (i) The establishment of high level research programmes related to the priority subjects outlined in Chapter 3; with particular reference to those problems which require multi-disciplinary study (improvements in crop/livestock integration, systems of production etc.); which are particularly amenable to a regional approach (improvement of major cereals); and/or which national organizations are usually unable to undertake effectively because of such factors as the long-term nature of the work, or the need for sophisticated equipment (soil/crop/water relationships and the value of fallow).
- (ii) To act as a "relay" station and coordinating centre in the Near East and N. Africa for the crop improvement work of other international research institutes. At the moment only CIMMYT and IRRI have active "outreach" programmes there, the situation is likely to become increasingly complex as ICRISAT, IPC, and possibly the African Livestock

and Asian Vegetable Centres develop comparable linkages to the Region.

- (iii) The establishment of standards of methodology in technical and socio-economic research and related subjects (plant exploration, statistical design, agro-climatology), which will provide guidance to other research programmes throughout the Region. This would contribute to the co-ordination of regional research efforts and to the building up of national research capabilities. Outreach programmes would play a crucial role in the latter, together with (iv), (v) and (vi) as inter-linked services.
- (iv) The provision of a physical centre for in-service training of research workers already in responsible positions.
- (v) Sponsoring and making facilities available for seminars, study groups and workshops on major problems of research and its application, of relevance to the Region, both at the inter-disciplinary and more specifically technical levels.
- (vi) The setting up of supporting library, documentation and information services which will be available throughout the Region.

169. It might be argued that there is no need for an international research centre in the Region to undertake these functions, despite the continuing pressures for its establishment and the existing models of IITA, CIAT, and ICRISAT; or that it might be wiser to defer any such decision at least until further experience has been gained in the functioning of these other inter-disciplinary research institutions. Alternatively, it could be argued that a more economical method would be to attempt to reinforce existing national and regional programmes with a view to expanding these to cover the tasks proposed above.

170. The Mission considered these alternatives but was of the opinion that neither would meet the exigencies of the circumstances. In its view the situation as outlined in Chapter 2 was too urgent to allow for the deferment of a decision. Strengthening existing regional and national programmes was considered unlikely in itself to prove adequate in successfully tackling the complex issues involved. It was felt rather that a better way of reinforcing such programmes would be by the establishment of an international research centre to complement their work.

171. It still might be questioned why so much importance is attached to an internationally organized centre of research and just what it has to offer which might not be made available by some sort of regionally coordinated effort based on multilateral aid. In the first place, an international research centre has a great degree of autonomy and freedom of action. It is independent of political constraint. It has continuity of action and is, therefore, able to take the long-term view of research. It can attract to its staff men of outstanding experience and competence in the sciences concerned, both on long term and shorter term contracts, and thus secure a very high degree of expertise which would otherwise not be readily available. It is the means whereby a centre of excellence can be established and it is to this that the Mission attaches so much importance. Such a centre can indeed make as much contribution by the training of national research workers as it can by its own direct contribution through research.

172. The Mission gave considerable thought to the advisability of recommending a "network" organization but concluded that any small "nuclear" coordinating centre, even if internationally organized, would be unable to meet the criteria indicated above. By its very nature, it would have to be primarily an organizational concept which would be likely to fall between two stools; it would neither be able effectively to reinforce national and regional programmes nor could it provide the



physical research and training centre which is both so desirable and necessary.

173. In considering the justification for the establishment of a major international centre in the Region there might still be the question of whether North Africa and the Near East, considered as a joint region, could in fact lay a sufficient and logical claim for the allocation to it of the considerable resources required. As has already been pointed out the Region presents many complexities. It comprises certain areas of great intensity of production (e.g. the Nile Valley) and great areas of extensive marginal production. Their development presents widely different research tasks. Yet water in one form or another represents a unifying constraint. Ecologically it has large broadly similar areas, their component parts sharing many inter-related problems. Except in a few countries (e.g. Afghanistan, Iran and Sudan) there are few opportunities to extend production by horizontal expansion; the major efforts have to be made in the intensification of land use in the areas already being cropped. The Region as a whole is under tremendous pressures to increase its production. There is thus strong justification for regarding the Region as sufficiently homogeneous to warrant many of its agricultural research and development problems being tackled to an increasing extent on a regional basis.

174. While there are good arguments for establishing an international research centre specifically for the needs of the Region, a truly international centre should be enabled, through its work, to look beyond the confines of the Region in which it is located and in which it works. In fact the agricultural and agro-climatic problems discussed in Chapters 2 and 3 are not confined solely to the Near East and North Africa; they are shared by much of the Mediterranean basin, they extend in certain measure south of the Sahara; into Turkey and southern USSR; and have their counterparts in other parts of the world, e.g. Australia, Chile and North-East Brazil. An international research centre based in the Region would thus have contributions to make beyond the Region which it would be initially, and primarily, designed to serve.

CHAPTER 6

LOCATION, FUNCTIONS, AND ORGANIZATION OF THE PROPOSED INTERNATIONAL CENTRE

175. A good deal of experience is being accumulated on the structuring and organization of international research institutes. They begin to follow a generally accepted plan, although each must be structured and organized to meet the demands of the research programmes envisaged. Nonetheless, there will, to an increasing extent, be considerable similarity in the way they are designed to operate. We have, therefore, been guided by reports of several previous missions with comparable terms of reference in making the recommendations which follow.

A. Location of the Centre

176. The factors taken into account in arriving at final recommendations for the location of the centre included the following:

- (i) Proximity to a range of ecological conditions typical of those which are to be observed throughout the Near East and North Africa.
- (ii) Adequate land resources for the campus of the centre and for field studies, including accessible outstations if circumstances dictate.
- (iii) Ready accessibility to an international airport having good connections with internal air services.
- (iv) Proximity to a centre of population with reasonable amenities for the staff and families of the centre (shopping, educational, medical, etc.)
- (v) An environment readily adapted to the accommodation of Arabic, English and French speaking people to provide for a supporting tri-lingual staff.
- (vi) Availability of suitably trained local technical, administrative, clerical and domestic staff.
- (vii) Proximity to a good university, faculty of agriculture and library resources.
- (viii) A host country willing to accommodate the centre and to give to it and its' non-national staff reasonable tax and import concessions and general freedom of operation appropriate to an international centre.

177. Additionally, geographic, ethnic and political stability factors were also taken into careful consideration. It was difficult to arrive at a final recommendation since geographic consideration alone presented such problems. The Near East and North Africa, stretching as they do from Morocco to Pakistan, cover a very great distance from west to east. Furthermore, certain countries which had many ecological advantages had to be ruled out on account of some of the other factors enumerated above.

178. Amongst the countries considered as being able to provide most, if not all, of the desiderata were the following:

Pakistan had already indicated its interest in being the host to the centre. It was, however, ruled out despite the many advantages to which it could lay claim, owing to its geographic position and being ethnically atypical.

Iran has a broad ecological spectrum and offers advantages in respect of the relatively high standards of its current research programmes. It was suggested that it would probably welcome the centre being established there. It was felt, however, that geographically it would not prove to be a suitable location, being in many ways "off centre" to the Region as a whole, and having no site with sufficiently representative conditions within easy access.

Lebanon could provide many of the requisites. It has available excellent local and international air transport and good social facilities in Beirut; it has both the National University and the American University of Beirut with its library, supporting services, faculty of agriculture and its field station in the Bekaa valley. Furthermore, it has important French contacts of longstanding through which closer contact could be established with the Maghreb. Infrastructurally, it would therefore have a great deal to offer to the proposed centre. Its limitations are that, from an agro-climatic point of view it is more restricted than other possible locations; but it is felt that other considerations more than outweigh this. Irrigation water is available in the Bekaa valley which climatically lies in the 300 mm to 800 mm rainfall zone. It cannot be claimed that typical steppe and range lands are immediately available in the vicinity but over the border in Syria these exist in great areas and it is felt that these resources could be drawn upon to supplement the field experimentation of the centre.

Syria was most carefully considered as being a country which, within its confines, could provide an extremely adequate ecological range. However, its relative inaccessibility puts it at a considerable disadvantage vis-à-vis other possible alternatives.

Egypt obviously had a great number of advantages as a location for the centre to which it could, in all probability, make outstanding support contributions. It was decided after much careful thought not to make a recommendation in its favour primarily on account of its highly specific agriculture which makes it atypical of the Region as a whole.

Algeria and Tunisia were considered most carefully by the Mission. Both conform to practically all the requirements, including that of governments anxious to act as hosts to the centre. They contain a very full range of eco-systems; and could give much support to the work of the centre through their research institutions, for example they already have well conceived advanced programmes with CIMMYT on cereal improvement. From many points of view, either appeared to be a suitable location and the Mission was for some time divided on this issue. In fact, throughout its work, the Mission has been extremely conscious of the difficulties presented by having to attempt to join together two regions which, broadly speaking (save for Egypt) ecologically have much in common and are united through common linguistics (save for Iran and Pakistan) yet which are geographically so widely separated.

179. A decision therefore had to be reached as to whether a recommendation should be made to establish the centre in either the Near East or in North Africa or to conceive of it as being divided between the two sub-regions. The latter was ruled out as a workable proposition in that it would inevitably lead to much replication and a division of resources.

It was accordingly resolved to make a recommendation in favour of one or the other of the two regions whilst not ruling out the possibility of establishing a "limb" of the centre in the region in which its headquarters was not located.

180. Taking all factors into consideration, it was decided that the centre could achieve more if it were located in the Near East, whose needs seemed to be the greater and whose problems appeared to be relatively more complex. Moreover, from the point of view of population and geographic area, it represents a larger bloc than North Africa.

181. Within the Near East, it was still a difficult task to determine an optimum location but after much discussion it was resolved to recommend Lebanon as the most suitable country and that, if located there the centre should be placed at an appropriate site in the Bekaa valley. It was understood that the Government of Lebanon would look favourably on the suggestion that it should provide facilities for the centre, but there was no opportunity to assess the possibility of it being specifically located in the Bekaa. The existence of the Ford Foundation in Beirut and its ALAD centre in the Bekaa would provide a starting point for the work of the centre which could also work in close contact with the Arab Centre in Damascus. The Mission envisaged that if the centre were to be established in Lebanon it should absorb the main elements of ALAD's programme since these basically would form an important part of its work.

182. In the event of Lebanon not proving to be a suitable location for the centre, then the Mission was of the opinion that it should be placed in either Tunisia or Northern Syria (Homs-Hama-Aleppo area), providing that free access could be assured either through Damascus or Beirut because of the latter's superior air connections.

183. In arriving at these difficult conclusions the view has been taken that the success of a centre of excellence such as is envisaged will ultimately depend as much upon the suitability of its social environment as upon the diversity of its ecological range. If scientists of outstanding ability are to be attracted to serve it over a number of years, it is essential that they and their families, and the advanced students who will be trained there, are enabled to work in an environment where their potential can be easily expressed.

#### B. Name of the Centre

184. It was generally agreed that "centre" rather than "institute" should be adopted. The term "institute" has a certain limiting nuance, possibly suggesting isolation, remoteness and some lack of flexibility whereas "centre" helps in conveying the concept of a service to the regional community intimately concerned with, and sharing its problems, and acting primarily as a catalyst to on-going research work at specifically regional and national levels.

185. Many attempts were made to isolate a name which would result in some reasonably euphonious initials and which would also be similarly acceptable when translated into French. The major stumbling block was over the way in which the Region could be satisfactorily described. "Mediterranean" was considered as being reasonably descriptive and acceptable as a technical term; it suffers, however, from being too inclusive, and possibly misleading, vis-à-vis Pakistan and Afghanistan and even Sudan and Iran. On the other hand, "North Africa and Near East" seemed to be too regionally slanted for an international centre as well as being cumbersome.

186. "Arid" or "semi-arid" were also explored as possible designations but these terms are already in use elsewhere and might, therefore, prove confusing - nor did either accurately describe the varied ecological ranges of the Region.

187. It proved exceedingly difficult to reach a final conclusion regarding the name but the following suggestion is put forward for further consideration:

I.R.C.M.A. - International Research Centre for Mediterranean Agriculture.

### C. Functions

189. The main functions of the centre would be:

- (i) To promote the development of sound principles of methodology in its own research work and throughout ongoing research in the Region.
- (ii) To undertake on-site research, developing as quickly as possible exemplary research programmes based on careful studies of priorities of direct relevance to the needs of the Region.
- (iii) To be closely involved in cooperative research with national, regional and international research programmes:
  - (a) by its on-site research;
  - (b) by initiating cooperative research networks;
  - (c) by establishing outreach programmes with national centres and appropriate institutes or agencies, e.g. FAO;
  - (d) by participating in cooperative programmes with other international research institutions (e.g. CIMMYT, IRRI, ICRISAT, IPC, etc.);
  - (e) by establishing close links with relevant research in selected universities and research institutions both in the Region and beyond its confines.
- (iv) To carry out training:
  - (a) at the advanced level by attaching selected research workers having sufficient background of laboratory and/or field experience to senior research staff of the centre;
  - (b) of middle-level research and extension staff through appropriate shorter courses.

At both levels of training emphasis should be given to inculcating specific techniques and skills, improving research methodology, developing critical faculties, developing interest in the multi-disciplinary approach to the planning and execution of research, and improving motivation and enthusiasm.

- (v) To establish documentation, information and publication services.

In order to achieve this, it must establish a supporting library receiving the main journals and reports relevant to its work and establish an interchange system.

- (vi) To establish, at an early stage, appropriate programmes of seminars and workshops.

### D. Major Research Activities of the Centre

190. The Mission believes that of the research priorities indicated in Chapter 3, the centre should initially concentrate on programmes under the following three main headings, all of which imply a multi-disciplinary approach to the work of the centre:

- (i) Studies to improve resource utilization, both in irrigated and rainfed areas.
- (ii) Increasing output of major food commodities.
- (iii) Development of improved farming systems, with special reference to those factors which have broad adaptability.

191. Within these broad multi-disciplinary categories specific lines of work proposed by the Mission are as follows:

- (a) Establishing methodologies for the collection and analysis of agro-climatic data;
- (b) Field scale research on irrigation and drainage in common with other agronomic practices for more efficient land and water use.
- (c) Improvement of cereal production, with priority to barley and wheat.
- (d) Improvement of other crops, especially legumes and oilseeds.
- (e) Increasing livestock feed supply by use of forage crops and sown pasture, to ensure better meat and milk production and to reduce grazing pressures on range lands.
- (f) Integration of crop/livestock production within and between land use zones.
- (g) Identification of conditions determining success and failure of attempts to modify traditional farming systems.
- (h) Identification of more intensive farming systems with special reference to irrigated zones and to the problems of the fallow.

#### E. Organization

##### (i) Governing Board

192. It is envisaged that the Board will consist of not more than 15 members including representatives of the host country, the scientific leaders in the countries involved and of the agencies providing financial assistance, and that the Director-General of the centre will be a full member of the Governing Board. The Chairman and non-host country representatives would be appointed on a rotating basis. If possible, the regular Board should be constituted ab initio; however, if this does not prove feasible an Interim Board of 5 to 7 members must be designated by the Consultative Group to cover the period until the permanent governing body can be established.

##### (ii) Administration and Governance

193. It is assumed that the centre would be administered by a Director, nominated by the Consultative Group and approved by the Governing Board. The latter would be responsible for establishing the policies under which the centre operates and would approve its budgets and the appointments to the senior staff upon the recommendation of the Director.

194. The Director would plan and execute the programmes of the centre and be responsible for its general operation. In order to be as free as possible from routine day-to-day administration, he should be supported by an Assistant Director for research; an Assistant Director for Training and Public Relations; and an Assistant Director for Administration who might also act as Secretary to the Board of Governors.

(iii) Research Liaison Committee

195. It is suggested that such a committee be established to act as a formal non-executive link of the centre with the agricultural research organizations of the countries of the Region. It must be widely representative not only of the countries concerned but also of the disciplines involved in the work of the centre. It might consist of 15 persons either nominated by the Governing Board on the recommendation of the Director or by governments invited to nominate members in rotation..

196. It is suggested that such a committee should be convened annually at the centre to receive a report on its work, to familiarize its members with ongoing research activities, to report relevant research conducted by national and regional organizations and to bring country research problems to the attention of the centre. Through such a committee, the centre would be regularly and collectively brought into close contact with changing national priorities and, in return, its work would be made more personally familiar to a competent cross section of those directly concerned with research throughout the Region.

(iv) Staff Committee

197. In order that the scientific staff of the centre may be in the closest touch with the Director, and through him with the Governing Board, it is considered important to establish formally a staff committee, under the chairmanship of the Director, charged to meet not less than 4 times a year to discuss the policies and programmes and to consider internal academic matters. By the institution of such a committee there can be adequate assurance of achieving the all important integration of the work of the centre.

(v) Host Country Relations

198. In the initial negotiations with the host country, assurances must be given by it that adequate legal status will be given to the centre to enable it to function smoothly as an international organization. It is of vital importance that specific legislation should be agreed prior to any firm commitment being made by either party.

199. Arrangements and assurances are needed to enable staff, visiting scientists, trainees and administrators to move freely and expeditiously and also to ensure the free and expeditious movement of scientific equipment, plant and animal material (subject to reasonable quarantine requirements being fulfilled) and research data and publications. Furthermore, assurances must be given that there will be no restriction on the appointment and posting of staff or on the entry and participation of scientists, visitors and trainees. It will be necessary to establish a quarantine station to serve the needs of the centre. This will have to be operated at the cost of the centre.

200. Arrangements will have to be made to cover tax exemptions for non-national staff members and their personal effects. There must also be satisfactory arrangements for ensuring that all essential supplies entering the host country for the centre can be expeditiously cleared of all formalities and not chargeable for import or excise duties.

F. Staffing

201. The senior staff of the centre must be appointed on an international basis without discrimination as to nationality or origin or any preconceived nationality ratio. The only considerations must be those of scientific and professional standing. Suggested phasing of senior staff appointments is shown in Table 6.

202. The difficulties of recruiting high level staff of the status, competence and experience required are well known amongst those responsible for establishing and running international research organizations, though the suggested location of the centre should be an asset in regard to recruiting. It must be most strongly urged that the first appointment

will be that of the Director and no effort must be spared to find a suitable man of established reputation, prepared to accept the considerable challenges with drive, enthusiasm and great vision. The disciplines represented by the Director are of far less importance than his personal qualities and background experience. It will take time to attract such a person to the post but it is such an important appointment that no attempt must be made to rush it.

203. It is envisaged that the centre will operate bilingually in English and French. It will be necessary for all senior staff to be able to work in both languages but bilingual status should not be insisted upon at appointment, provided that the candidate has expressed willingness to undertake, at the expense of the centre, a course in the appropriate language prior to or immediately on taking up his appointment.

204. The proposed senior staff will require support from assistant scientific staff, research assistants (on attachment) and laboratory and field technicians, together with adequate clerical staff. Technical, administrative, clerical and supporting operational staff should be primarily drawn from the host country on terms and conditions which are normal to that country, but with such modification as will ensure reasonable degrees of competency, and contentment with their work.

205. Trainees should play a most important role in the research work of the centre, even at the technician level, and every endeavour must be made to inculcate, at every level, a multi-disciplinary approach to all the research activities undertaken by the trainees.

Table 6: Senior Staff Appointments and Phasing

Time elapsed in years after decision to establish centre:

	<u>.5</u>	<u>1.5</u>	<u>2.5</u>	<u>3.5</u>	<u>4.5</u>
<u>Management and Administration</u>					
Director	1	1	1	1	1
Assistant Director Research	-	1	1	1	1
Assistant Director Training	-	-	1	1	1
Assistant Director Administration	1	1	1	1	1
Librarian	-	1	1	1	1
Head Documentation Unit	-	1	1	1	1
Head Translation Unit	-	-	1	1	1
<u>Scientific Staff</u>					
Agronomists (3)	-	2	3	3	3
Ecologist (1)	-	1	1	1	1
Animal Scientists (2)	-	1	2	2	2
Economists (3)	-	1	2	3	3
Systems Analyst (1)	-	-	1	1	1
Statistician (1)	-	1	1	1	1
Plant Breeders (2)	-	-	2	2	2
Plant Pathologist (1)	-	-	1	1	1
Plant Physiologist (1)	-	-	1	1	1
Entomologist (1)	-	-	1	1	1
Soil Chemist (1)	-	-	1	1	1
Soil Physicist (1)	-	-	1	1	1
Irrigation Engineer (1)	-	1	1	1	1
Climatologist (1)	-	1	1	1	1
Experiment Station Manager	1	1	1	1	1
Disciplines not determined (4)	-	-	-	1	2 4
	<u>3</u>	<u>14</u>	<u>27</u>	<u>29</u>	<u>30</u>

Notes on Staffing

- Agronomists - one of these would cover technical aspects of farm mechanization.
- Economists - one of the three is intended to be primarily a sociologist.
- Statistician - to cover the centre's needs in statistics and biometrics.
- Irrigation Engineer - to work on technical problems of on-farm water use.

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## G. Facilities

### (i) Land and Water

206. The campus of the centre must be established on a site adequate for its buildings and services and should also comprise a research farm of not less than 200 ha. The site must have a minimum rainfall of 400 mm with reasonably level and uniform soils which are readily permeable to water and root development. There must be a source of good quality water for perennial irrigation of up to 100 ha.

### (ii) Buildings

207. Suitable buildings will be required for:

- Administrative Headquarters
- Dining and common room facilities
- Training and conference activities
- Library, documentation centre
- Laboratories, <sup>1/</sup> studies and offices for scientific staff
- Computer unit
- Workshops for equipment maintenance, for vehicles and heavy plant
- Stores for scientific equipment and supplies and for general materials and equipment
- Housing for senior staff (see paragraph 208 below)
- Housing for senior visiting staff
- Housing for trainees and attached research assistants
- Housing for certain key technical and operational staff
- Medical services, swimming pool, canteen for operatives
- Farm buildings for farm office and records, animals, mechanical equipment, etc.
- Greenhouses for plant studies, with provision for environmental control
- Quarantine station
- Meteorological station

208. In respect of staff housing, the Mission assumes that on-campus housing will be made available to the senior administrative staff and to certain key technical and other domestic staff, etc., who through their duties, must be readily available on site. It will also be necessary to provide some housing for the lodgement of scientific staff on appointment, but it is hoped that a fair amount of suitable housing will be available for rent in the area in sufficient proximity to the station to meet most needs. It would be preferable, on social grounds, not to have the whole staff campus-bound, and on financial grounds not to have an excessive commitment to building staff housing. It will, however, be necessary to make an exploration of the local housing situation before any conclusion can be reached on this score.

## H. Preliminary Estimate of Budget Requirements

### (i) Capital costs

209. It was not considered feasible to attempt any detailed assessment of capital requirements until the TAC and Consultative Group had reached a decision on whether to support the proposed centre and a specific site had been selected. So much depends on the local construction costs at the chosen location; the amount of building, site levelling, irrigation drainage, road works required to develop an operational research centre; the availability of rentable staff housing at reasonable charges, and so on. However, the proposed staff and format of the centre has certain parallels with that of ICRISAT, for which a capital estimate of \$10-12 million was made. Allowing for inflation since 1971 the higher figure is probably

<sup>1/</sup> The computer unit, under direction of the statistician, would be responsible for statistical analysis of field trials, information systems, etc. It would be based on "desk" type computers; tasks requiring large computer facilities would be contracted out.

indicative of the general order of magnitude which might be required to build and equip a centre in the Near East. Further capital costs might be incurred if, after an initial period of operation of the main centre it was decided by the Board that any sub-centre was necessary, e.g. in North Africa.

(ii) Recurrent expenditure

210. A study of the 1974 work programmes and budgets of the four fully functional international centres shows that their research programmes represent between 40 and 50 percent of total core budget costs; conference, library, information, and training expenses around 18 percent; and administration and operating costs, including management and running of experiment stations and farms from 30-50 percent. The main individual item of costs is wages and salaries, amounting to between 55 and 65 percent. The cost per senior research scientist including his supporting scientific staff (a ratio of about 5 junior:1 senior staff member), secretarial assistance, etc. seems to vary between \$45,000 and \$60,000, depending on the institute. Inflation is running at around 7 percent per annum. Training costs are around \$4,000 per annum per long-term trainee.

211. Using these figures it is possible to make an approximate estimate of the probable "unrestricted" core budget operating costs of the proposed new centre over its first five years of existence, as shown in Table 7.

Table 7: Time Elapsed in Years after Decision to Establish Centre

Time elapsed (years)	.5	1.5	2.5	3.5	4.5	%
Number of senior scientists + administrators	1+2	9+5	20+7	22+7	24+7	
Research programmes <sup>1/</sup>	\$ -	\$ 480,000	\$ 1,140,000	\$ 1,260,000	\$ 1,380,000	50
Training, documentation, information <sup>2/3/</sup>	-	75,000	150,000	250,000	450,000	16
Administrative services <sup>4/</sup>	100,000	300,000	650,000	800,000	950,000	34
	100,000	855,000	1,940,000	2,310,000	2,780,000	100
Inflation 7 percent per annum	-	-	60,000	140,000	162,000	
	100,000	855,000	2,000,000	2,450,000	2,942,000	

<sup>1/</sup> Based on \$60,000 per senior scientist plus supporting staff costs.

<sup>2/</sup> Includes senior staff costs for Assistant Director Training, Librarian, documentation, and translation units.

<sup>3/</sup> Assumes main training and information programme commences year 3.5, with 75 long-term trainees on site by year 4.5; other costs are for seminars and library/documentation development (years 1.5 and 2.5), publications, etc.

<sup>4/</sup> Includes senior staff costs for Director and Assistant Directors Administration and Research; transport supplies, services (electricity, water, post and telegraph), maintenance of buildings, laboratories, experiment station operations.

212. The annual operating costs would thus be of the order of \$3 million  $4\frac{1}{2}$  years from the start-up date, by which time the bulk of the scientific staff would have been recruited, the library, information, and documentation services largely completed, the experimental farm and laboratories well developed; and the training programme in its first year of full scale operations.

213. Some further expansion of core professional staff can be expected over time to meet new demands, especially those of training, information, cooperative and outreach programmes. The latter are normally funded under special grants for individual projects, but experience, e.g. with CIMMYT, shows that they also make considerable demands on regular staff time.

214. The evolution of the programmes of the existing international centres suggests that if the knowledge built up as a result of research in their earlier years is to be transferred to and adopted by the countries which they serve, progressively greater weight has to be given to strengthening national research and extension capabilities. This tends to be reflected in the programmes and budgets of the centres in terms of increasing emphasis on training, workshops, outreach, projects (such as Plan Pueblo), travel of staff members and even outposting of scientific staff funded from the core budget. This trend is unlikely to be of importance during the first five years of a centre's existence, but cannot be ignored as a long-term expansionary implication of any decision to establish and fund a new centre.

#### I. Further Action

215. In the event of the main recommendations of this report being accepted by the Consultative Group, it will be necessary to set up a mechanism for their implementation. It may be assumed that the Consultative Group will provide a special "start-up" fund and appoint an Executive Agency to be responsible for the detailed planning and initial stages of the establishment of the new centre along the lines indicated in the Report of the Task Force commissioned by the African Livestock Sub-Committee of the Consultative Group on International Agricultural Research (the Tribe Committee Report of September 1972, pp. 60/63). The Mission is of the opinion that the proposals referred to provide excellent guidelines for the steps to be taken in the implementation of its recommendations.

## SOME REGIONAL STATISTICS

Source: FAO Production Yearbook 1971, Vol. 25

	Population	Total Area	Arable Land and Permanent Crop Land		Irrigated Arable and Permanent Crop Land		Natural Grazing Land	
	(1000 Inhab.)	(1000 ha)	(1000 ha)	% of Total Area	(1000 ha)	% of Arable Land	(1000 ha)	% of Total Area
Afghanistan	17,125	64,750	7,980	12.3	813	10.2	6,020	9.3
Algeria	13,723	238,174	6,787	2.8	270	4.0	37,416	15.7
Bahrain	213	60	-	-	-	-	-	-
Cyprus	633	925	432	46.7	102	24.8	93	10.0
Egypt	33,329	100,145	2,843	2.8	2,843	100.0	-	-
Iran	28,662	164,800	16,560	10.2	4,651	27.9	11,000	6.7
Iraq	9,752	43,492	10,163	23.5	3,675	36.1	63	0.1
Jordan	2,229	9,774	1,300	13.3	60	4.6	100	1.0
Kuwait	597	1,600	1	0.1	1	100.0	134	8.4
Lebanon	2,651	1,040	316	30.4	68	21.5	10	1.0
Libyan Arab Republic	1,975	175,594	2,515	1.4	124	5.0	1,130	0.6
Morocco	15,579	44,505	7,900	17.8	265	3.3	7,650	17.2
Oman	752	21,246	-	-	-	-	-	-
Pakistan West	56,720	80,360	16,755	20.8	11,030	65.8	10,240	-
Qatar	79	2,201	-	-	-	-	-	-
Saudi Arabia	5,330	214,969	809	0.4	130	16.2	85,000	39.5
Somalia	2,793	63,766	957	-	165	17.2	20,568	32.2
Sudan, The	15,626	250,581	7,100	2.8	711	10.0	24,000	9.6
Syrian Arab Republic	6,098	18,518	5,899	31.9	450	7.6	5,434	29.4
Tunisia	5,271	16,415	4,510	27.5	80	1.8	3,250	19.8
Yemen, Arab Republic	5,602	19,500	4,000	-	-	-	-	-
Yemen, Peoples Dem. Rep.	1,246	28,768	252	0.9	252	100.0	9,065	31.5
	<u>225,535</u>	<u>1,561,183</u>	<u>97,980</u>	<u>6.3</u>	<u>25,690</u>	<u>26.2</u>	<u>221,173</u>	<u>14.2</u>

APPENDIX I  
Table 2

CROPPING INTENSITY IN IRRIGATED AREA, 1962

Countries	Arable Area Irrigated (000 ha) (1)	Cropped Area Irrigated (000 ha) (2)	% (2:1)
Afghanistan	2,825	1,695	60.0
Fed. S. Arabia	259	77	29.7
Iran	4,600	2,765	60.1
Iraq	3,559	1,850	51.9
Jordan	55	39	70.9
Lebanon	60	53	88.3
Saudi Arabia	240	212	88.3
Sudan	1,350	677	50.1
Syria	500	350	70.0
U.A.R.	2,595	4,365	168.2
Regional Total	16,043	12,083	75.3

Source: IWP, Agricultural Development 1965-85, Near East, Vol.II,  
FAO, Rome 1966.

Wheat and Barley: Growth of Area and Yield in the Region 1948-52/1966-70

	Wheat Area ('000 ha)				Annual Increase % Compound 1948-52/1966-70		Barley Area ('000 ha) <sup>1/</sup>				Annual Increase % Compound 1948-52/1966-70	
	1948-52	1952-56	1961-65	1966-70	Wheat Area	Wheat Yield	1948-52	1952-56	1961-65	1966-70	Barley Area	Barley Yield
Turkey	4770	6653	7959	8355	3.2	1.0	1972	2500	2791	2680	1.8	0.9
Iran	2085	2430	3580	4580	4.5	0	757	850	1000	905	1.0	-0.3
Afghanistan	2000	2113	3321	2155	0.5	1.3	346	338	350	324	-0.4	2.1
Algeria	1597	1912	1969	2006	1.3	-0.5	1116	1362	810	593	-3.4	-0.9
Iraq	936	1259	1595	1942	4.1	0.7	934	1095	1129	1151	1.2	.1
Morocco	1287	1599	1578	1846	2.0	1.9	2033	2191	1627	1969	-0.2	1.2
Syria A.R.	994	1366	1396	930	-0.4	-0.6	369	526	740	673	3.4	-1.2
Tunisia	917	1110	1002	879	-0.3	-0.6	590	694	445	366	-2.6	-1.3
Egypt	605	679	557	547	-0.6	1.9	64	54	52	46	-1.8	1.1
Libyan A.R.	124	145	149	217	3.2	5.0	354	384	350	329	-0.4	1.0
Jordan	182	277	268	203	0.6	-0.3	62	100	91	59	-0.1	-1.2
Sudan	13	13	27	90	11.5	-0.1	-	-	-	-	-	-
Saudi Arabia	36	43	92	100	5.9	0.4	15	17	26	25	2.9	2.4
Lebanon	70	70	68	61	-0.8	0.8	20	19	13	12	-2.8	-1.4
Yemen A.R.	14	13	10	14	0	0.6	-	-	-	-	-	-
Yemen P.D.R.	2	2	4	5	5.2	1.6	-	-	-	-	-	-
Total Region plus Turkey	15632	19684	22575	24105	2.4	0.8	8682	10130	9424	9139	0.3	0.9
Growthrates (Area)	6.0	1.6	1.3				4.0	-0.8	-0.8			

Source: FAO Production Yearbook

<sup>1/</sup> Sudan, Yemen Arab Republic, Yemen People's Democratic Republic report less than 1,000 ha of barley, so are not included.

## Average Yearly Imports and Exports of Wheat and Wheat Flour and Barley by Selected Countries

COUNTRIES	WHEAT AND WHEAT FLOUR					BARLEY				
	1934-35 1938-39	1951-52 1955-56	1956-57 1960-61	1962-63 1965-66	1966-67 1970-71	1934-35 1938-39	1951-52 1955-56	1956-57 1960-61	1962-63 1965-66	1966-67 1970-71
<u>Imports</u>	.....thousand tons.....									
Iraq	-	20	107	71	149	-	-	-	-	-
Jordan	1	85	138	134	120	-	-	-	-	-
Lebanon	14a)	161	210	228	336	1	16	27	46	60
Syria	14a)	22	137	30	335	1a)	-	24	-	19
Turkey	-	74	162	375	453	-	-	-	-	-
Pakistan	58	341	839	1427	1371	-	-	-	-	-
Near East in Asia	125	861	1620	2060	2595	20	74	125	177	286
Algeria	35	89	294	235	641	-	-	-	-	-
Egypt	16	521	1090	1869	2270	-	-	-	-	-
Libya	73	46	84	135	200	10	1	-	5	69
Morocco	69	51	112	226	601	-	-	-	-	-
Sudan	24	52	88	129	182	-	-	-	-	-
Tunisia	17	30	111	169	360	-	-	-	-	-
<u>Exports</u>										
Syria	26a)	127	146	148	-	32a)	152	143	303	90
Near East in Asia	210	640	300	194	98	-	-	-	-	-
Algeria	238	23	41	13	8	37	94	76	91	32
Morocco	111	125	76	16	-	143	364	83	62	54
Tunisia	114	142	83	87	14	-	-	-	-	-
Iraq	-	-	-	-	-	209	408	133	58	44

Source: Derived from FAO World Grain Statistics, 1970-71, Rome 1972

(a) Syria and Lebanon Customs Union

## COMPARATIVE CHANGES IN HUMAN POPULATION AND CATTLE, SHEEP AND GOAT NUMBERS IN THE NEAR EAST

## AND NORTH AFRICA FOR THE FIVE-YEAR PERIOD 1966/67 - 1970/71

	Population (1000 Inhabitants)			Cattle (1000 head)			Sheep (1000 head)			Goats (1000 head)		
	1966	1970	Increase (% 5 yrs)	1966/67	1970/71	Increase (% 5 yrs)	1966/67	1970/71	Increase (% 5 yrs)	1966/67	1970/71	Increase (% 5 yrs)
Near East*	165,456	187,692	13.44	46,133	49,976	8.33	115,856	130,256	12.43	48,426	50,605	4.50
North Africa	30,478	34,573	13.44	4,796	5,160	7.59	24,037	29,000	20.65	10,442	11,400	9.17
Total for Region	195,934	222,265	13.44	50,929	55,136	8.26	139,893	159,256	13.84	58,868	62,005	5.33

Source: FAO Production Yearbook Vol. 25, 1971

\* Includes data for West Pakistan which was estimated.



PERCENTAGE COMPOSITION OF VALUE OF GROSS AGRICULTURAL OUTPUT

IN THE NEAR EAST AND NORTH AFRICA, 1962

	<u>Afghanistan</u>	<u>Iran</u>	<u>Iraq</u>	<u>Jordan</u>	<u>Lebanon</u>
Total Crops	55.1	59.4	57.3	82.2	72.0
Cereals	36.4	39.0	36.0	12.1	6.0
Fruits and Vegetables <sup>1/</sup>	11.7	8.1	17.1	64.0	57.3
Industrial Crops <sup>2/</sup>	5.5	9.2	2.9	1.8	3.1
Other Crops	1.5	3.1	1.3	4.3	5.6
Total Livestock	44.9	40.6	42.7	17.8	28.0
Gross Agricultural Output	100.0	100.0	100.0	100.0	100.0
	<u>Saudi Arabia</u>	<u>Sudan</u>	<u>Syria</u>	<u>ARE</u>	<u>Total Near East</u>
Total Crops	67.1	51.3	72.6	78.5	64.6
Cereals	14.3	11.4	25.2	25.5	27.3
Fruits and Vegetables	52.1	8.0	18.0	19.9	17.1
Industrial Crops	.1	26.7	26.1	29.2	17.0
Other Crops	.6	5.2	3.3	3.9	3.2
Total Livestock	32.9	48.7	27.4	21.5	35.4
Gross Agricultural Output	100.0	100.0	100.0	100.0	100.0
	<u>Tunisia</u>	<u>Algeria</u>	<u>Morocco</u>		<u>Total North Africa</u>
Total Crops	73.0	85.0	62.0		72.0
Cereals	21.0	28.0	32.0		28.0
Fruits and Vegetables <sup>1/</sup>	38.0	55.0	28.0		40.0
Industrial Crops <sup>2/</sup>	14.0	2.0	2.0		4.0
Other Crops	-	-	-		-
Total Livestock	27.0	15.0	38.0		28.0
Gross Agricultural Output	100.0	100.0	100.0		100.0

<sup>1/</sup> Includes starchy roots, pulses, nuts and grapes for wine

<sup>2/</sup> Comprises cotton, oilseeds, sugar crops and tobacco

Source: IWP Agricultural Development 1965-85, Near East, Vol. II, 1966 and other FAO statistics for North Africa.

CALORIES AND PROTEIN FROM PLANT SOURCES FOR  
SELECTED COUNTRIES IN THE NEAR EAST

COUNTRY	Calorie			Protein		
	Total	% From Plants	% From Cereals	Total	% From Plants	% From Cereals
Afghanistan	2057	93	84	65.4	88	80
A.R.E.	2639	93	70	76.6	84	70
Iran	2029	91	63	55.2	79	70
Iraq	2055	89	58	58.	77	64
Jordan	2397	93	54	64.8	83	62
Lebanon	2363	85	49	69.9	71	52
Libya	2068	92	57	53.9	78	66
Pakistan	1995	89	71	49.6	79	67
Somalia	1770	80	68	57.2	61	72
Saudi Arabia	2082	92	62	56.2	83	51
Sudan	2091	85	46	58.9	68	49
Syria	2451	89	61	69.2	83	71

Taken from: S. Nour Eldin, S. Milodi, "Trends and Problems of Population Growth in Relation to Food Production and Consumption in the Near East", FAO/UNFPA, Seminar on Population Problems, Cairo, 1972.

MEMBERS OF THE MISSION

1. Team Leader - Mr. Dunstan Skilbeck (U.K.). Formerly Principal of Wye Agricultural College of the University of London; specialist in research organization and management. Has carried out a number of overseas assignments and consultancies for ODA, FAO and the University of London.
2. Professor G. Barbero (Italy). Professor of Agricultural Economics and Dean of the Faculty of Economics and Banking, University of Siena. Has served in various capacities with FAO and UN in Rome, Latin America and Mediterranean countries.
3. Professor Charles Bower (USA). Specialist in soil salinity and drainage. Formerly head of US Salinity Laboratory, Riverside, California, now affiliated on a part-time basis with the Tropical College of Agriculture of the University of Hawaii. Has been consultant for USAID, IBRD and FAC.
4. Mr. E.D. Carter (Australia). Animal production and integration with crops. Currently Senior Lecturer in Agronomy with special reference to pasture and animal ecology at the Waite Agricultural Research Institute, South Australia (University of Adelaide). Previously officer in charge, South Australian Government Research Centre for soil-plant-animal studies. In 1966 worked as consultant to the Chile Agricultural Programme of the Rockefeller Foundation; elected Honorary Professor of the Faculty of Agronomy of the University of Chile. Has travelled widely in Latin America and the US.
5. Ir. G.J. Koopman (Netherlands). Specialist in water use and management. Presently Deputy Director (Projects and Research), Royal Tropical Institute, Amsterdam; also Senior Lecturer at the ITC-UNESCO Centre for Integrated Surveys, Euschede. Has consulted widely in the Near East and North Africa (Iran, Syria, Kuwait, Libya), as well as in other countries for the Netherlands Government, FAO, and international consultant firms.
6. Dr. I Abu Sharr (Palestine). Senior Agronomist, FAO/IBRD Cooperative Programme. FAO agronomist in Libya and Cyprus. Former Project Manager, Institute for Agricultural Research, Ethiopia. Has participated in agricultural sector surveys, etc. in Greece, Egypt, Syria, Kenya, and Yemen Arab Republic. Formerly Deputy Director of Deir Alla Agricultural Research Station, Jordan.
7. Mr. G. van Poorten (France). Institut National Agronomique, Paris. Inspecteur Général de l'Agriculture; Director-Général Adjoint de l'Institut de Recherches Agronomiques Tropicales (IRAT). Agronomist responsible for co-ordination of French technical assistance programmes to North Africa, and also has wide experience of research organization in Asia and Africa as well as in Near East Countries. Joined the Mission in Cairo on 1 April taking part in the visits to Tunis and Algeria only.

APPENDIX III

ITINERARY, INSTITUTIONS VISITED, AND PERSONS CONTACTED

Egypt (4 - 11 March)

Ministry of Agriculture

Mostafa El Gabaly	Minister of Agriculture
Salah El Abd	Deputy Minister of Agriculture
Hassan Baghdadi	Head, Agricultural Research Centre

Agriculture Department

M.A. Ghaffar	Director-General, Department of Agriculture and Cotton Research Institute
D.M. Stewart	Acting Project Manager FAO/UNDP Improvement of Field Crops Productivity
S.M. Dessouki	Head, Wheat and Barley Research
I. Abdelal	Head, Oil Crops Research
S.I. Salama	Head, Maize and Grain Sorghum Research
M.M. Hakam	Head, Legume Crops Research
Mostafa Serry	Senior Research Officer, Oil Crops
Abbas Omran	Research Officer, Oil Crops
Abdel-Mahab Mostafa	Senior Research Officer, Forage Crops

Soils Institute

M.I. Shebassy	Under-Secretary
Ali Sirry	Head, Plant Nutrition
Ismail Rafat	Head, Soil Survey Section
Abdul Monem El Nahal	Senior Research Officer

Plant Protection Institute

M. Hafez	Director
M. El Sayed	Director, Pesticides Laboratory
W.J. Magee	FAO/UNDP Project Manager, Pesticides Laboratory

Plant Pathology Department

T. Abdel-Hak	Director-General
A.M. El Zarka	Chief Plant Pathologist
A.S. Samra	Director, Maize and Sugar Cane Diseases Laboratory
A.H. Kamel	Senior Plant Pathologist, Wheat Diseases

Animal Husbandry Institute

M. Kheir Eldeen	Director
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Animal Health Institute

Y. Ozawa	FAO/UNDP Project Manager
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Sakha Research Station

M. Ismail	Director
N. Ghannam	Manager
E. Talat	Senior Wheat Breeder
A.M. Makky	Head Animal Nutrition Research Section
E. Vasilije	FAO/UNDP Project Manager, Animal Husbandry and Training Project
D. Stosic	Animal Nutrition Officer (FAO)

National Research Centre

K. Faraj	Secretary General
I. Rifat	Professor of Dairying
I. Higazi	Professor of Agriculture

Desert Research Institute

M. Atef Abdel Salam	Director
Nabil Rofail	Head, Water Resources Department
M.A.M. El Mahdi	Head, Botanical Laboratory
Saad Ali Sabet	Professor of Soil Science
A.A. Younis	Sheep Production Specialist

APPENDIX III (Contd.)

University of Cairo

Dr. A.M. Ghany

Dean of Faculty of Agriculture

FAO Near East Regional Office

Professor Mohammed Nour

Assistant Director-General (Near Eastern Affairs),  
and staff

Iran (11 - 18 March)

Ministry of Agriculture

Mir Haydar

Under Secretary

Ahmad Jalali

Planning Bureau

Soil Institute

A. Mahdavi

Director

Seed and Plant Improvement Institute

M.A. Sheybani

Director

Karaj Seed and Plant Research Centre

M. Samii

Director of Centre

H. Kaveh

Director, Wheat and Barley Improvement  
Programme

N. Aristoteles

FAO Seed Production Officer

Animal Husbandry Department

M. Mashhoon

Director

M.A. Manuchehri

Deputy Director

Razi Animal Health Institute

D. Kaveh

Director

Senior Institute Staff

College of Agriculture, University of Teheran

Amir Shahi

Deputy Director

M. Shahin

Agronomist

Rizayeh Province

Staff of the Ministry of Agriculture in charge of Field Crops, Horticultural and Animal Husbandry.

Veramin-Garamsar Project

National and FAO Staff

Lebanon (18 - 21 March)

Ministry of Agriculture

Malek Basbous	President of the Green Plan and Near East Representative to the Consultative Group
Mustafa Zeidan	Director-General
Joseph Chami	Head of projects and programmes
Khalil Choueiri	Head, Agricultural Education Department
Noubar Kasparian	Seed Production Officer
Sami Saredidine	Head, Department of Horticulture and Fruit Production
Khalil Feghali	Head of Agronomy Division
<u>National Council for Scientific Research</u>	
Joseph Najjar	President
Joseph Naffah	Secretary General
Moustafa S. Soufi	Science Adviser
Abdul Monim Talhouk	Professor of Economic Entomology A.U.B.
Joseph A. Asmar	Professor of Veterinary Medicine A.U.B.
Abdullah El Khatib	Head of Agronomy Division, Agricultural Research Institute
Fawwak T. Sliman	Animal Production Specialist
Adib T. Saad	Associate Professor of Plant Pathology A.U.B.
Antoine H. Sayegh	Associate Professor of Soils A.U.B.

APPENDIX III (Contd.)

Ministry of Planning

Mustafa Nsouli Director-General

Agricultural Research Council

Halim Najjar Chairman

Agricultural Research Institute (Tel Amara, Terbol, and Fanar Stations)

Joseph Haraoui Director-General

Ahmed Osman Soils Specialist

Joseph Kleime Plant Breeding Specialist

Salim Sarraf Irrigation Specialist

D. Alamuddin Vegetable Crops Specialist

Edmond Choueiri Animal Production Specialist

Abdulatif Elzein Animal Health Specialist

Arid Lands Agricultural Development Programme (Ford Foundation)

Robert D. Havener Director

Hassan El Tobgy Ford Foundation Programme Adviser (N.E.)  
TAC Member

Courtney Nelson Representative for Middle East Affairs

Owen L. Brough Deputy Director

Lawrence C. Curtis Livestock Specialist

Carroll W. Fox

Wesley A. Hardison Livestock Specialist

Leland R. House Plant Breeder Summer Cereals

Gerbrand Kingma Plant Breeder Winter Cereals

J. Dean McCrary

American University Beirut (and University Farm Bekaa)

Stanley Swanson Dean, Faculty of Agricultural Sciences

J.W. Cowan Professor of Food Technology and Nutrition,  
Associate Dean.



APPENDIX III (Contd.)

American University Beirut (and University Farm Bekaa)

K.C. Berger	Chairman, Soils and Irrigation
Harry D. Henderson	Professor of Agricultural Mechanization
Salah Abu Shakra	Associate Professor, Agronomy and Seed Technology
Hikmat G. Nasr	Assistant Professor, Plant Breeding and Plant Genetics
Ray M. Nightingale	Assistant Professor, Agricultural Economics

Iraq (21 March - 27 March)

Ministry of Agriculture

Mustafa Hamdoon	First Under Secretary
Hisham Alizzi	Director-General of Diwan
A. Alsoz	Director-General of Planning and Followup
Tariq Al Orfali	Assistant Director-General for Technical Affairs

High Agricultural Council

Taha Al Abdulla	Acting Chairman
Hussain Al Ani	President, State Organization for Agricultural Development
Afeef El Rawi	Under Secretary, Ministry of Irrigation
Abdul Wahab Al Dahiry	Economist
Samal Majeed	Economist
Saad Malik Al-Ali	Engineer

Scientific Research Foundation

Naji Abdul Kadir	President
S.I. Tahsin	Secretary General
R. Al Badrawy	Director, Agricultural Research Centre
A. Al Zubaidy	Director, Palms and Dates Research Centre

APPENDIX III (Contd.)

Ministry of Agriculture, Abu Ghraib Station

R.S. Marouf	Director General Field Crops
Haidar El Haidary	Director General Plant Protection
M. Rawi	Director General Veterinary Services
Sami El Kaseer	Director General Animal Resources
A. Aziz	Plant Breeder ( FAO )
G. Grewal	Oil Seeds Specialist ( FAO )
Mahmoud Al-Mishhadni	Head of Soil Survey and Land Classification Division
Fakhir Jabbar Al Nasir	Head of Technical Division
Mudhaffer A. Ismail	Assistant Director, Division of Investigation and Design
M.S. El Mahdy	FAO Irrigation and Drainage Engineer
Khalil Mosluh	Head of Fertility and Plant Nutrition Department
Abdul Jalil Kademe	Irrigation Engineer
Omar Ali Ameen	Director, Cereal Crops Division
Tarik A. Tabrah	Director, Cotton Division
Abdul Sattar Kirukchi	Director, Industrial Crops Division
Kamil Alkaisi	Director, Weed Control Division
Raja Abdeleis	Director, Seed Production Division
Abdul Jabbar Ameen	Field Crops
Mahmoud Mayouf	Forage and Pasture Crops
Khairy Habib	Forage and Pasture Crops

Institute for Applied Research on Natural Resources

Jamal S. Dougrameji	Director
R.N. Kaul	UNESCO Project Manager
M. Said Kettaneh	Watershed Management
R. Van Aart	Land Reclamation

Institute of Agricultural Technology

Mohammed Abid Al Saidy	Director
Salah Noah	FAO/UNDP Project Manager
Saad Abbadi	Horticulture
Mohammed Oloufa	Animal Production
Labiba Husseni-Delsi	Home Economist

Institute for Cooperatives and Agricultural Extension

T.L. Poulos	Senior Adviser
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Aski Kalak Livestock Station

Hassan Karam	FAO/UNDP Project Manager Development of Livestock Production
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Erbil Forest Research Institute

Hashim Mohammed	Director
M. Kalembe	FAO/UNDP Officer-in-Charge of Research, Training and Demonstration Project
I. Hussein	Range Management FAO

Nineveh Experiment Station

Field Crop Research Officers

Mosul University - College of Agriculture and Forestry

Hassan Fahmi Jumaa	Dean
Abdullah Fakhri	Head, Department of Agriculture
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S. Krishnamurthi	FAO/UNDP Project Manager
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S.M.A. Husain	Agricultural Economist (FAO)
B.N. Roy	Soil Scientist (FAO)

Greater Mussayeb Authority

Dhari Al-Hardan	Director-General
J.G. Pike	FAO/UNDP Project Manager Greater Mussayeb Project



APPENDIX III (Contd.)

Animal Production and Health Directorate (contd.)

M. Bahra	Animal Health
Ali Share	Range Division

Staff of IZRA Dryland Station

Staff of Karanta Field Crops Station

Staff of Sergayeh Horticulture Station

Staff of Ghab Project

Staff of Sallamia Sheep and Range Station

Wadi El Azeeb Project and Sheep Fattening Cooperative

Omar Draz	FAO Pasture and Forage Specialist
Fawaz El Reyen	Chief, Eghidat Tribe

Ministry of Planning

Mahmoud Said	Director of Agriculture and Irrigation Planning
M. Said Halabi	Deputy Director
Nihad Rida	Director of Technical Assistance
Rouwaida Gazal	In Charge UNDP Projects

Institute of National Planning

Mahmoud El Shaffie	FAO/UNDP Project Manager
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TUNISIA

Ministry of Agriculture

El Dawi Hanabliya	Minister of Agriculture
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National Institute for Agricultural Research (INRAT)

Mohammad Skouri	Director
Ali Ridha Maamouri	Head, Cereals Research
Mohsen Ben Amer	Animal Nutritionist
A. Blomeyer	Animal Nutritionist - bilateral assistance (Federal Republic of Germany)
J. Gachet	Forage Crops Specialist - French bilateral assistance



APPENDIX III (Contd.)

Project Cereals (contd.)

W.L. Nelson	Agronomist/Breeder CIMMYT
Michel Augustin	Chief of Caisse, Centrale Cooperation Economique (France)
Ante Golusie	FAO/UNDP Project Manager

Hodna Project

G. Popov	FAO/UNDP Project Manager
J. Cazautets	Agronomist (FAO)

Haut-Cheliff Development Project

Tamzali Abdullah	Commissioner
J.C. Legoupil	Agronomist/Bioclimatologist - French bilateral Assistant (IRAT)
M. Khalifa	Manager Haut-Cheliff Expt. Station

National Centre for Livestock Research (CNZR) - Baba Ali

M. Kerbaa	Director
Mme. Kerbaa	Animal Nutrition

National Centre for Agricultural Research (CNRA) - Maison Carré

M. Hachemi	Head, Plant Breeding Section
A. Hamadi	Head, Soil Fertility Section
Ghoura Mallad	Plant Nutrition
M. Hemard	Seed Production
De Bellanger	Agronomist
M. Petit	Seed Control

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APPENDIX V

ACKNOWLEDGEMENTS

The Mission desires to record its particular gratitude to the following:

FAO, Rome - for all the forethought given to the preparation, orientation and documentation of the Mission.

Near East Regional Office - FAO, Cairo

to the Assistant Director-General and his colleagues and for the great help given to the Mission throughout its visits in the Near East by Dr. Abdul Hafiz who was seconded to it from the Near East Office.

The UNDP Country Representatives

The FAO Country Representatives and Senior Agricultural Advisers

The Director and Staff of the Ford Foundation Arid Lands Agricultural Development Programme - Beirut, and of the Ford Foundation/CIMMYT team.

The Director and staff of INRAT - Tunis  
The Director and staff of C.N.R.A. - Algeria.

It also desires to record its appreciation of all the help and hospitality received from the considerable number of persons with whom it had discussions in the seven countries visited, particularly to the Ministers, Vice-Ministers and the Senior Civil Servants who so readily placed themselves at the disposal of the Mission in order to facilitate its work. The names are recorded in Appendix III.

It wishes to record its thanks to Mr. Peter Oram, the Secretary of TAC, who was so largely responsible for the planning and organization of the Mission and who gave it so much assistance throughout its deliberations.



A

INTERNATIONAL AGRICULTURAL RESEARCH : AN ENCOURAGING VENTURE  
IN INTERNATIONAL COLLABORATION

I

1. This lecture is about international agricultural research and, more especially, developments since May 1971. In that month the first meeting of the Consultative Group on International Agricultural Research (CGIAR) was held. The membership comprised the Sponsors - World Bank, (IBRD), Food and Agriculture Organization (FAO) and United Nations Development Programme (UNDP) - and eighteen members - nine national governments<sup>\*</sup>, two regional Banks, three Foundations (Rockefeller, Ford and Kellogg) and the very young International Development Research Centre (IDRC) of Canada.
  
2. In fact this Group had met informally in January 1971 following on continuing talks between the two major Foundations, IBRD, FAO and UNDP since October 1969. The leadership was provided by the Bank which now provides the Chairman and Secretariat of the Group. The May meeting adopted a number of objectives (See Appendix I) - all designed to strengthen existing international research centres (CIMMYT), Philippines (IRRI), Latin America (CIAT), and West Africa (IITA) and to develop new activities to meet priority needs as determined by the Group on the advice of its Technical Advisory Committee (TAC). Of TAC more anon.
  
3. It should be understood from the outset that the mainspring of action was the desire to encourage a greater research effort aimed at

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\* Canada, Denmark, France, West Germany, Netherlands, Norway, Sweden, U.K. & U.S.A. As observers (mostly now members) there were delegates from Australia, Belgium, Finland, Italy, Japan, New Zealand and Switzerland. The membership is now 29 donor members, and representatives of five major developing regions.

assisting developing nations to increase the quantity and improve the quality of their agricultural output and thus to raise standards of living. All parties realised that increased agricultural productivity was essential to economic and social development in the great majority of these countries. The belief in research as an aid to this end was based on the spectacular results emerging already from CIMMYT (wheat and, less assuredly then, maize) and IRRI (rice). The other two centres were in early stages of establishment but were clearly modelled on the older two\*. The Consultative Group believed that research could provide much needed new technologies in the developing countries, and that international organization could provide a critical research mass whose cost would be beyond the resource of developing countries but would, through concentration of very high skills in research, provide an economical way of achieving widespread results. I will refer to this again.

4. Additionally, it should be understood that the two Foundations whose initiative had given the research centres to the world had indicated that the future needs of these centres and needed further centres would be beyond their financial capacity. They indicated continuing strong support but nevertheless felt the need, in the unofficial words of one senior official, of "going public". I believe the step the Foundations took will be given a high and honourable place in the history and achievements of international co-operation.

5. To assist it in its work, the Consultative Group established in May 1971 the Technical Advisory Committee (TAC) of which I have the

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\* As at June 1971 the declared interests of CIAT and IITA were, however, rather wider than those of IRRI and CIMMYT. See para. 6 below.

honour to be Chairman. It comprises twelve scientists and me. (See Appendix II for details.) FAO provides the Secretariat which is headed by Mr P.A. Oram. Put in a sentence, the task of TAC was to define priorities for research and to recommend action. It could act either on its own initiative or consider proposals submitted from the Consultative Group through its sponsors. The full terms of reference are given in Appendix III. I will shortly discuss their significance in relation to priorities and to some of the constraints which must necessarily affect TAC's approach to its task and the Group's power to act on TAC recommendations.

6. I wish early, however, to remove from your minds any suspicion the word "constraints" may immediately arouse. Progress so far made by the Group is quite remarkable although, of course, the final test will be in the scientific output that emerges from established centres and those in process of establishment - not to mention the final test of all: the policy and action programmes to be built on the work of the scientists. We now have the following institutes or centres in being or about to be established:

1. IRRI (International Rice Research Institute), Los Banos, Philippines:
  - Research: Rice under irrigation  
Multiple cropping systems  
Upland Rice
  - Coverage: world wide, special emphasis in Asia.
  
2. CIMMYT (International Maize and Wheat Improvement Centre), El Batan, Mexico:
  - Research: Wheat (also triticale, barley)  
Maize
  - Coverage: world wide.



4.

3. CIAT (International Centre for Tropical Agriculture),  
Palmira, Colombia:

Research: Beef  
Cassava  
Field Beans  
Farming Systems  
Swine (minor)  
Maize and Rice (Regional Relay Stations  
to CIMMYT and IRRI)

Coverage: world wide in lowland tropics, special  
emphasis in Latin America.

4. IITA (International Institute of Tropical Agriculture),  
Ibadan, Nigeria:

Research: Farming Systems Programme (maintaining  
fertility in humid tropics)  
Cereals Improvement (rice and maize as  
Regional Relay Stations for IRRI and  
CIMMYT)  
Grain legume improvement (cowpeas, soybeans,  
lima beans, pigeon peas)  
Root and tuber improvement (cassava, sweet  
potatoes, yams)

Coverage: world wide in lowland tropics, special  
emphasis in Africa.

5. CIP (International Potato Centre), Lima, Peru:

Research: Potatoes (for both tropics and temperate  
regions)

Coverage: world wide including linkages with developed  
countries.

6. ICRISAT (International Crops Research Institute for the  
Semi-Arid Tropics), Hyderabad, India:

Research: Sorghum  
Pearl Millet  
Pigeon Peas  
Chick Peas  
Farming Systems

Coverage: world wide, special emphasis on dry semi-  
arid tropics, non irrigated farming.  
Special relay stations in Africa under  
negotiation.

7. ILRAD (International Laboratory for Research on Animal Diseases), Nairobi, Kenya:  
 Research: Trypanosomiasis  
 Theileriosis (mainly East Coast Fever)  
 Coverage: Africa.
8. ILCA (International Livestock Centre for Africa), Ethiopia, plus organized relay links:  
 Research: Livestock Production Systems (for major ecological regions in tropical zones of Africa.)
9. AVRDC (Asian Vegetable Research and Development Centre),  
 Taiwan:  
 Research: Crops and Cropping Systems:  
 Mung Beans  
 Soybeans  
 Tomatoes  
 Sweet Potatoes  
 White Potatoes  
 Chinese Cabbage  
 Coverage: humid tropics and sub-tropics of Asia.
10. Crop Genetics Resources Network (in process of launching: approved by Consultative Group, November 2 1973):  
 To conserve plant material with special reference to cereals.
11. \*\* WARDA (West African Rice Development Association):  
 A regional co-operative effort in adaptive rice research among twelve nations with IITA and IRRI support.
12. \*\* Near East/ North African Research:  
 Probably a centre or centres for crop and mixed farming systems research.

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\* Limited support as borderline case in priorities. Nevertheless, free to develop links with other "members" of the Consultative Group "research club".

\*\* Under consideration.

13. \*\* INTSOY (an effort to develop soybean work in developing countries with the University of Illinois as base).
14. \*\* Some further proposals for legume work (general) and in Latin America.

From a cost of about \$US12-14 million in 1972, the programme financed by the Group is now close to \$US33 million for 1974 (capital, core budget and outreach programmes) with an implicit commitment of about \$US57 million circa 1977 (at constant 1973 prices). I will talk more of this later when dealing with the question of financial constraints. At least you can be sure that in a short period of two years (TAC held its first meeting in June 1971) the CGIAR system has given extremely solid evidence of its willingness and ability to back its judgement that international research has a vital role to play. It is about this and the priorities selected that I wish now to say a good deal more.

## II

7. I will begin with a few comments on TAC's terms of reference if only to lead most easily into the question of its concepts of research priorities.

(a) TAC is expected to act on its own initiative: this is particularly true in the matter of "main gaps and priorities". It has to be remembered that the established four centres -

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\*\* Under consideration

IRRI, CIMMYT, CIAT and IITA - virtually pre-empted judgement <sup>to review / present</sup>

While TAC had little difficulty in approving the main work of these bodies, it has begun to encourage some new thrusts such as the move into rainfed rice production by IRRI.

(b) The work of TAC is explicitly related to the problems of developing countries both in technical (agricultural) and socio-economic fields. National research in developed countries is often highly relevant but is of formal concern to TAC only when it is or can be linked with the problems of developing countries. An example is INTSOY - an attempt to make the research in this crop in the University of Illinois fully international in operation and coverage.

(c) TAC is not strictly limited in its work of review to international research, for the term of reference (ii) does stress "international or regional efforts". When I turn to priorities I will stress the importance of national research centres.\* In the meantime, however, it is well to note that TAC has defined "international research" broadly to mean "research which, although based in one country, is of wider concern, regionally or globally; is independent of national interest and government control; and retains appropriate links with national and other regional or international research systems to ensure the necessary testing of results and the feedback of both results and needs. The centres whose activities are being

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\* It is, of course, important to ensure an adequate network among the international centres themselves - clearly in the interests of world wide coverage in crops like rice, wheat and the legumes.

supported within the framework provided by the Consultative Group all have international Boards of trustees and their staffs are international".

TAC strongly insists that the vitality of international research depends significantly on feedback from adaptive research operations and for this reason has begun to press for greater national research capacity in developing countries in order to maximise the dividend from investment in international research. As part of this linkage TAC fully recognizes as part of the programmes of the centres their training of national leaders in research and extension.

(d) TAC is advisory only: the Consultative Group will not act on important research proposals without prior advice from TAC but remains free to reject or modify the advice it receives. It follows that the Consultative Group has to be persuaded by TAC in its development of ideas in priorities.

(e) It would be within the competence of TAC to see research simply in terms of the technical improvements (e.g., high yielding varieties) which flow from research. However, both the Consultative Group and TAC have realised that the practical achievements sought may be frustrated by economic and social constraints and by the inadequacies of general national agricultural and economic policies. This matter is discussed at some length later in this address.

(f) Again, judgement about priorities is directly affected by the varying situations of developing countries. Thus, TAC has so far been much influenced by the needs of developing countries in which the following circumstances are marked:

- (i) the agricultural sector includes the largest proportion of the total population, almost always larger than its share of the national income available for consumption and saving;
- (ii) the agricultural sector of necessity (trade or migration offering no alternative solution) provides close to 100% of the food needs of the national population; and
- (iii) new technologies are necessary to raise output, incomes and employment in the agricultural sector and to provide a stronger complement to industrial and tertiary sector expansion. The growing interest in socio-economic "agricultural" research is in part the recognition that urban development, apart from its own social costs, in many countries cannot fully relieve the population pressure reflected in unemployment and underemployment in the agricultural sector. It also accounts for the ever present concern to find labour intensive, but advanced, technologies for agriculture.

8. For the next part of my remarks I will follow rather closely (but in much summarised terms) a document on priorities presented by TAC and adopted by the Consultative Group on the first of this month in Washington.

The paper, based on drafts prepared by me and by Mr Oram, Secretary to TAC, embodies the considered views of TAC. The paper, which is likely to be published in the near future, discusses priorities and some implications of these for national donor agencies and international bodies like FAO, UNDP, the World Bank. At best I can only briefly cover the ground tonight.

### III

9. I will discuss the following matters:
- (a) Food Commodities as First Order Priority.
  - (b) Factor-oriented research, including systems research.
  - (c) Relation between Applied and Basic Research.
  - (d) Socio-economic research.
  - (e) Flexibility in organizing international research.
  - (f) Strengthening national research.
  - (g) Financial constraints in relation to priorities.
  - (h) TAC's role in reviews of progress in research.

#### First Order Priority: Research on Food Commodities

10. TAC, confirmed by the Consultative Group, places the highest importance on research directed to increasing the amount and quality of food produced. This is hardly surprising in the Malthusian situation in which much of the world finds itself. At best, TAC believes research will buy time while population growth is brought under control: but

it is vital even for this purpose. This is reflected in TAC's statement on the cereals which I here reproduce.

"In the first place cereals provide the mainstay of the diet in most developing countries, especially for the poorer people, supplying an average 52 percent of the calories and nearly half the total protein. It has been shown that if there is a serious deficit in calories in the diet the body consumes protein for energy. Since cereals generally make the largest single contribution of any commodity to both energy and protein, research to increase their yield and protein content is of crucial nutritional importance. Upgrading their amino-acid composition could, at no extra cost to consumers, make a further improvement in the quality of the diet. Secondly, despite the real successes in increasing wheat and rice output, cereal production in developing countries has barely kept pace with population and income growth during recent years, and experience in Asia in the last two years shows how fragile is the base on which these critical supplies rests. Income elasticity of demand for cereals is still high in the poorer countries, quite unlike the situation for food grains in the developed economies, and an important indication that food consumption levels are inadequate. In a number of countries failure to increase production rapidly enough to meet domestic demand has led to increasing imports, draining foreign exchange required for social and economic development. Third, cereals are the lynchpin of the cropping system in many developing countries and contribute significantly to income and employment. Finally, a faster growth of grain production will be necessary if feed supplies are to become available in sufficient quantity at prices which will permit their economic use in livestock rations. It is relevant to note the rapidly rising demand for feedgrains in the more affluent nations, which has been one factor contributing to the recent stringency and high prices of cereals and soya beans. This has in turn affected the availability of grains on concessional or normal trade terms to developing countries and further emphasizes the need to increase output in these countries as rapidly as possible."

11. The TAC goes on to observe the growing necessity to raise yields per hectare as new arable land becomes more and more limited in relation to population. Its report comments:

"It thus becomes increasingly necessary to turn towards raising yields and crop intensities as the major source of future growth, and since cereals occupy the largest share of the arable area in a wide range of environments, they hold the key to the more effective use of land and water resources. Unless their yields can be increased or their time to maturity reduced, it will be correspondingly more difficult to make significant progress with other crops and livestock since more and more land will have to be devoted to satisfying basic calorie requirements. The alternative - increasing imports - is open only to a few countries.



12. The main cereals supported are rice, wheat, barley, triticale, sorghum and millet. Turning from cereals to other key commodities, the TAC has accorded high priority to those which will improve the quality of the diet, especially in respect of protein. In particular it has focussed attention on the food legumes and on ruminant livestock. (It recognizes fully the place of pigs and poultry, especially in developing their production by labour-intensive methods. Most members have felt the opportunities open for such development could be seized by the application of known methods of disease control, better feeding and management and did not require extensive research.) TAC is also supporting research in starchy foods including cassava, potatoes, yams and sweet potatoes. The importance of these crops in many developing areas with poor resources in relation to population, as in tropical Africa, is very great indeed. TAC has yet to determine its position in respect of aquaculture but there is evidence of scope for research with definite promise of breakthrough.

13. TAC does recognize a second level priority for food research.

To quote its report again:

"Having taken a firm position on its priorities for cereals, food legumes, roots and tubers, and ruminant livestock (especially cattle), and placed a temporary questionmark against aquaculture, the TAC has been less decisive on some other foods, in particular oilseeds, vegetables and tropical fruits. This is partly the result of pressure of work related to the commodities listed above, which, it decided in its earliest session, were of highest priority, and where some good projects were already in the pipeline, but it also reflects a lack of sound proposals for research on other food commodities."

TAC is at present reviewing the case for fruit and gave qualified support to vegetable research in Taiwan. (See reference to the AVRC in para. 6 above.)

14. This brings me to the important question of "non-food", "industrial" or "agricultural raw materials" which have considerable importance in the economies of many developing countries. Cotton, jute, rubber and forests are examples. Given the probable order of financial constraint which I discuss later, TAC has been firm that it would be unhappy to give preference to research <sup>in these crops</sup> (to be supported by the Consultative Group) if this was likely to impair necessary programmes of food research. TAC is willing to consider proposals <sup>in this area</sup> referred to it provided that "the over-riding need to secure the staple food supplies of the mass of the people was first covered by existing or new international and regional research programmes".

#### Factor-Oriented Research and Systems Research

15. You will notice that I have outlined our priorities in commodity terms. This at least has the merit of clarity and easy definition. Nevertheless, TAC has also had before it certain proposals for research related to what might best be defined as factors of production - water use and management, fertilisers, integrated pest control, pesticide residues, etc. - which have caused it some difficulty. TAC has stated its position as follows:

"In general, members have taken the view that such problems are most meaningfully studied in relation to specific commodities rather than as ends in themselves. They have argued that one of reasons for the success of the rice and wheat programmes has been the realisation by IRRI and CIMMYT of the need to develop and present to the farmer an integrated "package" of technology appropriate to their new varieties, and not just the latter in isolation unsupported by other essential inputs.

While there is much merit in this argument there are nevertheless instances which can be identified where it may be an inadequate approach and where it is essential to move from the study of the

commodity or package of technology to that of the system. Except in monocultures, water use and management has to be related to the crop-mix rather than to the individual crop; fertiliser and pesticide residues contributing to environmental pollution again come from the totality of the farm and not just one enterprise. The introduction of small-scale livestock often implies a major revision of an established system. Multiple cropping depending on high output per annum involves radically different management and plant breeding and cultural concepts than systems which depend principally on high yield per individual crop. Inadequate survey and exploration of surface and sub-surface water resources combined with insufficient research on soil/plant/water relationships is frequently a serious obstacle to sound design, good water management and the development of optimum production systems in irrigated areas. Storage; and control of certain causes of crop loss, e.g. rodents, may present problems of a broader nature than a single crop."

16. It is with these thoughts in mind that TAC has, of late, been stressing the scope for systems work which leads into socio-economic research also. It is naturally concerned, within this framework, to devise means of intensifying agriculture as a means of raising total productivity (of two or more crops) per hectare through better resource utilisation. In doing so, it may at times, be forced to recognize a degree of location specificity not normally a constraint on commodity oriented research. This in turn gives emphasis to regional and national research capable of the kind now being considered in Africa (livestock management) and in the Middle East about which we will determine a view next February.

17. Despite the greater difficulty confronting TAC in looking at research in non-commodity oriented terms, TAC is prepared to do so. Its general position is summed as follows:

"But although increasing yields and production of basic staple foods must remain a priority goal, the ultimate objective of agricultural research is development and the economic well-being of people. We must not be so bewitched with the hopes

of further spectacular successes with single crops that we fail to recognize that other pathways to growth may exist. In some regions, for ecological, social, or economic reasons, research of a broader nature - even if it appears more complex, may offer the better hope of a solution. Where such an approach seems desirable the TAC and the Consultative Group must grasp the nettle boldly."

#### Socio-Economic Research

18. This sub-heading is worth two lectures: I can afford but a few paragraphs to report TAC's position. I would be glad to enlarge in question time if this is in order. The very real problems of, and opportunities for success in, the "green revolution" have aroused widespread demands for an <sup>single</sup> international centre in socio-economic research. At the other extreme many expect IRRI and CIMMYT to carry the whole burden of socio-economic research associated in the national application of the rice and wheat technologies emerging from their work. Neither approach <sup>alone</sup> makes sense.

19. TAC has recognized three levels of action:

- "(i) research at the micro-level (farm or village community), to identify the socio-economic constraints to the successful adoption of new technology, and to guide scientists at the International Centres and elsewhere as to the types of technology most likely to be acceptable to farmers.
- (ii) research at the level of public policy, e.g. to determine the measures and incentives needed to accelerate the use by farmers of technical innovations, to give early warnings of possible "second generation" effects of such innovations, e.g. on employment or prices, and to illuminate the choice of alternatives.
- (iii) research at the macro-level on broad issues affecting more than one country, or the economy of a country as a whole, e.g. on commodities and trade, some aspects of nutrition, sectoral analysis, etc."

20. It is clear that the international research centres can do much under (i); and TAC has recommended accordingly. This first category leads into (ii) - public policy social and economic issues. While external technical assistance and investment support can be given in these areas, the identification of problems and plans for their solution is very much a problem for research, planning and governments in the nations affected. They can be helped, but no more, by training and seminars conducted by the international centres.

21. Where issues affect more than one country there is scope for more international action. This will become increasingly apparent in fertiliser supplies, commodity trade and pricing problems, investment aid for development. In some of these matters - e.g. an early warning system for cereal production forecasts or for major issues of world food policy there is undoubted room for concentrated international effort - governmental and non-governmental. But these are beyond my terms of reference.

22. The real need, therefore, is strengthened socio-economic work associated with the development of new technologies at research centres: international and national (including universities); national work on public policy implications of new technologies; and international effort especially on economic and environmental efforts beyond the scope of national governments alone.

Basic and Applied Research : Flexibility in Research Organization

23. The TAC report does touch on this question. My comment must be extremely brief and in terms avoiding the problems of theoretical

delineation of the two terms. Indeed I wish only to make one point: it may not be wise or necessary to tackle "basic" problems through new institutions. Thus triticale is the product of basic work in Canada and elsewhere; soybean problems are probably better handled in places like the University of Illinois and some of the worrying relatively low yield characteristics of legumes which may have physiological and morphological explanations could be referred by contracts to University centres for research. TAC has started to consider this last possibility. It is an illustration also of needed flexibility in our approach to international research. Not everything calls for an IRRI or a CIMMYT in organizational terms. Time does not permit further comment on the question of research organization.

#### Strengthening National Institutions

24. TAC could not possibly handle requests for strengthening national research systems nor is the CGIAR established for this purpose. Nevertheless, TAC is clear that unless national research capacities are strengthened to an extent that enables them to take advantage of the results of international research the dividend from international research will be limited. Moreover, I do not ~~...ate~~ stress again the importance to the international centres of feedback from adaptive research within national boundaries. Sometimes this is effected by outreach programmes; but Indian and even Indonesian research capacities are not typical of the many very poor countries in Africa and Asia. Accordingly TAC has strongly urged more attention by FAO, UNDP and the World Bank and bilateral donors ~~xxxxxxxxxxxx~~ to financial and organizational support for national research.

Financial Constraints

25. I refer now to an attachment to TAC's Report. This is a table giving some estimates of prospective costs of international research. It is not for publication and is accordingly not attached to copies of this address for publication. It was prepared some months ago and the total of core, capital and outreach programmes shown as \$US29 million for 1973 will in fact be close to \$US33 million in 1974. At constant prices this could - given continued support by the Group - reach \$US57 million in the late seventies and perhaps \$US64 million in the early eighties. These two figures could be \$US65 million and \$US87 million if inflation continues at recent rates.

26. We have here a dilemma of concern both to TAC and the Consultative Group. On the one hand, TAC cannot assume unlimited support; on the other, once the Group offers support it must also offer reasonable continuity in that support. The Group has given TAC very strong backing thus far. For its part, I believe TAC has in its priorities, acted with care and financial responsibility. It knows very well that research programmes must be reviewed from time to time and unnecessary or unpromising work deleted. It is about to establish working relations with the centres to this end. On the other hand, it will continue to press for support for new work where this is considered by it to be a vital contribution to the solution of the world's Malthusian situation.

27. I think I should finish on a note of confidence. The CGIAR/TAC system is a unique venture in international collaboration. It has succeeded beyond anyone's real expectations in 1971. We confidently

await an increasing and usable output from the rising research investment. Much now depends on international and national economic and social policies to apply the actual and anticipated research results. This topic, which embraces the whole meaning of, and prospect for, development in the poorest areas of the world, is beyond my brief to-night. However, I conclude simply by saying I do not belong to the band of the hopeless pessimists. The CGIAR/TAC experiment has buoyed my hopes and expectations that good sense will yet prevail.

J.G. Crawford

26 November 1973



## CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

Objectives

The main objectives of the Consultative Group (assisted as necessary by its Technical Advisory Committee (TAC) are:

- (i) on the basis of a review of existing national, regional and international research activities, to examine the needs of developing countries for special effort in agricultural research at the international and regional levels in critical subject sectors unlikely otherwise to be adequately covered by existing research facilities, and to consider how these needs could be met; 1/
- (ii) to attempt to ensure maximum complementarity of international and regional efforts with national efforts in financing and undertaking agricultural research in the future and to encourage full exchange of information among national, regional and international agricultural research centers;
- (iii) to review the financial and other requirements of those international and regional research activities which the Group considers of high priority, and to consider the provision of finance for those activities, 2/ taking into account the need to ensure continuity of research over a substantial period;
- (iv) to undertake a continuing review of priorities and research networks related to the needs of developing countries, to enable the Group to adjust its support policies to changing needs, and to achieve economy of effort; and
- (v) to suggest feasibility studies of specific proposals to reach mutual agreement on how these studies should be undertaken and financed, and to exchange information on the results.

In all of the deliberations of the Consultative Group and the Technical Advisory Committee, account will be taken not only of technical, but also of ecological, economic and social factors.

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1/ Research is used in this document in a broad sense to include not only the development and testing of improved production technology, but also training and other activities designed to facilitate and speed effective and widespread use of improved technology.

2/ Final decisions on funding remain a responsibility of each member in connection with specific proposals.

MEMBERS OF THE TECHNICAL ADVISORY COMMITTEE ON INTERNATIONAL  
(c)  
AGRICULTURAL RESEARCH

1. Sir John Crawford (Economist), Australian National University, Canberra. Chairman -Australia
  2. Inq. Manuel Elqueta (Agronomist), Ex-Director, Chilean Agricultural Research Institute; now working with IICA as Director of proposed Turrialba Research Corporation. -Chile
  3. Professor Dr Hassan Ali El-Tobgy (Genetecist), Under-Secretary, Agriculture, and Chairman, Research Committee. -U.A.R.
  4. Professor H. Fukuda (Irrigation Specialist), Vice President, International Commission for Irrigation and Drainage, Tokyo University. -Japan (a)
  5. Dr G. Harrar (Plant Pathologist), President, Rockefeller Foundation. -U.S.A. (b)
  6. Dr W.D. Hopper (Economist), President, International Development Research Centre. -Canada
  7. Dr Luis Marcano (Agronomist), President, Shell Foundation. -Venezuela
  8. Dr T. Muriithi (Animal Health), Director, Veterinary Services. -Kenya
  9. Dr J. Pagot (Animal Production), Directeur General Institut d'Elevage et de Medecine Veterinaire des Pays Tropicaux. -France
  10. Dr H.C. Pereira (Physicist), Director, East Malling Research Station, Kent (previously Director, Central African Research Organization). -U.K.
  11. Dr L. Sauger (Agronomist), Directeur, Centre de Recherche Agronomique du Bambey. -Senegal
  12. Dr M.S. Swaminathan (Genetecist), Director, Indian Agricultural Research Institute, New Delhi. -India
- 
- (a) Since succeeded by Dr N. Yamada, Director, Tropical Agricultural Research Center, Ministry of Agriculture and Forestry. -Japan
  - (b) Since succeeded by Dr V.W. Ruttan, Agricultural Development Council, New York. -U.S.A.
  - (c) Professor D. Bommer, Head, Institute for Plant Cultivation and Seed Research, Agricultural Research Centre, in June 1972 was added as the thirteenth member. -Fed. Republic of Germany

TERMS OF REFERENCE : TECHNICAL ADVISORY COMMITTEE

TAC will, acting either upon reference from the Consultative Group or on its own initiative:

- (i) advise the Consultative Group on the main gaps and priorities in agricultural research related to the problems of the developing countries, both in the technical and socio-economic fields, based on a continuing review of existing national, regional and international research activities;
  - (ii) recommend to the Consultative Group feasibility studies designed to explore in depth how best to organize and conduct agricultural research on priority problems, particularly those calling for international or regional effort;
  - (iii) examine the results of these or other feasibility studies and present its views and recommendations for action for the guidance of the Consultative Group;
  - (iv) advise the Consultative Group on the effectiveness of specific existing international research programs;
- and
- (v) in other ways encourage the creation of an international network of research institutions and the effective interchange of information among them.

These terms of reference may be amended from time to time by the Consultative Group.

BMC  
FI

DEPARTMENT OF STATE  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D. C. 20523

ASSISTANT  
ADMINISTRATOR

October 30, 1973

MEMORANDUM

TO: Sir John Crawford  
Chairman, TAC

FROM: Joel Bernstein *JB*  
Assistant Administrator for Technical Assistance

SUBJECT: Research Priorities Paper

Having been away a month, I've just had the chance to read your Sept. 1 revision of the priorities paper. We find it very insightful and useful and are confident that it will benefit substantially the CG/TAC work.

I'm sending along a list of comments where we take some exception or have some question, for such use as you may care to make in any further drafts, rather than raising the points in meetings. They add up to very little compared to the overall contents, which we applaud.

1. While we agree with your designation of fruits and vegetables in general as a second level priority at this time, it might be desirable to note that truck gardening is both labor intensive and will offer increasing opportunities for higher value production, given the rapidly growing urban areas of LDCs and the rapidly expanding prospects for economic air transport of truck gardening products to developed countries as well as ground shipment of processed products. Thus this prospect calls for special scrutiny, early on.\*

2. Re para. 63, the seminar was sponsored by the CGIAR, not USAID. I chaired the preparatory committee, at the request of the CG Chairman.

3. Section VIII seems to mix together, in a fashion that we found a bit confusing, two different sets of questions on the interest that the CG/TAC should take in harnessing basic research capabilities of developed countries more effectively to its purposes. One need, most frequently mentioned to date, is to strengthen the working linkages between the Centers and more basic (and other) research at developed country institutions that can help to reduce problems impeding the impact of the more "applied" types of research done at the Centers, i.e., to work out an appropriate division of labor that helps the Centers to concentrate on what they can do best while benefitting from outside help in breaking "bottlenecks" to advances in their work. (IITA cooperation with some UK universities on soils work, and CIMMYT cooperation with Purdue on high lysine corn research are cases in point.) Most of Section VIII seems to be addressing another type of need, viz., for fuller organization of "mission-oriented" collaborative research efforts by developed country institutions on basic research problems important for LDC's but not

\*Attached is a fuller memo that an AID staff economist did on this same subject, providing additional arguments for supporting appropriate fruit and vegetable research.

central to the specific research goals of the international Centers, i.e., this is not primarily concerned with collaboration between the Centers and institutions with strong basic research capabilities. Or do we read the Section wrong?

4. Para. 74 could be read to imply that the Centers are not involved in research networks involving working linkages with many other research institutions, as of course they are. I gather your intent merely is to point out that some research needs are best addressed by building a collaborative network without resort to establishment of new international Centers to play a lead role in the network.

5. Para. 75 sound inconsistent with the note that I showed you just prior to Centers Week, setting down our understanding of the criteria agreed at the outset of the CGIAR for eligibility of research programs for CGIAR financing. I gather you don't intend this, as you indicated agreement with the note, which the CG Chairman had also verified. The agreed criteria were importance/pervasiveness in the LDCs of the need addressed by the research program (the sole criterion stated in para. 75) and operation of the program via a structure that has an autonomous international character so that there is assurance that the program content and management is not subject to national policy constraints. As you know and as TAC has recognized, the latter is very important in permitting the type of program effort mobilized at the Centers. The second criterion is the sense in which the word "international" was used to limit the CGIAR role, the intended distinction being substantive rather than semantic.

6. Re Section X, it seems to us that the main needs are what you recommend in para. 85 (and I would add bilateral donors to the organizations needing to give more direct support to building of national research capabilities), plus (or as part of the first) encouragement and support by all donors for the building of working linkages from individual LDC research institutions into the global networks working on problems with which they're concerned. Some of this support will show up as "Special Projects" for Center "outreach." The other notions in Section X seem much more marginal to the central purpose.

7. Re para. 80, while we agree wholeheartedly with the importance of assuring the high priority collections of genetic resources, we continue to doubt the comparative efficiency of pursuing this purpose via regional centers established especially for this purpose.

8. Re para. 90, I'd only say Amen and go you one better, i.e., I suspect that you have underestimated the level of outreach expenditure that is desirable and likely to occur by 1977 and 1980. As your Report shows, these programs are still gathering momentum and are only operative in 4 Centers in 1973.

9. Finally, I would note what appear to be some inadvertent omissions.

- para. 18. Did you mean to leave out IITA in referring to cassava work in the first line? This could be read to imply that TAC does not support IITA's working on cassava.
- para. 20. May be a similar negative implication re TAC's view on CIAT's pig work, since it isn't mentioned affirmatively as an exception to the general comment discouraging such work. Perhaps the CIAT pig work is or should be regarded primarily as an important ingredient in a farming system approach at CIAT, rather than an effort to push pigs per se.
- para. 20. No mention of major CIAT cattle program in discussing livestock work in Latin America.
- para. 43. Reference to fertilizer research leaves out the most important potential, viz., design of new types of fertilizer that would increase substantially the yield/cost ratio under LDC conditions and lower the total cost barrier to more use of fertilizer by small farmers. (We have supported some TVA research that is making significant progress along these lines, on a minimal budget.) I suspect that one of the largest and least developed potentials for increasing food production in LDC's lies in the area of fertilizer research. We are beginning to look more systematically at the extent that this may be true.

UNITED STATES GOVERNMENT

# Memorandum

TO : TAB/AGR, Mr. Guy Baird

DATE: 10/29/73

FROM : PPC/PDA/DA, Dana G. Dalrymple DCD

SUBJECT: TAC Paper on Priorities

I have read the TAC paper on priorities with keen interest. Sir John has done a masterful job on a broad and complex subject.

I find only one very minor flaw. In para. 28 he states, with respect to the Asian Vegetable Center:

...there were also doubts in members minds both on (1) the technical feasibility on working successfully on such a wide range of crops and (2) concerning their contribution to the diets of poorer people.

On the first point, it should be noted that since the November meeting a year ago, the AVRC has reduced the number of crops studied down to 5 or so, and the director stressed in August that it is technically feasible to work on these.

The second point is, it seems to me, open to rebuttal on several angles:

- First, the income elasticity of demand for vegetables in all LDC's is estimated by FAO to be .45. While this is well above the basic crops such as roots, cereals, and pulses, it is below the averages for meat (beef and veal .46; pig meat .70; mutton and lamb .71; poultry meat .89) dairy products (cheese .49; skim milk .53; butter .55; whole milk .79), and eggs (.78).<sup>1</sup> Since TAC has given fourth priority to ruminant livestock, it hardly seems appropriate to place vegetables in a lower ranking. On the basis of income elasticities they are, if anything, more apt to be consumed by poorer people.
- Secondly, much vegetable production is, as suggested in para. 27, probably unreported because it consists of home plots. Similarly the structure of vegetable production is more likely to be in the hands of poorer farmers than is true of ruminant livestock production. And vegetable production is much more labor intensive.



- Thirdly, while vegetables in general are not outstanding sources of calories, proteins, and fats, they are likely to become increasingly important in the future. Increases projected by FAO for the 1962 to 1975 period were: calories +17%; proteins +21.4%; fats +50.0%.<sup>2/</sup> Furthermore, vegetables are particularly rich sources of vitamins and minerals. The AVRC includes, it should be recalled, soybeans among its crops to be studied.

*- Fourthly, fruits and vegetables are the primary source of vitamins and minerals.*  
Thus, I don't see how TAC can on one hand endorse work on ruminant livestock and on the other reject equal priority for vegetables in terms of their contribution to the diets of poor people. Individual vegetables could well vary in this ranking but it could well be used as a criteria for selection.

All of this may well be too picky and detailed to bring up at the CG general meeting, but if Bernstein is commenting on other individuals sections of the priorities paper, he might suggest some reservations about the second sentence of para. 28. Possibly more could be accomplished if I simply gave copies of this memo to the economists on the TAC.

<sup>1/</sup>From the summary table on p. 50 of my draft paper on "Plants, Animals, and Human Nutrition in the Developing Nations."

<sup>2/</sup>Ibid., p. 55.

cc: PPC/PDA/DA, John Eriksson