

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

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TO: Members of the Consultative Group and of TAC
FROM: Executive Secretary
SUBJECT: Progress Reviews of CIP and IITA

Attached for the information of members of the Consultative Group and of the Technical Advisory Committee are progress reviews of the International Potato Center (CIP) and of the International Institute of Tropical Agriculture (IITA). As mentioned in the Executive Secretary's memorandum of July 10, the CIP report is the work of Dr. George Dion and Mr. Andrew Urquhart, and the IITA report is the work of Mr. L. J. C. Evans and Mr. Urquhart. Some editorial changes have been made by the Secretariat.

Attachments

PROGRESS REVIEW OF
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

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PROGRESS REVIEW OF
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE
SUMMARY AND CONCLUSIONS

i. A mission of Mr. L.J.C. Evans and Mr. A. Urquhart visited IITA from April 9 through April 13. Discussions took place with the Director, Mr. H. Albrecht, Associate Director, Mr. J. Nickel, and with other members of staff.

ii. The mission has a generally excellent impression of the scientific staff, its leadership, achievements to date and research work in progress. Important results -- in some cases perhaps "break-throughs" -- have been or are in the course of being achieved. In the Farming Systems Program, the highlights so far are the development of new information on the effect of soil temperatures and the development of mulching and "minimum tillage" cultivation techniques. The leader of this Program, Dr. J.C. Moomaw, is to become Assistant Director for Outreach, and he will be succeeded as leader of the Farming Systems Program by the well-known Nigerian Agronomist, Professor Okigbo. In the Cereals Improvement Program breakthroughs are being made in the development of high lysine maize varieties for tropical areas, in the methodology of testing for "opaqueness", and also, it is hoped, in the development of maize varieties tolerant of higher soil temperatures. In the Grain Legume Improvement Program, encouraging results have already been obtained after testing several thousand varieties of cow-peas; excellent work has been done on pigeon peas which will be of direct benefit to ICRISAT; work on lima beans already shows promise. In the Root and Tuber Program 100,000 cassava crosses have been made, and testing for mosaic (a virus disease important in Africa and parts of Asia but absent in Latin America) is under way.

iii. The IITA mandate which requires research into ways of maintaining fertility in the low humid tropics implies a wider target than that given to a commodity research center such as the International Potato Center. The revised organizational structure which provides for the four main research programs referred to in paragraph ii above, instead of the single discipline departments originally contemplated (Soils Department, Pathology Department, etc.) is proving successful. The degree of focus already achieved, necessitating as it has done the elimination of many attractive research possibilities, is on the whole commendable; but there is a continuing need to resist additions to the already substantial list of crops included in the crop improvement programs.

iv. In the selection of the research objectives and planning of the program of work and budget, there appear to be at least two serious dilemmas:

- (a) In case research confirms that forage grasses must play an essential role in permanent cropping systems in the humid tropics, is it wise for IITA to do rather little work on grasses - and none on livestock? On the other hand, addition of such work would add a new dimension to the program and budget. To what extent can IITA depend on adequate grass/livestock work by other centers, for instance, Ibadan University or ILCA?
- (b) How great is the risk that research results which will be obtained under the Farming Systems Program within IITA's ringfence will not prove relevant on small farms in the various socio-ecological situations outside it? Will there not be a need for a significantly bigger farming systems research program outside the Institute than has yet been programmed or budgeted?

v. There do not yet appear to be any serious problems of overlap or duplications between IITA work programs and those of CIAT, CIMMYT, IRRI, ICRISAT or AVRDC. Good relations with Ibadan University are important and efforts are being made to improve them.

vi. Because of the high quality of the research work under way and the fact that results have already been obtained, requests to IITA for outreach programs may soon be more than IITA can meet. Careful selection, and rejection of some requests, will be necessary. Programs in Tanzania, Zaire, Liberia, Sierra Leone, and Ghana have been approved or are under consideration.

vii. The Training Program is now gearing up to provide production and research training of several kinds. The first rice production training program will begin, at WARDA's request, in June 1973; a senior trainer from the Philippines, nominated by IRRI, is already in residence at IITA.

viii. The building program, apart from the provision of more staff housing and more dormitory accommodation, is approaching completion. The steel framework for the large glasshouses is nearly complete; glazing and screening should be completed by June 1973 at the latest. The 1974 draft budget includes a proposal for building a new guest house at Ikeja which needs to be weighed carefully.

ix. There are continuous and serious delays in admission of plant material through the Nigerian Plant Quarantine Station, and apparently, no certain prospects of improvement.

x. Management of the experimental farm, though not seriously deficient, needs improvement.

xi. The physical facilities of the Institute are unusually good, but the rather sophisticated design (e.g., of the airconditioning system) may in the end be as expensive to operate and maintain in the Ibadan environment as more modest facilities would have been. Prima facie, it seems that savings would be possible in vehicle usage, but this would require further investigation. It is suggested that this matter be left until it can be reviewed in the context of a comparative review of vehicle usage at all the international centers.

xii. The budget request of IITA to the Consultative Group for 1974 is for \$5,923,000 for core operation (an increase of \$1,025,000 or 21% over the 1973 budget) and \$500,000 for capital (a decrease of \$570,000 or 47% from the 1973 budget) for a total of \$6,423,000 as compared with \$5,968,000 in 1973 - an 8% increase. Only one new professional position is proposed for 1974, but a substantial increase in regular personnel is planned to support the professionals who only made a start on their programs in 1972 and 1973. There appears to be some over-budgeting in providing for a full year's cost for all of these new staff members since it seems unlikely that they can all start work by January 1, 1974. The number of special projects is growing. In the past the amounts charged to special projects for indirect costs have probably been insufficient to avoid their being a drain on core operations; but management intends to correct this for the future. IITA is projecting a levelling off in core operations after 1976. Funding of the 1973 budget has been uncertain and this has adversely affected an orderly development; it would seem advantageous to request working capital as a one-time item to help avoid cash flow problems.

I. INTRODUCTION

1.01 A mission composed of Messrs. L.J.C. Evans and A. Urquhart visited the International Institute of Tropical Agriculture (IITA) near Ibadan, Nigeria, from April 9-13, 1973. Its purpose was to report to the Chairman of the Consultative Group on International Agricultural Research (CGIAR) on the program and progress of IITA.

1.02 On arrival at IITA, the mission discussed its terms of reference (Annex 1) with the Director, Dr. Herbert R. Albrecht, and Associate Director, Dr. John L. Nickel. During its four-and-a-half days at IITA the mission reviewed the progress of work with the Director, Associate Director, Program Leaders, scientific, administrative and support staff.

1.03 IITA was established as an autonomous, non-profit corporation in July, 1967. The first meeting of the Board of Trustees took place in July, 1968, in Ibadan. The Federal Government of Nigeria provided the land for the Institute, and accepted responsibility for resettling and compensating the displaced families. Initial capital funds for construction and site development came from the Ford Foundation, which also provided a grant for planning and development of the resettlement village. The construction of buildings started late in 1968.

1.04 Funds for equipment and furnishings were provided by the Ford and Rockefeller Foundations, the Canadian International Development Agency (CIDA), the Netherlands Government, and the United States Agency for International Development (USAID). Operating funds and special project funds have been or are being supplied by the Ford and Rockefeller Foundations, Belgium, Canada, Denmark, the Federal Republic of Germany, the Netherlands, the United Kingdom, the United States and the International Development Association of the World Bank Group.

II. IITA'S MANDATE AND SCOPE OF WORK

2.01 The original mandate for IITA was described in a paper by Dr. Will M. Myers of the Rockefeller Foundation in 1966, as follows:

"The research of the Institute is to focus primarily on problems of improving food production in the humid tropics and on the soil and crop management requirements for developing a stable, permanent agriculture in which the food crops occupy a central position."

Those who conceived the need for IITA argued that as world population increases, and demand for food grows, mankind cannot afford to underutilize the potential of rainforest areas, which have abundant sunshine

and moisture but soils that are difficult to manage. Dr. Myers suggested that the humid tropics could be defined as "those parts of the tropics in which the rainfall is adequate in amount and distribution to cause forests to be the climax vegetation". The definition subsequently adopted, when the Institute was established, referred to areas of the tropics below 600m elevation with precipitation greater than evaporation for over six months a year.

2.02 The IITA mandate is simply described nowadays as "to improve the quantity and quality of food in the lowland humid tropics". Such a mandate is clearly wider in scope than that of a single commodity research center; and it poses more difficult problems in program selection and management. A proper focus, with a clear selection of some research programs and a firm rejection of others, is essential if the Institute is to achieve its objective. Of necessity a number of important and possibly attractive research problems may not find a place in the program. IITA cannot attempt to be a center of excellence in too many things.

2.03 Dr. Myers emphasized that "while such tree and industrial crops as cocoa, bananas, rubber, oil palm, cotton, and tobacco may be grown as parts of cropping schemes at the Institute, the research will not be focussed on them. There will not be research in breeding, pathology, pest control, etc., of such crops". As to research disciplines, he proposed that research would be required in plant sciences, including genetics and cytogenetics, plant breeding and physiology; in agronomy and soil science, including soil and crop management, forage crop management and utilization, weed control, soil chemistry, soil microbiology, soil physics, soil fertility and classification, and agricultural climatology and physical-physiology; in plant protection including plant pathology, nematology and entomology; in biochemistry; in animal sciences including cattle management and nutrition; in agricultural engineering; and in economics and social science.

2.04 Research is now under way on one aspect or another of all the above disciplines, except that no research has been done and none is planned in animal sciences. Not much has yet been done on forage crop management and utilization. The place of forage and animal research in IITA's program is discussed in Chapter XV.

2.05 Crops such as cocoa, bananas, rubber, oil palm, cotton and tobacco are not being researched at IITA, nor does it seem desirable that they should be. The scientific staff are likely to be fully occupied for some time to come on the cereals, grain legumes, roots and tubers which are important in the humid lowland tropics of Western and Central Africa; and even in these programs it is essential to restrict the work to only a limited number of crops of each kind. Reference is made in paragraphs 5.06 and 5.07 to proposals, currently being considered, for including in the Farming Systems Program some work on vegetables, bananas, plantains and cocoyams.

2.06 IITA now has four main research programs, first of which is the Farming Systems Program. There are three Crop Improvement Programs: the Cereal Improvement Program, the Grain Legume Improvement Program and the Root and Tuber Improvement Program. Each of these Programs is discussed further in Chapter V. In the mission's opinion the total research program and the four components of it have been properly selected, they are well-balanced and they are relevant to the objectives of the Institute; but the mission is not attracted to the possibility of undertaking work on vegetables, bananas, plantains and cocoyams (paragraphs 5.06, 5.07), and comments on the possible importance of forage and livestock research in Chapter XV.

III. ORGANIZATIONAL STRUCTURE FOR RESEARCH

3.01 Dr. Myer's original conception of IITA's major areas of activity was referred to in paragraph 2.03. He referred to broad areas of activity as Departments "without, however, necessarily implying a departmental structure of administrative organization". He referred to a Plant Science Department, an Agronomy and Soil Science Department, a Plant Protection Department, a Biochemistry Department and an Animal Science Department.

3.02 Organization began on the basis of scientific disciplines but has now been altered so that staff of different disciplines are allocated to one or another of the four research programs (paragraph 2.06) to work in multi-disciplinary teams with clearly "mission-oriented" objectives. For instance, the team working on Grain Legume Improvement consists of a very experienced plant breeder (who in this program is the team leader), an agronomist, a biochemist, an entomologist, a plant physiologist, and a plant pathologist; and during the past two years two visiting breeders have been working in the program.

3.03 This organizational structure has the full endorsement of the mission. The staff know the objectives to which they are working, and success or lack of it can be easily judged against objectives. From time to time there may be problems of proper team balance; and it may be appropriate on occasion, in order to make the best use of the talents of individuals, to allow cross-commitments, i.e., to let a scientist contribute to the work of more than one of the main multi-disciplinary teams. It is important to note that though each of the programs and program teams is "mission-oriented", the laboratory facilities are arranged according to scientific disciplines. Thus, for example, the entomologists working in the several programs are each working on a different and clearly defined mission, but for working purposes, they are physically located in the same building so that frequent intra-disciplinary contacts are facilitated.

IV. SCIENTIFIC STAFFING AND LEADERSHIP

4.01 The mission has a generally excellent impression of the calibre of the scientific staff and its leadership. Each of the main program teams appears to be well led and the team members keen and well-motivated. The mission was favourably impressed by the coherent oral presentations made by teams and individuals when outlining their research objectives, problems, results and future work.

V. THE RESEARCH PROGRAMS

A. The Farming Systems Program

5.01 This program is central to the whole research thrust of the Institute and has the largest multi-disciplinary team working in it. It is designed to undertake an integrated and in-depth examination of the physical, biological, economic and engineering problems of agriculture in the lowland humid tropics. It is intended to combine experimentally the improved plant materials and cultural practices derived from the Crop Improvement Programs with improved management practices suggested by the research in soils, agronomy and engineering. Importantly, the economic and social viability of practices developed in the research program should be tested on farms in different ecological and social environments.

5.02 It is hardly possible to summarize, or even to mention within a short compass, the many research exercises and results to date of this important program. (A much fuller account is, of course, contained in IITA's program and budget proposals for 1974.) Research is being done into systems of cultivation and levels of mechanization in several crops in combination with different inputs of fertilizers and herbicides, e.g. ploughing for rice cultivation with and without nitrogen. Small-scale machinery developed in IRRI's Agricultural Engineering Department is being tested. Tillage experiments include combinations of hand and machine tillage and important "minimum tillage" experiments are already producing promising results, particularly in the case of maize and soya beans for which suitable herbicides are available. No less important, in relation to soil temperature, weed control, moisture conservation and tillage requirements, is the work on mulching. Soil temperature is emerging as a possibly critical factor and temperatures can be lowered significantly by control of mulching and tillage techniques. Since weeds are a particularly serious problem under humid tropical conditions, especially under continuous cropping systems, and are often a significant constraint in smallholder farming, a vigorous weed research program is under way.

5.03 The harmful effect of nematodes in certain situations is well known and IITA's nematode research is beginning to produce results of considerable relevance for the humid tropics. It confirms that the nematode population in the soil changes markedly after bush clearing and that it is influenced by cropping sequences, fallow periods and moisture content of soil.

5.04 In soil microbiology, the program includes organic matter studies and research into aspects of nitrogen fixation, the coating of urea with sulphur, and the effect of pesticides and herbicides on soil micro-organisms. The soil chemistry program includes a number of interesting studies, in some of which there is useful cooperation with Reading University, England. Research in water engineering is getting under way because in parts of the humid tropics supplemental water may be available to permit multiple cropping during severe hot dry seasons. With the recent arrival of an agroclimatologist research in this rather neglected field has begun.

5.05 On the socio-economic side, a study of one hundred farms in three Yoruba villages in different ecological areas has already provided a considerable amount of data on farm size, cropping systems, timing of operations, work-time spent on different crops and cultivations and much else; farmers were interviewed on alternate days over a thirteen-month period. The study has also shown how difficult it is to obtain reliable data of this kind, which are of fundamental importance to the Farming Systems Research Program. It is unfortunate that Dr. Hedley, the scientist in charge, has left IITA to return to Canada; the associate who worked with him on the study is now writing up the work at Reading University. Work of this kind needs repeating in other locations and in other countries, and it is important that it be restarted and extended when the Institute's agricultural economist staff is again at full strength.

5.06 Two more aspects of the Farming Systems Research Program call for comment: the work proposed on vegetables and the work proposed on bananas and plantains. Many kinds of vegetables are grown, often in combinations with other crops, on smallholdings in the humid lowland tropics. Not enough is known about them, and much could be learned through research. Bananas and plantains are also important in some cropping systems and are an important source of food. IITA is envisaging having a scientist devote most of his time to vegetables research and there is no doubt that he could be usefully employed. Plans for research on bananas and plantains are not firm, but it is envisaged that a visiting scientist might work on these crops, consulting as much as possible with scientists elsewhere who have experience of them.

5.07 In the opinion of the mission, the question of whether to proceed with work on vegetables, bananas and plantains confronts the Director and Board with a dilemma of the kind that is likely to be common at IITA. The crops are not unimportant and would repay research;

but the same could presumably be said for several other crops on which little if any time is devoted. The need to be selective and to exclude worthwhile but not top-priority projects cannot be escaped.

5.08 For reasons elaborated in Chapter XV, the mission suggests that if funds are available in the budget for the scientist, visiting scientist and consultant referred to in paragraph 5.06, higher priority ought to be given to including in the program work on forage grasses and legumes and some work on cattle management.

B. The Cereals Improvement Program

5.09 This program focusses on the two main cereal crops of the humid lowland tropics, namely rice and maize. In each case work is in close cooperation with another international center having major responsibility for the crop - IRRI in the case of rice and CIMMYT in the case of maize. The IITA rice and maize programs are developed as integral components of the global research of IRRI and CIMMYT, and include close participation in the outreach programs of those two institutions in humid tropical Africa.

5.10 Though IITA in its cereals work may thus appear to play a subordinate role, it is a role of importance and the research already undertaken indicates that a high pay-off is likely to be achieved.

5.11 In rice, about 80% of the work will be on upland rice rather than on paddy, to reflect the situation in Africa, where most rice is grown on rainfed, upland soils. It will not be necessary to breed for paddy conditions at IITA since available IRRI varieties can be used. In breeding for upland conditions close cooperation with IRRI and exchange of lines will be necessary; upland rice in many parts of Africa is grown under different conditions, e.g., generally on lighter soils, than in Asia. Close cooperation with the West African Rice Development Association (WARDA) is being maintained, and WARDA will be responsible for regional trials of IITA materials.

5.12 Exciting achievements are in prospect for maize. On the IITA farm, with two rainy seasons a year and with irrigation in the dry season, three generations can be grown in one year, which enables a considerable amount of testing to be done in a short time. By the beginning of 1974, the ninth generation of Composite A and the twelfth generation of Composite B will have been completed. Central American maizes have been introduced that promise to be superior to the best varieties in Nigeria; they will respond to higher inputs, which the local varieties will not, and they are likely to be higher in protein. It is said that the yield improvement during two years of breeding is of the order of 50%.

5.13 Two highlights of the maize research which may be on the way to becoming "breakthroughs" are related to maize protein content and to the potential for significant maize improvement under tropical conditions. First, IITA now has opaque 2 versions of Nigerian composites, and has promising hard endosperm material. Second, work on the effect of soil temperature on maize, which links closely to the work on the Farming Systems Program, shows that soil temperature is extremely important, especially at and just after germination. Apart from possibilities of management to reduce high soil temperature, e.g. by mulching or planting on the flat, the indications are that there may be significant varietal differences, suggesting that it may be possible to extend the range of maize growing into hotter areas, just as it has been possible to produce maize which does well under cooler conditions than previously, e.g. in Northern Europe.

5.14 The vacant post for a plant pathologist in the Cereals Improvement Program, it is hoped, will be filled shortly.

C. Grain Legume Improvement Program

5.15 Because of their importance, both as sources of high quality proteins in tropical diets and (which is insufficiently recognized) of caloric energy, improvement of grain legumes is one of the major research programs at IITA. There are many grain legumes used in the humid lowland tropics, and some, such as soya beans, which ought to be used more. It is no easy problem to decide which legumes to include in the research program. The program now includes cowpeas, for which IITA has main responsibility amongst the international centers; substantive work on lima beans and pigeon peas both of which are important in the humid lowland tropics; some work on yam beans, jack beans and winged beans, and also some work on soya beans. In these grain legumes there is potential for significant improvements in productivity and nutritive quality which will have important economic benefits. IITA has estimated that 1.2 million tons of cowpeas are produced annually in the humid lowland tropics with a low average yield of only 370 Kg per ha. Yields six times as high as this have been obtained at IITA, and, even if substantially discounted to allow for the expected difference between yields of experiment stations and small farmers, indicate that increases in the cowpea crop would amount to hundreds of millions of dollars a year.

5.16 The cowpea is characteristic of the lowland tropics from semi-arid to humid tropics; suitable high-yielding varieties, resistant to pests and diseases, would greatly increase the potential of this crop in the humid lowland tropics. Thirty-five hundred accessions have already been screened, of which all but 250 have been eliminated. Research work is in progress on pests such as thrips, aphids, leaf-eating beetles and bruchids (both in field and store), and on diseases,

including wet stem rot, root knot, nematode and viruses. Several new genetic stocks are being developed with potential for erect growth, profuse podding, and insensitivity to day length. Sources of resistance have been discovered to the major fungal, bacterial and viral diseases, and preliminary identification has been made of tolerance or moderate resistance to thrips and possibly podborers.

5.17 Collections of lima beans and pigeon peas have been made (the latter including promising selections brought by the team leader from eastern Africa) and some show considerable potential. ICRISAT is to have the principal responsibility amongst the international centers for research on pigeon peas; but work on this crop should not be discontinued at IITA, since it will take some time for ICRISAT's research programs to get fully under way and of course work at IITA on pigeon peas for the humid tropics will need to continue.

5.18 Soya beans have such potential for the humid lowland tropics that work on them seems justified in IITA's program. There is considerable interest in this crop in several African countries, including Ghana and Tanzania. The IITA role ought to be that of a regional outreach station linked with a center of excellence such as Illinois University. As yet adequate funding for a collaborative program with Illinois does not seem to be in sight. A visiting scientist from CIAT has been doing a year's sabbatical at IITA mainly on soya bean breeding.

5.19 A small amount of work is being done on the African Yam Bean (*Sphenostylis stenocarpa*) but not much more will be done this year than to maintain the collection and add to it; on the Jack Bean (*Canavalia ensiformis* and *Canavalia gladiata*) which is hardy, resistant to pests and gives big yields; and on the Winged Bean (*Psophocarpus tetragonolobus*). One hundred and fifty lines of Field Beans (*Phaseolus vulgaris*), mostly originating from Colombia, were brought from Makerere to IITA but the crop is not of such importance in the lowland tropics as to justify much work by IITA. Seed collections of Mung Bean and Green Gram are being maintained but little priority is given to them since they are not characteristic of the humid tropics.

D. Root and Tuber Improvement Program

5.20 Many root and tuber crops are grown widely in the humid lowland tropics. It is said that about 50 million tons of roots and tubers are grown annually in tropical Africa, of which 30 million tons are cassava, grown on about 5 million hectares; and that this is about 35% of world production and about 50% of the land area devoted to the crop throughout the world. Most of the cassava produced in Africa is grown in Western Africa. It is calculated that 20 million tons of yams and sweet potatoes are grown annually in Western Africa on 3 million hectares.

5.21 The IITA program's objectives are to minimize the factors which limit production, to develop widely adapted plant types responsive to intensive management, to develop more efficient carbohydrate assimilation and to improve quality for human consumption.

5.22 Although CIAT has primary international responsibility for cassava research, IITA's cassava program is justified because, unlike CIAT's, it is primarily concerned with cassava as a human food rather than as cattle feed, and secondly because cassava in Colombia is free from mosaic whereas the disease is endemic in Nigeria. The emphasis which IITA is placing on identifying and incorporating mosaic virus resistance in its breeding programs should be of considerable relevance to the needs of cassava growers in Africa and also in Asia, including southern India. One hundred thousand crosses have already been made; several hundred plants having high resistance to mosaic have been found and are being used in breeding. A tissue culture program is now under way; this is especially important for vegetatively produced crops and may greatly assist in overcoming the constraints in the way of exchanging plant materials due to phytosanitary difficulties, as well as enabling the rapid propagation of breeding materials of wide genetic diversity.

5.23 IITA has rendered valuable service to Zaire recently by sending a team which successfully identified the devastating "candle disease" in cassava and made recommendations for its control.

5.24 Screening for hydrocyanic acid content is under way; 10,000 plants had been screened by April and the aim is to have screened 100,000 by October, 1973.

5.25 The IITA Board has approved international activities in sweet potato and yam research. It is likely that research may succeed in really significant sweet potato improvement. Ten thousand seedlings have been produced during the past year, and varietal screening has started. Several high yielding clones have been produced with a potential of over 30 tons per ha in four months. The main emphasis at this time is on carbohydrate rather than protein production. Later, research will have to be intensified on storage problems, on the leaves and tops, and on mechanization.

5.26 In comparison with cassava and sweet potato, little research has been done anywhere on yams (*Dioscorea* spp.), although this is an important crop in humid lowland parts of Africa. Propagation is difficult, since yams normally do not flower, and when they do, crossing is difficult. Not much is known of yam physiology, and the study of the physiology of flowering is likely to be important. Collections of yam plant material are being made. Twenty varieties have been collected from Dahomey, 100 varieties will be collected from the Cameroons; and it will be necessary to get material from South-east Asia and the West Indies. Importation is difficult because vegetative plants have to be imported, and this creates plant quarantine problems.

5.27 The draft Program and Budget for 1974 refers to a "vacancy" created by a transfer from the Root and Tuber Program to the Farming Systems Program, and proposes that this "vacancy" be filled by a second plant breeder to handle cocoyams and Irish potatoes. It may be asked whether the transfer of work from one program to another automatically creates a vacancy; and though research on cocoyams may be worthwhile per se, there is a question, in the opinion of the mission, whether it has sufficient priority to justify breeding work now. Nor is it evident that IITA ought to go at this time beyond testing of Irish potato varieties made available by CIP. The Root and Tuber Improvement Program already includes a formidable agenda of work on cassava, sweet potato and yams.

VI. OUTREACH

6.01 The IITA Outreach Program now covers operations in several African countries and is beginning to be a significant part of the Institute's work. In Zaire, IITA is participating with CIMMYT in Zaire's national maize program. IITA's contribution is being made through the Cereal Improvement Program.

6.02 In Nigeria, with the support of USAID, a team of consultants from IITA, CIMMYT, IRRI and the Nigerian Government prepared a plan for a national accelerated food program which would provide for research and extension at several stages in Nigeria. The program would focus on maize, rice, wheat, sorghum, millet and cassava.

6.03 Also with the support of USAID and at the request of the government, CIMMYT and IITA have developed a research project covering maize and grain legumes in Tanzania.

6.04 In Liberia, an IITA team investigated the possibility of a rice research program which would be undertaken as part of a project supported by IDA funds. IITA is to post a rice breeder/agronomist at the experiment station at Suokoko. In Sierra Leone, IITA has been discussing with the government a project which would involve rice research at the Rokupr Rice Research Station by a 3-man team. This project would be supported by UNDP funds, but there have been difficulties in completing negotiations. IITA believes that there is a need to resolve the problem of the role of FAO as executing agency for UNDP in relation to the role of IITA. In the first place, FAO has proposed that an FAO project leader would be needed; IITA believes this would be superfluous. Secondly, FAO has claimed the whole of the funds allowed by UNDP for overheads, meaning that IITA would have to pay for IITA overheads from its core budget, contributed by donors who did not have this purpose in mind.

6.05 Contacts and visits between IITA and the Kumasi Soil Research Institute in Ghana are expected to lead to a project for investigations of soil conservation and erosion control to be supported by CIDA.

6.06 The increased momentum of the outreach program results in part from the growing appreciation by African countries of the results beginning to be achieved by IITA and of the contribution the Institute is going to be in a position to make. Recently, an IITA team did a notable piece of work in Zaire, successfully identifying "candle disease" in cassava and making recommendations for its control. Requests for this kind of "fire-fighting" operation may become more frequent and, if IITA is not to dissipate its resources, its response will have to be a selective one. The overall strategy and components of the outreach program will no doubt need to be planned rather than be allowed to develop in response to ad hoc requests from governments.

VII. TRAINING

7.01 Resident training programs at IITA now form an important part of the Institute's work. Training is offered in research and in production.

A. The Research Training Program

7.02 The objective of the Research Training Program is "to develop the research potential and capabilities of research workers interested in improvement of food crops in the lowland humid tropics" All IITA scientific staff participate in the program.

7.03 Participants accepted for the Research Training Program are classified into four main categories. In ascending order of seniority, they are as follows: research training associate, senior research training associate, research scholar, and research fellow. All participants in the Research Training Program submit periodical written reports to their IITA advisers and to the Training Office, present their findings at IITA seminars, and prepare their results for publication. Research results are considered the property of IITA until released by the Institute. More than 50 participants in the Research Training Program, which began in 1969, have come from developed and developing countries. Some notable contributions to IITA's work by trainees have already been made. For degree candidates, IITA has cooperative arrangements with eight universities in Africa, Europe and North America, and is negotiating similar arrangements with ten other universities.

7.04 Training requires that IITA scientists devote the necessary time to it, and this affects the number of trainees that can be accepted. As a center of excellence in tropical agricultural research, IITA offers obvious attractions to research workers who want further training and to universities, research institutes and development agencies who wish to have their people trained. In the future, care may have to be taken to balance the competing claims of developed and developing countries if, as is likely, IITA continues to receive many more nominations than it is able to accept. Donors may themselves have to exercise restraint in seeking training facilities for their nominees.

B. The Production Training Program

7.05 The objective of the Production Training Program is to familiarize trainers or supervisors with the methods for growing a given crop and with the methods for conducting an accelerated production campaign for such a crop ("training the trainers"). Participants are not normally degree candidates. They are called "Production Training Associates" and are appointed for periods of from three months to one year. Trainees are nominated mainly by government ministries of agriculture and before acceptance are usually interviewed by IITA staff. There are no upper age limits for this program and sometimes comparatively elderly trainees are accepted.

7.06 In 1972 production training courses in rice were given. In June 1973 a five-month course in rice production will begin for 28 extension leaders from 14 western African countries at the request of WARDA. Already an experienced rice production trainer from the Philippines, nominated by IRRI, is at IITA on a ten-month assignment. The course will have about 30 to 35 participants, and WARDA will be responsible for providing translators and interpreters.

VIII. SUPPORT SERVICES AND LAND DEVELOPMENT

8.01 The library does not aim to be a comprehensive library covering all of tropical agriculture but it aims to focus on IITA objectives. It comprises over 4,000 books and 3,000 bound journals. During 1973 and in 1974, it is expected that there may be an addition of about 5,000 new books and back numbers of periodicals. Six hundred journals are regularly received. A bibliography on cowpeas is being prepared and one for yams will be prepared later. One person regularly reviews incoming journals and calls attention of scientists to relevant publications. The library also abstracts the titles of publications on rice for WARDA.

8.02 The Statistical Services Unit has helped scientists in the design of experiments and in the analysis of data for over 150 research projects since August, 1972. Advice is also given in connection with outreach programs to staff outside IITA. IITA has a rented computer, the servicing of which has been providing some problems.

8.03 The Communications and Information Unit works closely with the Training Unit in providing training material and helping to advise trainees on communications techniques. It is also responsible for the printing and dissemination of IITA official reports and for the preparation and handling of scientists' research reports for technical journals. The Unit operates a photo laboratory and print shop. As is the case with other international research centers, the reception of visitors is time-consuming. The need to provide information about IITA's activities in French-speaking Western Africa and to respond to requests is realized, but this has not proven easy. News items for instance cannot yet be disseminated in French.

8.04 The farm land of the research station is in course of development year by year. Some 430 acres had been cleared by the beginning of 1973, and a further 200 acres will be cleared in 1973/74. The farm manager is assisted by an assistant farm manager, a field supervisor, six overseers and about 400 farm workers, of whom 150 are permanent and the remainder casual. Land clearing is mainly done by contractors rather than direct by IITA work force. The fact that such a considerable volume of field work has been achieved in the Farming Systems Program and in the Crop Improvement Programs suggests that the farm has been able to provide substantial support to the research scientist. Nevertheless, there seem to be some indications that farm management needs improvement.

IX. PLANT QUARANTINE

9.01 Several of the scientists working at IITA, especially those in the Crop Improvement Programs, have complained about inefficient service and lack of cooperation from the government plant quarantine center. The mission unfortunately had not time to visit the center nor to meet the quarantine officers. IITA staff say that the situation has been unsatisfactory for a considerable time and that representations to government have not resulted in much improvement. Prompt and efficient handling of plant importations by quarantine officials is of considerable importance to the research work of a center such as IITA and for this reason it is normal for assurances that effective quarantine arrangements will be provided to be given by host governments at the time such centers are being established. Research workers must be prepared to respect appropriate phytosanitary

regulations; but there may be a need for some revision of regulations if, as is alleged, some of the proscribed diseases are already present in Western Africa. It is to be hoped that FAO support for a regional plant quarantine establishment may lead to some improvement.

X. RELATIONS WITH INTERNATIONAL CENTERS AND OTHER BODIES

10.01 The Institute has already established effective relations with other international research centers, and reference has been made to this in Chapter V in relation to specific research programs. From the IITA end, there seems at present to be no serious duplication or overlap. With developing and dynamic research programs at all centers, it will not be surprising if jurisdictional problems arise from time to time.

10.02 There may be a question about which center should take the lead in certain outreach programs. In the case of maize, for instance, CIMMYT is the main agency responsible for outreach programs, but where these are to be carried out in the lowland humid tropics of Africa, a strong IITA contribution will be essential; and IITA is developing special expertise in this field. Moreover there will often be occasions when an agency having subordinate responsibility for a crop may, because of its location, have valuable local knowledge to complement an outreach operation of the principal agency.

10.03 There may also be a question about how restricted the role of a subordinate agency should be. It makes no sense for several agencies to compete simultaneously for funds from the Consultative Group on International Agricultural Research for the same research. On the other hand, an agency having a subordinate role, as IITA has for maize, may occasionally find itself pursuing a promising line of research which, as it develops, may seem possibly more appropriate for the principal agency. Dr. Harrison's outstanding work at IITA on developing technologies for testing for opaqueness in maize may be a case in point. All that can be said is that such cases are bound to occur. Center directors and trustees have regular opportunities of consulting with their counterparts in other centers and too narrow a jurisdictional interpretation probably should not be applied.

10.04 Decisions on allocation of responsibilities between centers may sometimes depend on the relative stage of research at two centers. For instance, although it has been agreed that ICRISAT will have principal responsibility for research in pigeon peas, it would be inadvisable for IITA to discontinue work on this crop. Promising results are beginning to appear at IITA; it will take time for ICRISAT to make comparable progress in its own work on pigeon peas. Provided that consultation between the two centers is maintained, it should not be difficult to decide on a sensible allocation of work as time goes on.

10.05 Good relations between IITA and Ibadan University are important, though not necessarily easy to preserve. It appears that there is no lack of awareness of this on both sides and there are some signs of improvement. For instance, the joint seminars organized monthly, with the venue alternating between the University and the Institute, are proving useful and are being increasingly well attended. Some IITA staff serve on university committees or give occasional lectures.

10.06 IITA has taken pains to cooperate meaningfully with WARDA and has gone out of its way to fall in with WARDA's desires in the matter of the 1973 Production Training Program in rice, though WARDA's chosen starting date of June does not fit the season well and is later than the Institute would have liked.

10.07 It does seem particularly desirable that IITA should continue to do everything possible to understand and help to meet the needs of francophone Africa. Facility in the French language is important; library services in French as well as English are being developed. It will be particularly important to undertake effective outreach programs in some francophone countries.

XI. PHYSICAL PLANT

11.01 The main building program which consisted of two phases is practically complete; all that remains to be done is put the finishing touches on the auditorium building and glaze the large glasshouses. Some of the principal items included in Phases I & II are:

- Threshing and crop drying building
- Engineering services building
- electrical utility services building
- Mechanical utility services building
- Research laboratory and library building
- Plant growth building
- Greenhouses
- Administration building
- Laundry building
- Store building
- Workers' food services building
- 12 apartments
- 31 houses
- Auditorium
- Social center and guest house building
- Swimming pool and cabana
- 2 student dormitory buildings
- Water storage, sewage treatment and other site utilities.

11.02 IITA's facilities have been built to what appears to be a high standard of construction and technical sophistication; for instance there is a central air-conditioning system serving all buildings and houses which is so sophisticated that no local expertise is available for servicing it. In the opinion of the mission this and other features of the facilities may in the long run prove to be inconvenient and expensive to maintain.

11.03 Work has started on a third student dormitory building being financed out of 1973 budgeted funds.

11.04 Including visiting scientists, post doctoral fellows and special project staff, IITA will have obligations to provide housing for 71 people in 1974 and 74 in 1975. Houses and apartments presently available total only 43. IITA has found that the problems and costs associated with renting off-site housing for so many people warrant the provision of more housing on site; consequently, the capital budget request for 1974 includes a 4-unit apartment block (\$160,000), 4 houses (\$240,000) and associated site works and utilities (\$35,000).

11.05 The other item in the 1974 capital budget is \$65,000 for the construction or purchase of a communications centre/guest house in Lagos to replace the present rented facility which is proving inadequate.

11.06 Capital development plans for 1975 and 1976 include the construction of six more houses, the addition of 8 guest rooms to the social center and guest house building and development of the west bank of the farm.

XII. ADMINISTRATION

12.01 The Institute operates what amounts in essence to a small town. Doing this in Nigeria to a standard which will attract and retain top quality scientific staff is expensive and has required a relatively large number of expatriate administrative and support personnel.

12.02 Efforts are being made to replace expatriates with qualified Nigerians in some of these posts; but care must be taken that this "indigenization" is carried out in such a way that it does not lead to a deterioration in the quality of administration and services.

12.03 The mission agrees with IITA's policy of employing Nigerians wherever possible to perform support functions; this is necessary from a political and public relations as well as a financial point of view. The policy should be pursued but not at the expense of adversely affecting research.

12.04 Terms of reference for the mission drew attention to "the large fleet of vehicles at IITA". Without a thorough review of the needs and uses of vehicles we cannot judge what size the fleet should be. We suggest that this is a matter requiring careful study, which might be included with others where a comparative study among centers would be useful. It is worth noting that several factors have contributed to the current size of the fleet:

- a) Nigeria recently changed over from driving on the left to driving on the right, making right hand drive vehicles dangerous for use on the public roads.
- b) IITA used to be able to dispose of used vehicles on the open market at favourable prices; the Government no longer allows this and instead takes the vehicles at a valuation determined by them for use by Government departments. Many vehicles are awaiting transfer to the Government.
- c) The farm is large and housing is some away from buildings making it necessary for most people to move around using a vehicle.

XIII. BUDGETS AND FINANCES

A. The 1974 Budget

13.01 IITA's budget proposals for 1974 are \$5,923,000 for core operations and \$500,000 for capital as compared with \$4,898,000 and \$1,916,000 respectively in 1973. The following table compares 1974 proposals with the 1973 budget and actual expenditures for 1972:

	<u>Actual</u> <u>1972</u>	<u>Budget</u> <u>1973</u>	<u>Budget</u> <u>1974</u>	<u>% increase</u> <u>1974/1973</u>
		<u>\$ thousands</u>		
Core operations	3270	4898	5923	21%
Capital	<u>3127</u>	<u>1916</u>	<u>500</u>	- 74%
Total	<u>6397</u>	<u>6814</u>	<u>6423</u>	- 6%

13.02 Only one new professional position is planned for 1974 - for a second breeder in the Grain Legume Improvement Program. Annex 1 shows a breakdown of the 1974 core budget and gives details of the professional staff by program and support department.

13.03 With programs becoming fully staffed with senior professionals^{a/} research effort is speeding up and more regular staff^{b/} are required. The 1974 budget includes 762 regular staff (staff below professional level); this is a substantial increase compared with the 647 in the 1973 budget.

13.04 An approximate breakdown of the \$1,025,000 (21%) increase in the budget for core operations is as follows:

	<u>\$ thousands</u>	<u>% over 73 budget</u>
Due to inflation of approximately 5%	245	5
*Cost of new staff and activities	550	11
Due to full year cost of new staff and activities begun in 1973 and other in- creases.	<u>230</u>	<u>5</u>
	<u>1025</u>	<u>21</u>

13.05 All proposed new staff positions are budgeted for a full year. It seems unlikely that all or even a large part of the new people can start by January 1. A staggering seems more likely and therefore there seems to be some over-budgeting.

13.06 IITA has a growing number of special projects. The amounts which are charged to these special projects for indirect costs vary. No study has been made as to what indirect costs should be charged

* This includes any additional staff in 1974 even though they are in support of a program started in 1973 or earlier.

a/ Senior scientists and certain administrative and technical staff who are expatriates.

b/ Regular staff are locally hired permanent employees ranging from research assistants and secretaries to laborers and farm workers.

but it seems clear that in some cases there is a drain on core operations. Management intends that in future all special projects should be charged with an appropriate portion of indirect costs. For existing special projects supported by donors who prove unwilling to pay a fair share of indirect costs, management will decide whether to continue the special projects and support them out of core operations or discontinue them. The core budget for 1974 assumes that the number of special projects will be more or less the same as in 1973. However, it is likely that there will be more, in which case core expenditures will increase to support these but the increase will be offset by an increased recovery of indirect costs.

13.07 The budget for 1974 includes \$467,000 for equipment. This figure is for new and additional equipment (\$335,000) and for the replacement of equipment (\$132,000). The former might perhaps be more appropriately classed as capital expenses to be covered by a capital grant.

B. Projections 1975 - 1977

13.08 IITA's projections of core operations for 1975 - 1977 show further increases in 1975, when three senior professionals will be added, and 1976, when some regular staff only will be added; between 1976 and 1977 there will be no increase other than for inflation which is assumed at 6% p.a. It is assumed that the level reached in 1976 will be the point at which IITA will stabilize.

13.09 Annexes 1 and 2 attached give an eight-year summary of the core operations budgets. These annexes are taken from IITA's budget document as presented to the Consultative Group with a modification introduced by the mission, namely: the line "provision for price changes" did not assume the cumulative effect of 6% inflation after 1975 i.e. that costs in 1976 will be more than 12% higher than those in 1974, rather than slightly more than 6% higher. This line has been corrected to read \$788,000 instead of \$418,000 in 1976 and \$1,229,000 instead of \$442,000 in 1977; the total figures have been adjusted accordingly.

C. Funding and the 1973 Budget

13.10 Although the situation is now much improved, funding of the 1973 budget has been a problem. This has adversely affected the smooth development of the planned increases for the year. No adjustments have been made, pending resolution of all funding problems, but when they are made, quite significant shifts within the 1973 total will probably be seen.

13.11 One consequence of the difficulties with funding in 1973 has been that IITA has had to run down base stocks (which are part of fixed assets) by not replacing items used. One way to relieve the cash-flow situation would be to provide a working capital fund, as

recommended in a draft paper on budgeting procedures and practices prepared by the Consultative Group Secretariat in cooperation with Center Directors. No fund of this kind has been requested in IITA's 1974 capital budget.

XIV. DILEMMAS

14.01 The Board and management of IITA are likely to be confronted with difficult decisions about what to include in the research programs and what to exclude. In the mission's view, two major questions need consideration and resolution.

A. Farming systems without grass or livestock

14.02 The first dilemma can be simply stated. In case the ongoing research at IITA, especially that under the Farming Systems Program, confirms that permanent cropping systems in the humid tropics (excluding tree crops or shifting cultivation) are difficult or impossible to devise without the inclusion of grasses, is it wise for IITA to do rather little work on grasses and none on livestock?

14.03 In the 1966 paper previously referred to (para. 2.01) Dr. Myers was clearly concerned about this question. He wrote, "Perennial herbaceous legumes and perennial grasses in crop rotations appear to provide the most promising presently known replacement for bush fallow or tree crops in stable agricultural production in the humid tropics". There is certainly evidence to support this and there are examples, mostly on research stations, of rotations (usually seven or eight year rotations, including perhaps three or four years of annual arable food crops and three to four years under grass) which do appear to maintain fertility under humid tropical conditions.

14.04 Dr. Myers suggested that extensive collections ought to be made of the most promising species of grasses and legumes, that selection and hybridization programs should be initiated, and that species of legumes and grasses, and combinations of them, should be evaluated for total and seasonal productivity, nutritive value and persistence, in order to find the most effective means of integrating legume and grass production into farming systems, to determine the most effective grazing and cutting management practices for utilization of the forage produced, to develop effective methods of preserving surplus forage during the rainy season, and to devise appropriate combinations of grazing, cut green feed, and preserved feed.

14.05 By itself the development of an effective combination of grasses, legumes and other crops into workable rotation would not be of interest to farmers unless the forage grasses and legumes could be

profitably utilized by livestock. Since cattle are relatively little used in the humid tropics and much needs to be learned about production, pathological and economic aspects, the research problems would be formidable.

14.06 Dr. Myers thought that "a full-scale animal science program would require approximately double the facilities and staff projected for the crops and soils program". He went on to argue: "Accepting the premises that (a) animal science is ultimately a desirable objective of tropical agricultural research and (b) that a full-scale research program on animal science cannot now be included in the International Institute of Tropical Agriculture, the following conclusions regarding the initial role of animal science in the Institute seem justified. Effective soil management, in the absence of a bush fallow, will require crop rotations including either tree cash crops or perennial soil improving crops such as the forage grasses and legumes. If the latter are to be accepted by the farmers, effective and profitable ways of utilizing them must be found. This means, given the present state of our knowledge, ruminant animals, chiefly dairy and beef cattle. Therefore, it is suggested that animal science research at the Institute be focused specifically on effective, profitable utilization of the forages required in the crop rotations and of by-products of the food and tree crops. Animal health, although critical to success of such research, would not itself be the subject of research. Instead the best disease and parasite control measures currently available would be practiced, utilizing information from the Veterinary Research Institute, Vom; the Veterinary Department, University of Ibadan; the Trypanosomiasis Laboratory, Kaduna; and other animal health research centers. Likewise, cattle breeding for improvement would not be done. The available breeds, and any improvements of them from such centers as the Fashola Animal Research Station, would be used".

14.07 Some excellent, though part-time work, has been done by Dr. Loy V. Crowder on the evaluation of some forage grasses and legumes; but nothing is being done in animal science. It may be supposed that neither the Board of Trustees nor the donors would show much enthusiasm for any proposal that would significantly expand the size of IITA's work program and budget at this time. If it were simply a question whether IITA should become a major livestock research center as well as a crops research center, the question could easily be decided in the negative. A more difficult question is whether IITA can continue to concern itself relatively little with forage grasses and legumes, and not at all with livestock, when a vital part of IITA's role is to find ways of maintaining fertility in the humid tropics; inclusion of greases in crop rotations may be indispensable or at least important; while farmers are not likely to take the trouble to grow grass merely for fertility maintenance unless they can use it for livestock.

14.08 Nor is the question merely whether to add research in an additional crop to an already onerous program. Reference has been made

earlier to the question of adding research programs in bananas, plantains, vegetables and cocoyams. Such crops, though important in some humid tropical farming systems, are not essential in maintaining fertility, whereas grass quite possibly is. Is there not therefore a serious risk that the farming systems work at IITA will be unbalanced, incomplete, and perhaps unsuccessful if management of forage grasses and legumes in rotations is not being researched at IITA?

14.09 Short of undertaking major programs in forages and animal science, what can IITA do on its own or in association with other research centers? Could IITA, for instance, leave such work entirely to others? In the mission's opinion it should not. The strategy of the IITA Farming Systems Program is so organized as "to provide an integrated and intensive research examination of the physical, biological, economic and engineering problems of agriculture in the humid low-land tropics. The program will combine experimentally the improved plant materials and cultural practices developed in the Institute's Crop Improvement Programs with the improved management practices identified from research in soils, agronomy and engineering It is proposed to operate at the Institute over a period of years a number of cropping systems on plots of appropriate size As cropping systems are developed at IITA that appear to have promise for use in different parts of the humid tropics, efforts will be made to enter into cooperative arrangements with national research organizations under which these systems will be tested at a variety of suitable local conditions." The Crop Improvement Programs in cereals, grain legumes, roots and tubers are beginning to produce improved plants and cultural practices that can be incorporated into the Farming Systems work; but so long as there is no sustained program in forage grasses or forage legumes at IITA, there may be little or no opportunity for the scientists working the Farming Systems Program to work on or even to understand the role of grasses in fertility maintenance.

14.10 The mission therefore recommends that IITA should concern itself more than it is doing at present with forage grasses and forage legumes. A full-scale crop improvement program is not essential. For a start within the Farming Systems Program, one man could work on forage grasses and legumes rather than on vegetables; he would not do any breeding but would be responsible for introducing promising species for testing as components of crop rotations and soil fertility maintenance systems. He would, for instance, be concerned with the practicalities and economics of their establishment and later eradication; and since their management would require either grazing or cutting for stall feeding or processing or a combination of methods, it would be essential that there should be ruminant livestock on the IITA farm. It is not proposed that IITA should undertake livestock research other than the research in livestock management that would be relevant in the farming system. Obviously, strong collaboration would have to be arranged with

other appropriate centers. (Ibadan University has had research programs in grasses, particularly *Cynodon* species, for a number of years and has also done some notable work on *Pennisetum* species; unfortunately, however, the scientist mainly responsible for this is discontinuing his work on grasses.) When the International Livestock Centre for Africa (ILCA) is established it may be that a cooperative research program with IITA would be appropriate.

14.11 If a start on forage and livestock work were made by one man this would not necessarily increase IITA's estimated budget requirements, assuming this work were adjudged to have priority over research in vegetables, bananas and plantains which it would replace. Management of livestock would, of course, add to the problems of managing the experimental farms.

B. Relevance of research within IITA to farming systems outside

14.12 A second question which may prove to be a dilemma for the Director and Board - quite soon, if not now - is whether there is a risk that research results obtained under the Farming Systems Program within IITA's ring-fence will prove irrelevant on small farms in the various socio-ecological conditions outside it.

14.13 There is good reason to suppose that the outstanding researchers now working in the Farming Systems Program will succeed in devising crop rotations and farming systems capable of maintaining soil fertility under the conditions at IITA. With the help of their colleagues working in the Crop Improvement Programs, they will probably be able to demonstrate at the same time greatly increased productivity compared with most traditional systems.

14.14 The first part of the problem is whether results obtained on the experimental farm at IITA will be repeatable at experimental centers elsewhere in other, different environments in the lowland humid tropics (some of them, perhaps, in locations more characteristic of the lowland humid tropics than is IITA itself). This part of the problem is not very difficult, since a normal outreach program and effective cooperation with other centers should result in thorough testing of IITA's results and recommendations and their modification as necessary in different environments.

14.15 The second part of the problem is more difficult: how to guard against the risk that results of research done on the IITA farm, and on cooperating experimental farms in other centers, will prove irrelevant to the needs of small farmers. This is by no means merely a question of having good extension services. Small farmers can often accept simple innovations, such as improved varieties, especially when they involve only a single change. It is more difficult for them to accept innovations involving the multiple changes which

tend to be suggested by rotation experiments and systems research. It is also difficult for scientists, working perhaps in a rather unfamiliar environment, to know what a small farmer will or will not be able to accept.

14.16 If research suggests that high soil temperature is harmful to crop growth in certain situations and that soil temperatures are lower with flat cultivation than with hills or ridges, how does the scientist find out whether and under what circumstances a small farmer can dispense with hills or ridges? The difficulty increases if, as is often the case, the size of plots on the experimental farm is much larger than on typical smallholdings and when the resources deployed on the experimental farm (labor, machinery, tools, fertilizers, insecticides etc.) are more than are commonly available to the small farmer.

14.17 Not only the extension workers but the scientists need to understand the motivations and constraints of small farmers. How at IITA are they to acquire it? In developed countries agricultural scientists often combine competence in research with practical farming experience; it is more difficult for scientists working in a foreign environment to have this combination of science and local farming knowledge.

14.18 Of course a strong outreach program will be important, especially if as much emphasis is placed on learning as on teaching. The appointments of Dr. Moomaw, presently leader of the Farming Systems Program, to be Assistant Director for Outreach, and of Professor Okigbo, the well-known Nigerian agronomist, to be leader of the Farming Systems Program, are to be welcomed. Also, continuation of socio-economic work of the kind begun by the agricultural economists will be essential; otherwise information about farm labor requirements and availability will be inadequate to allow meaningful small farm systems to be planned. In fact the socio-economic work will certainly need to be extended to cover situations elsewhere in Nigeria and in other countries.

14.19 In addition it will be necessary to orient the techniques used on the IITA farm (including cultivation and management practices) away from a rather exotic experimental farm situation and towards the situation actually existing on typical small farms (in relation to availability of equipment, tools, imports and labor). Furthermore, since farming systems tend to be location-specific it may be desirable for most of the scientists in the Farming Systems Program to do a significant amount of their work outside IITA, in different environments, often in association with programs being undertaken by national

research centers or departments of agriculture, especially where such programs involve work with farmers outside experiment stations. (Perhaps, at an appropriate time in the future, IITA could consider organizing, in several typical locations, operations on the lines of the Puebla Project in Mexico, which benefitted not only the participating farmers but, importantly, the CIMMYT scientists associated with it.) Such activities would presumably require additional funding beyond anything yet envisaged, but the feedback from them could be so vital to the success of the Farming Systems Program that before too long IITA perhaps should prepare precise plans and cost estimates for the consideration of donors.

1974 BUDGET
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE
Summary of Costs by Program and Activity 1970-1977
(U.S. \$ thousands)

Annex 1

	Actual			Estimate and Budget			Projected		
	1970 Core	1971 Core	1972 Core	1973 Est. Exp. Core	1973 Budget Core	1974 Budget Core	1975 Core	1976 Core	1977 Core
<u>Major Activities</u>									
1. <u>Research</u>					a/				
Farming Systems	16	224	492	873		938	1057	1113	1113
Cereal Improvement	7	200	133	360		426	453	477	477
Grain Legume Improvement	3	103	207	420		569	660	687	692
Root and Tuber Improvement	2	55	135	415		506	582	621	625
Total	28	582	967	2068		2439	2752	2898	2907
2. <u>Conferences and Training</u>									
Training Program	1	)	50	203		206	188	187	187
Conferences and Workshops	7	) 30	)	45		80	100	100	100
Postdoctoral Fellowships	-	)	) 8	40		72	96	120	120
Visiting Scientists and Consultants	-	)	)	42		60	60	60	60
Total	8	30	58	330		418	444	467	467
3. <u>Library, Documentation and Information</u>									
Communications and Information	2	12	82	94		121	130	128	128
Library and Documentation	19	39	57	122		157	150	146	146
Total	21	51	139	216		278	280	274	274
4. <u>Support Operations</u>									
(a) Service Activities:									
Research Station	)	116	60	176		167	210	186	187
Statistical Services	)	17	47	60		105	116	117	117
Service Laboratories	) 587	-	)	88		76	80	87	93
Plant Growth Facilities	)	-	) 93	12		70	42	42	14
Research Support (General)	)	20	)	39		50	46	51	43
Physical Plant Services	299	377	661	776		957	959	960	983
Auxiliary Services	-	35	57	(3)		39	13	(5)	(12)
Total	886	565	918	1148		1464	1466	1438	1425
(b) General Administration:									
Trustees Compensation and Travel	12	12	10	16		16	18	18	20
Ikeja Office	15	4	4	10		10	11	11	11
Contingencies	)	)	)	120		100	150	150	150
Administration General	) 357	) 872 b/	) 1049 c/	689		770	807	837	839
Total	384	888	1063	835		896	986	1016	1020
5. <u>General Operations</u>									
Light and Power	) 13	) 49	82	291		378	396	416	416
Water	)	)	24	-		40	42	44	44
Communications	2	4	19	10		10	11	12	12
Total	15	53	125	301		428	449	472	472
6. <u>All Other</u>									
Provision for Price Changes				-		-	382	788	1229
Total Core	1342	2169	3270	4898		5923	6759	7353	7794
Total Special Projects		6	10	205 d/		1440	1932	2110	2265

a/ Final allocation of funds for Core Operations 1973 not known. It is anticipated that final allocation will be near the estimate 1973 (previous column).

b/ Includes \$257,000 Capital Expenses charged to Core Expenditure.

c/ Includes \$253,000 non-recurring expenditure relating to previous years.

d/ Revised estimate for Special Projects expenditure in 1973 is \$913,000.

1974 BUDGET

Annex 2

INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

Summary of Manyyears and Costs by Organisational Unit - 1970-1977

(U.S. \$ thousands)

By Organizational Unit	Actual						Estimate and Budget						Projected						
	1970		1971		1972		1973 Est.		1973 Budget		1974		1975		1976		1977		
	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	Man- Years	Cost	
a/																			
1. Program Units																			
Farming Systems	16		8	224	11	492	14	873			14	938	15	1057	15	1113	15	1113	
Cereal Improvement	7		6	200	3	133	6	360			6	426	6	453	6	477	6	477	
Grain Legume Improvement	3		3	103	4	207	7	420			8	569	9	660	9	687	9	692	
Root and Tuber Improvement	2		2	55	3	135	7	415			7	506	8	582	8	621	8	625	
Training and Conferences	1		-	30	-	50	4	288			7	358	9	384	11	407	11	407	
Total Operating	29		19	612	21	1017	38	2356			42	2797	47	3136	49	3305	49	3314	
2. Support Units																			
(a) Service Operations:																			
Research Station	)		)		1	46	1	176			1	167	1	210	1	186	1	187
Statistical Services	)		)		-	35	1	60			1	105	1	116	1	117	1	117
Communications and Information))	2	240	1	51	1	94			1	121	1	130	1	128	1	128
Library and Documentation	)	930	)		1	45	1	122			1	157	1	150	1	146	1	146
Research and Training (General)))		170	1	181			1	256	1	228	1	240	1	210		
Physical Plant Services	)		6	429	5	786	6	1077			6	1385	6	1408	6	1432	6	1455
Auxiliary Services	)		-	-	-	57	-	(3)			-	39	-	13	-	(5)	-	(12)
Total	930		8	669	8	1190	11	1707			11	2230	11	2255	11	2244	11	2231	
(b) General Administration:																			
Administration	383		6	888	8	1063	8	835			8	896	8	986	8	1016	8	1020	
Total	383		6	888	8	1063	8	835			8	896	8	986	8	1016	8	1020	
3. General Operations																			
	-		-		-		-				-		-		-		-		
Provision for Future Price Changes											-	-	-	382	-	418	-	442	
Total Core Budget	32	1342	33	2169	37	3270	57	4898			61	5923	66	6759	68	6983	68	7007	
By Object of Expenditure																			
Personal Services Costs	980		1204		1611		3157				3384		3729		3916		3922		
Offsite Research, Consultants & Conferences	7		12		8		82				229		253		262		265		
Travel	26		19		51		167				174		184		187		187		
Supplies and Expenses	329		735		1489		1140				1669		1777		1821		1819		
Equipment	-		199		111		352				467		434		379		372		
Total	1342		2169		3270		4898				5923		6377		6565		6565		
Provision for Future Price Changes	-		-		-		-			-	-		382		788		1229		
Total Core Budget	1342		2169		3270		4898				5923		6759		7353		7794		

a/ Final allocation of funds for Core Operations 1973 not known. It is anticipated that final allocation will be near the estimate 1973 (previous column).

b/ Light and Power, Water and Communications included in Physical Plant Services budget.