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THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

ROLE OF THE CGIAR IN CROP PROTECTION RESEARCH

TAC SECRETARIAT

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CGIAR AND CROP PROTECTION RESEARCH: A DISCUSSION PAPER

1. Introduction

Research to increase crop productivity, yield stability and sustainability has formed part of the central thrust of the CGIAR System which employs a multidisciplinary research approach. One of the primary objectives of crop productivity research is to defend against the reduction in attainable yields. According to the CGIAR Priorities and Future Strategies (1987), crop protection research in pursuit of this objective is directed towards complementary genetic and agronomic improvements.

The purpose of this paper is to review and analyse the available background material to facilitate the task of the TAC Panel on Crop Protection Research in making provisional assessments of the three non-associated Centres, ICIPE, AVRDC and INIBAP with regards to their research activities in crop protection. ICRAF has not been considered in this analysis because it does not as yet appear to have a coherent set of crop protection research activities upon which to base judgment.

The paper touches on the need for CGIAR involvment in crop protection research and briefly assesses research activities in the CG and the non-associated Centres. The paper compares the crop protection activities of the non-associated Centres with those of the CG Centres, and provides an overall assessment of possible options which the Panel could consider.

Panel's attention is drawn to the background material used for this analysis. It includes:

(i) the revised statement of the CGIAR mission and goals;

(ii) the TAC (1989) paper - "A possible Expansion of the CGIAR - Part I Interim Report";

(iii) the TAC (1989) paper - "Activities and Modes of Operation in the CGIAR System";

(iv) External Review Reports, Long-term Strategy Reports, Annual Reports, etc;

(v) Report of the TAC fact-finding missions to ICIPE, INIBAP and ICRAF (There has not been a TAC fact-finding mission to AVRDC, but the TAC Vegetables Research Panel, not expected to meet before TAC 51, is planning to visit AVRDC in April/May);

(vi) Mackenzie (1989): Evaluation of Crop Protection Research, Training and Technology Transfer at the IARCs".

Another background document on Integrated Pest Management developed under the auspecies of ACIAR is expected to be available to the Panel.

2. The Need for CGIAR Involvement in Crop Protection Research

It is estimated that generally yield losses of 20% to 30% occur annually due to pests, diseases and weeds. This overall global figure hides variations which can extend to complete crop failures in local situations, involving both traditional as well as improved crop cultivars.

Amongst the CGIAR commodities, there are some (e.g. cowpeas, beans) for which there are still no satisfactory low-cost technologies for sole cropping because of problems with insect pests and diseases. Consequently, for such crops, intercropping and other cultural practices continue to be employed as essential crop protection tactics by the resource-poor, small-farmer. In the moist subhumid and humid warm tropics, insect pests, diseases and weeds continue to limit crop and labour productivity, as well as imposing geo-ecological limits to the cultivation of short season dryland crops. In the semi-arid warm tropics, there are still no satisfactory solutions to problems of borers, shoot-fly and head moulds in cereals, and the semi-parasitic weed, Striga, continues to remain a major constraint to cereal production in the drier parts. In wetland rice ecologies, weed control problems together with insect pest and disease problems constitute a major set of constraints to achievement of further sustainable increases in yields.

There has been much said and written about the ever present threat of increased infestation arising from increases in cropping intensity as well as from greater potential genetic vulnerability resulting from large scale adoption of only a few genetically narrow-based varieties. The so called green revolution has offered several instances of such threats. Also, examples abound of excessive and careless use of biocides to combat insect pest, disease and weed problems, and multi-national chemical companies have often been able to distort national priorities and strategies in crop protection, contributing their share of health hazards and environmental pollution.

Considering the generic, transnational and geo-ecological nature of insect pest, disease and weed constraints that affect CGIAR commodities, the need for CGIAR involvement in crop protection research is, therefore, not an issue. The main concern is what research requires international efforts? Where does the CGIAR System have or need to develop a comparative advantage? and, How can CGIAR conduct its research effectively and efficiently?

CGIAR commodity Centres act as global repositories of germplasm. They are major producers and providers of improved insect pest and disease resistant germplasm to national programmes to spearhead the production of low-cost and safe technologies. If this role is to continue in the future as a major bulwark against insect pests and diseases, then CGIAR's involvement in crop protection research is essential. Also, while a large number of insect pests, fungal, bacterial and viral diseases, and weeds are involved in reducing crop productivity gains, many lend themselves to international research because of their transnational and geo-ecological characteristsics, and because of the possibility and feasibility of developing varietal resistance, and of large-scale biological control. Additionally, there are several strategic and applied aspects of cultural, mechanical and integrated control which justify international efforts.

The TAC Interim Report mentions that "the area in crop productivity research needing reinforcement recognizes the small farmers' need for low-cost techniques, for cost-saving changes and for means to exploit marginal areas into which they are driven". It notes that the emphasis on weed control recognizes the low labour and power resources of the small farmer and the inevitable role of timeliness in crop management for higher yields.

The rising costs of chemicals, their loss of effectiveness through evolving tolerance in the populations of insect pests and pathogens, and growing public concern about pollution of the environment and health have all cast doubts on the indiscriminate use of chemicals. Further, advances have been made in understanding the circumstances that promote greater persistence or durability in the genetic resistance bred into new crop varieties. These sets of considerations, coupled with continuing advances in biological control and biotechnology, have reinforced the need for CGIAR to continue to put a heavy emphasis on breeding work for resistance to, or tolerance of, biotic stresses, and to supplement and complement this where appropriate with research on biological and integrated control.

In situations where the use of broad spectrum biocides is absent, the main strength of the classical biological control approach is that its effects can be relatively rapid and persistant once successfully implemented. The second equally important strength is that it requires relatively little special skills or resource inputs from the farmers. However, biological control research cannot be pursued simply based on applied research. The strategy must be based on biologically sound principles which integrate basic and applied research components. Basic research here is not only needed to aquire fundamental knowledge of the pests and their predators but also to assess and understand the eventual outcome of the control effort. Where biological control research is taken seriously, it generally has a relatively longer time-horizon, and may require greater investments in specialized facilities. However, well defined and efficiently implemented biological control research strategies are generally very cost-effective.

The TAC Interim Report makes a statement that "there is strong demand for research on integrated pest management (IPM)". It does not expand on what is the definition of IPM. However, IPM means different things to different people, and there are several views about how practical it is at the farmers level, and whether the CGIAR can have a research role on IPM. This aspect needs further consideration particularly because of the notion that IPM, as a control tactic, deals mainly with integration of several components in relation to specified locations and farming systems. Consequently, therefore, it can be argued that the business of generating IPM technologies (as opposed to generating IPM components) and undertaking adaptive research on IPM is the responsibility of national programmes, NGOs and international technical assistance and development agencies. On the other hand, it can also be argued that principles underlying IPM strategies and systems for the resource-poor producer have not been fully explored, and that there are international research components which require to be addressed if efficient IPM strategies and systems are to be developed and managed by national and international bodies.

3. CGIAR Activities

There are four main aspects to the System's work on crop protection research: varietal resistance, the identification and monitoring of insect pests and disease organisms, biological control and the efficient use of chemicals. The need for chemical control is minimized by attempting, wherever possible, to breed into a single variety durable resistance to its major insect pests and diseases. This approach features strongly in Centres' programmes. In breeding and maintaining resistance varieties, constant vigilance is necessary, and the work is closely linked to monitoring the occurrences of known races of insect pests and pathogens and identifying new ones.

However, CGIAR Centres have not been consistant in conducting research on mechanisms and genetics of resistance as an important input into breeding for resistance. Instead, they appear to have relied more on building up large germplasm collection across a wide geographical spread. In this process, crop protection research in some crop improvement programmes at CGIAR Centres appear to play a service role only to the breeders and national programmes, and there is relatively little time devoted by entomologists, pathologists, geneticists and physiologists to scientific research on crop protection.

Further, CGIAR Centres have not developed an organized capability to conduct basic and strategic research on biology and ecology of insects, diseases and weeds. Also, biological control has not been a regular component of crop protection research in all Centres, but the level and extent of activity is gradually beginning to increase, including basic and strategic research on insect pest biology and ecology. For example, the 1990-94 work plan of IRRI's subprogramme on improved pest management proposes a substantial increase in the level of basic and strategic research in crop protection.

According to CGIAR Priorities and Future Strategies (1987), work on efficient use of chemicals has several aspects. For the control of insect pests, for example, the aim is to kill the pests without reducing the effectiveness of their natural predators and parasites. Preferred insecticides are those that can be targetted to specific pests. Similarly, adequate control of weeds is fundamental to crop productivity in all tropical environments. Although herbicides are relatively expensive, the System's approach is to examine their use as an aid to timely weed control. Again, this research work on efficient use of chemicals does not appear to have been conducted in a consistent manner, nor is it perhaps possible to do so as long as the business of developing, manufacturing and distributing biocides has a life of its own, and as long as the CGIAR Centres as a group are not at the front end of scientific research on the biology and ecology of insect pests, diseases and weeds.

The MacKenzie report provides a comprehensive picture of the tactics (host-plant resistance, mechanical practices, chemical control, biological control, cultural practices and integrated control), and the methodologies (modelling, population dynamics, and research on the biology and ecology of pests and how they affect the crop) in use in crop protection research at the CGIAR Centres, as well as the implementation of crop protection measures (research dealing with surveys, monitoring, forcasting, loss assessment and economic thresholds).

starting with southern Africa. The proposal is designed to bring about a sytematic build up of indigenous research, including crop protection research, through a collaborative partnership among national research systems, and between those systems and AVRDC.

4.3. INIBAP

INIBAP has identified two broad thematic activities - "germplasm improvement" and "pathology" - upon which to concentrate its effort in the first five years. The unifying element between the two themes is that diseases are identified as the main constraint on production, and breeding is considered the most feasible method of alleviating the damage. The 1989 budget allocation to crop protection research is $0.10 million or 7% of the total budget (Appendix A-1).

Main attention is focused on two diseases, both of which are still spreading: the Black Sigatoka, a virulent fungal disease and the aphid transmitted Banana Bunchy Top Virus (BBTV). Several other diseases such as Panama disease, and Bacterial Wilt as well as nematodes and weevils have had some attention. At present there are no economically acceptable control measures available for Black Sigatoka, and the principal research activities on the disease will be monitoring geographical occurrence and assessing varietal reaction to infection. Very little is known about the BBTV disease and efficient indexing methods to test in vitro plantlets are still needed.

The major objective of INIBAP's four regional networks (East Africa, West and Central Africa, Latin America and the Caribbean, Southeast Asia and the Pacific) is the identification and the introduction of improved germplasm with resistance to the Black Sigatoka disease, the BBTV disease, Panama disease, Fusarium Wilt and to some species of nematodes. For this purpose, the regional networks have established quarantine procedures to acquire germplasm from different parts of the world, for trials in different countries. An essential component of the regional network is the organization of training courses.

INIBAP has a working agreement with IITA which has a major breeding programme located at Onne, and that station will undoubtedly become a major germplasm centre. Long-term plans of INIBAP will need to take into account the IITA programme, to avoid duplication of efforts. Also, the West African Regional Cooperative for Research on Plantain (WARCORP), which was initiated and coordinated by IITA, has devolved to INIBAP for coordination. INIBAP depends on ICIPE to work on banana weevil problems in East Africa.

5. Activities of the Non-Associated Centres in Relation to CGIAR Centres

ICIPE's collaboration with national programmes (Appendix A-2) is in the area of applied research and institution building. Some aspects of the former (e.g. host-plant resistance) appear to partly overlap with that of some CGIAR Centres. The collaborative research work that is conducted directly with CGIAR Centres (e.g. IITA and IRRI) is of mutual benefit and complementary. The strategic research conducted by ICIPE in support of its own problem-oriented Crop Pest

Research Programme does not overlap with activities in CGIAR Centres. Generally, there is overlap in applied research activities between ICIPE and CGIAR Centres. In those instances where ICIPE has embarked upon the development of insect resistant cultivars, and to undertake research on genetics and inheritance of plant resistance to insect pests, there has been a strong overlap, and possibly some duplication of effort. However, ICIPE has limited capacity for plant breeding, and does not intend to develop one. Also, it has no plans to expand its activities on genetics of plant resistance beyond what is considered relevant to understanding the nature of host-plant resistance or susceptibility and its relationship to insect behaviour, in the development of IPM components and strategies.

The crop protection research work conducted by AVRDC on vegetables is not in conflict with the work of the CGIAR since CGIAR Centres do not conduct vegetables research. However, CIP conducts research on sweet potato and it, like AVRDC, considers scab, viruses, weevils and vine borers as the major disease and pest constraints to increasing productivity. CIP and AVRDC have had joint activities during the past two years, such as the study of sweet potato in China, and participation of AVRDC in CIP conferences in Asia. To avoid duplication of efforts and to maximize complementarity, AVRDC and CIP would need to continue to cooperate closely. According to the CIP 1989 EPR report, the process leading to a mutually agreed plan for cooperation between CIP and AVRDC in sweet potato research is underway, and AVRDC will probably be in position to make its decision on whether to continue with sweet potato work at its spring 1990 Board meeting.

INIBAP's strategy is mainly focussed on germplasm improvement and the pathology of the Black Sigatoka and the BBTV disease. IITA also undertakes crop protection research on plantain, and considers Black Sigatoka disease as the major constraint to increasing sustainable production of plantain in Africa. IITA plans to address the problem of Black Sigatoka through two essential short-term research activities as well as a longer-term strategy. First, collaboration will be established with the Honduras Foundation, and the products of the Foundation's breeding programme will be screened in West Africa for resistance by importing cultures in vitro. Second, East African cooking banana collection will be screened for resistance to the disease.

As a longer-term solution, IITA expects to establish a plantain breeding capability for Africa, with first priority given to Black Sigatoka resistance. Other breeding objectives will include resistance to nematodes. IITA's plan envisages a close collaboration with INIBAP networks (and WARCORP), and links with breeders in Latin America.

As mentioned earlier, collaboration for research has been established between IITA and INIBAP which has provided for the appointment of a West and Central Africa Regional Coordinator to be resident at IITA. It would appear that INIBAP's activities are complementary to those of IITA, and as long as the two institutions take account of each others future plans, and collaborate closely, duplication of efforts in crop protection research could be avoided, and complementarity maximized. However, it would seem that potential for conflict and duplication of effort in the future, particularly in Africa, remain high.

6. Research by other Organizations

6.1. National

Most national research systems in the developing world now have crop protection research programmes of some form, with activities ranging from basic and strategic to applied and adaptive depending on the crop, the problem and the availability of resources. Most developing nations have been gradually moving to strengthening crop protection research, as their national research systems increase their capacities and capabilities. However, much of the crop protection research so far has had a heavy focus on selection for host-plant resistance and chemical control. In general, national systems have not developed centralized capacities to undertake basic and strategic crop protection research, although some specialist crop protection institutions with research and service functions do exist (e.g. Tanzania Pest Research Institute).

Crop protection research specifically on banana and plantain, and on vegetables in most developing countries is of recent origin and therefore fragmented. However, a significant number of developing countries have crop protection research programmes on horticultural crops.

Several developed nations (e.g. UK, France, Germany, Holland, Australia, Canada and USA) maintain government funded technical units that undertake collaborative programmes (within aid projects) in crop protection. Such programmes may involve pest and disease surveys, basic and applied research or development activities, and there has been some limited work done on banana and plantain, vegetables and CGIAR commodity crops. Some of these technical units have had collaboration with CGIAR Centres on aspects of crop protection research (e.g. ODNRI), and CIRAD has ongoing collaboration with INIBAP. Similarly, disciplinary expertise from university departments and crop protection or commodity institutions in developed nations have also been engaged in international activities in the field of crop protection. All these institutions are scientific and technical resource bases which will continue to serve developing countries in a complementary and supplimentary manner through various collaborative and contractual arrangements.

6.2. International

There are no publically funded international institutions (other than IITA, INIBAP and AVRDC) undertaking or promoting applied crop protection research specifically on banana and plantain or vegetables to raise and sustain their productivity in the developing world.

CABI is an intergovernmental organization that provides scientific and development services to clients worldwide through its four institutes: Institute of Entomology, Mycological Institute, Institute of Parasitology and Institute of Biological Control. The first three deal with the science of taxanomy and provide identification and related services; the fourth deals with biological control. They all undertake research to enhance their own knowledge base as well as scientific and development service activities.

CABI's current focus of activity is on insect pest management services including crop-oriented insect pests and disease surveys, economic studies of pest and disease problems, IPM programmes, and the strengthening of national quarantine services. These contract services are tailored to the needs of the clients, and the work undertaken is not in conflict with the CGIAR Centres or ICIPE.

The multi-national chemical companies are aiming at increasing the sales of their biocides including microbial sprays, and they are making major investments in the development of herbicide resistant varieties of major food and cash crops of the developing world. Further, the de novo synthesis of biocides by the host plant for its own defence is also an area that is seriously being pursued by the private companies. Successes have already been anounced, in the area of biocide resistance and de novo synthesis of toxins, by Agreacetus, Rohn and Haas, Monsanto, Du Pont, Northrop King and Ciba-Geigy with tomato, soybean, cotton and tobacco.

7. Overall Assessment and Preliminary Conclusions

The Panel may wish to consider the subject matter of crop protection research in three parts. Firstly, there are issues related to the future role of CGIAR in crop protection research - What should be the main elements of future CGIAR priorities and strategies in crop protection research? Is the current commodity-based approach correct for defining priorities and strategies for crop protection research as an activity under crop productivity category? Does the approach leave any gaps, for example with regards to storage insect pests and diseases, or with regards to multi-commodity insect pests, diseases and weeds such as locust, armyworm, termites, parasitic weeds? What about Quelea? Also, Is there adequate basic and strategic crop protection research being conducted at the CGIAR Centres? Is there a need to strengthen research on genetics of resistance, insect science, pathology and weed science? Does the current approach of crop improvement programmes of CGIAR Centres, relying mainly on host-plant resistance, adequately tackle research needs in the areas of crop protection? Is there a need for complementing and supplementing host-plant resistance research with research on biological and integrated control?

Secondly, issues concerning the need for strengthening basic and strategic research on crop protection require attention - What is the nature of the evolving need and how can it be met effectively and efficiently? Can the need be met in a decentralized manner? Is there a case for developing research support facilities (including biotechnology) for crop protection research, such as those at ICIPE, at each commodity-oriented CGIAR Centre? Is there a need to develop centralized support facilities to serve the needs of the CGIAR System?

Thirdly, there are the issues related to the research activities on crop protection at ICIPE (which has a discipline focus), and AVRDC and INIBAP (which have a commodity focus). Some of these activities are complementary to the work and goals of CGIAR. Do any of them qualify for CGIAR support? If yes, what are the options for providing such support?

7.1. The Future of Crop Protection Research in the CGIAR

The CGIAR commodity approach to crop productivity research does not adequately address the research needed on migratory and non-migratory pests that are transnational and continental in scope, and may affect a wide range of commodities within farming systems. Also, the low priority given to storage pests has meant that, in some crops at least, current breeding programmes do not adequately breed for resistance to storage pests. In the case of grain legumes, it is likely that the deliberate strategy of not breeding for resistance to storage pests may have led to resistance genes being selected out.

Considering the future importance of crop protection research, strong arguments can be made to justify the notion that its current profile (as an activity with crop productivity category) be raised, with several activities including entomology, pathology and virology as appropriate, and that it be strongly intergrated with other areas of crop production research.

There is little doubt about the need to maintain the gains in crop productivity achieved through varietal resistance. However, there is a need to build on the traditional types of breeding programmes an adequate knowledge base on mechanisms and genetics of resistance, and biology and ecology of insect pests and diseases, to enable the development of more efficient crop improvement programmes and permit crop protection scientists to play a more strategic research role.

Also, the future role of biological control needs to be examined, given the fact that: (a) there is now a greater appreciation by the CGIAR scientific community of the potential applications and benefits of classical and augmentational biological control, and (b) the feasibility of conducting biological control research in the field has improved significantly. Increased investments in biological control research also increase the demand for basic knowledge and strategic research on pest biology and ecology. As already mentioned above, a strategic plant breeding programme also has a greater demand for basic research on insect biology and ecology. Thus, a Centre with strategic crop protection research should also find it relatively cost-effective to add research activities on biological control to complement host-plant resistance tactics.

There is a certain lack of clarity regarding the potential role of CGIAR in the development of IPM technologies. The integration of the components of IPM into management packages is a very important research area. It requires an emphasis on modelling and other integrative research , and needs to be undertaken in such a way that strong linkages with national programmes can be established.

The MacKenzie report has highlighted the notion that there is a need for greater cooperation and communication of IARC crop protection specialists, with the purpose of strengthening research coordination, collaboration and communication in IARC crop protection. The report further suggests that this strengthening could be achieved, in the first instance, through the formation of a network of IARC crop protection specialists. Is such a formal network essential for CGIAR Centres?

7.2. Facilities for Basic and Strategic Research on Crop Protection

Basic and strategic crop protection research has an important role in the CGIAR System. Support facilities required to undertake strategic research may include units dealing with chemistry and biochemistry, cell molecular biology, sensory physiology, biological control, and biotechnology. There is ample evidence that basic and strategic research cannot be sustained without adequate support facilities in one or more of the areas just mentioned. The developing countries in general are unlikely to set up such facilities to strengthen national crop protection research programmes in any major way during the next two decades. Any investment in such facilities by the industrialized corporate sector are unlikely to be available to national programmes in developing countries or to CGIAR Centres, and there would be little in the way of shared objectives.

To advance the above line of thought would require a quantification of the System-wide need for support facilities for strategic crop protection research. Except for the Hirst 1982 study and the MacKenzie study, there has not been a full stripe review of crop protection research activities in the CGIAR System. Such a review would be necessary to provide an assessment of the System-wide need for strategic research, the facilities needed to support such research, how effectively are these needs and support facilities currently being met, and what options could be considered for meeting future needs.

There is a strong case for a stripe review in the light of the fact that: (a) the CGIAR commodity Centres today are better aware of their individual and common needs in the area of basic and strategic crop protection research, (b) the national programmes are much stronger now and will continue to become stronger as time goes by, thus raising the prospects of developing more effective crop protection research strategies and technologies at the national level, (c) the continuing advances in biotechnology, communication and information technology are opening up new and better opportunities for innovative international research on crop protection, and (d) there is a much greater need to ensure that scientific knowledge on insect pest and disease biology and ecology is adequately taken into account in the identification of problems and their solutions (including their impact on environment and human health).

An alternative option for CGIAR Centres would be to rely, through collaborative and contract arrangements, on specialized non-CGIAR centres, including ICIPE, CABI, to tackle certain aspects of basic and strategic research. The appropriateness of this strategy needs to be examined carefully because of its tendency to work against integration. Also, current trend in the CGIAR System suggests that such a strategy may not be fully satisfactory.

7.3. Crop Protection Research

7.3.1. ICIPE

ICIPE is a mono-disciplinary (entomology) international Centre with a pan-African focus. It undertakes research on insect-related constraints, and has developed its own scientific and technical capacity to serve the needs of its problem-oriented research activities. It has

strength and comparative advantage in basic insect biology and ecology which is of particular importance in the development of technologies for insect control including biological and integrated control.

ICIPE's applied crop protection research is integrated with basic as well as adaptive research. It could be argued that linking ICIPE to commodity-oriented crop improvement as well as farming systems research activities of CGIAR Centres (major providers of improved germplasm with host-plant resistance) would raise the probabilities of achieving early impact on productivity at the farm level. This line of argument would offer at least three options for supporting ICIPE's role in international crop protection research. The first option would be to provide direct support to the whole of ICIPE's Crop Pest Research Programme, and to bring it into line with CGIAR priorities, strategies and modes of operation, as a condition of effectiveness. Such an option would make it possible to provide sizable support to a clearly identifiable component of ICIPE's core research programme.

The second option would be to support only those aspects of crop protection research which would be of interest to the CGIAR, leaving ICIPE free to develop other areas of crop protection and insect science research.

The third option would be to accept ICIPE as a 'favoured' scientific and technical resource base, and for CGIAR Centres to continue to develop closer cooperation and collaboration through which an increased level of CGIAR support could flow, on a case by case basis. This option would have the advantage of not being unnecessarily radical, and yet would reinforce a desirable trend in collaborative international research on crop protection.

There is an additional option which would be to support ICIPE's Crop Protection Research Programme (including the research support units) that would focus research on multi-commodity insect pests that are presently not covered by the CGIAR, such as locusts (which has recently been accepted as a special project by ICIPE), armyworm and termites, and other insect pests which appear to be inadequately covered at present, such as borers, common vectors and storage insects.

7.3.2. AVRDC

The importance of research to improve vegetable production has been recognized by CGIAR since the early 1970s. The establishment of AVRDC in 1971 was not seen as sufficient to meet the global needs for vegetables research. A proposal to establish a small International Vegetable Research Institute for the Tropics was examined by CGIAR in 1979, but was not developed further. TAC tabled a proposal in 1988 for the creation of an International Service for Vegetable Research (ISVR) and the establishment of regional vegetable research networks in Africa and subsequently in Latin America. The mid-term meeting of CGIAR, held at Berlin in 1988, endorsed in principle the need for an increased involvement in vegetable research. At the 1989 mid-term meeting of CGIAR in Canberra, the Group decided that as an interim action a proposal for an African Vegetable Research Network should be developed for consideration by the Group in its autumn 1989 meeting. Consequently, a proposal for Collaborative Vegetable Research Network in Southern Africa, developed through a joint CGIAR/SADCC/AVRDC mission, was presented to the Group in November.

AVRDC has developed into an effective research, training and technical assistance or backstopping agency for the southeast Asia region. AVRDC's crop protection research includes a good deal of adaptive activities which could be transferred over time to NARS with improved capabilities.

AVRDC has developed considerable strength and experience in crop protection research on vegetables. One option would be to tap this expertise through an organizational model that would respond to the global need for vegetables research as well as provide for maximum collaboration and coordination of effort. An alternative option would be to consider providing CGIAR support to crop protection research at AVRDC independent of such an arrangement.

7.3.3. INIBAP

INIBAP, with its germplasm improvement (for disease resistance) and pathology programmes, can be regarded as constituting a service network for crop protection research. As INIBAP has only recently come into existance, it has some way to go before it is established and its impact felt. This situation makes it difficult to formulate a rationale for CGIAR support to INIBAP's crop protection research at this stage, notwithstanding its network and service mode of operation. INIBAP appears to collaborate closely with IITA (which is focusing its plantain programme essentially on East and Central Africa), and the activities of the two institutions complement each other well. Strengthening this collaboration for Africa, through CGIAR support via IITA, in the first instance could contribute towards ensuring that crop protection research on banana and plantain continues to develop effectively and efficiently at both international and national levels. Such an arrangement may help IITA to continue to develop a highly focused research programme with plantain in Africa, leaving other work on plantain, as well as work on banana, to national programmes, backstopped by INIBAP.

Another option would be to consider extending direct CGIAR support to INIBAP to develop its in-house research (as opposed to networking and technical backstopping) activities on pathology and breeding for host-plant resistance. This option might be feasible to administer but INIBAP has not yet developed a core programme of scientific research. Also, it is not clear how such an option would enable CGIAR to develop a comparative adavantage in crop protection research on banana and plantain. Support under this option, for Africa atleast, could also be provided through IITA.

7.4. Preliminary Conclusions

Crop protection research is an important facet and an integral part of the diverse crop improvement programmes and resource management research activities at CGIAR Centres. Current expenditures by CGIAR Centres in crop protection research amount to some 21% of their crop productivity research budgets, and is projected to rise to over 23% by 1993.

The grave global food situation in the 60s and the 70s, and the research psychology which went with it, have shaped the growth of CGIAR commodity Centres to what they are today. The Centres now face a very

differt future. Crop protection research in CGIAR must plan to extend its range and develop an adequate agenda of basic and strategic research. Support facilities required to do so might be developed in a centralized manner, or be established at each Centre as appropriate. This issue needs careful consideration.

Given the importance of crop protection research, a strong case can be made for the need to upgrade the profile of the activity to a higher level. The current commodity approach to crop protection research does not adequately tackle the different components of control and management of insects, diseases and weeds, some of which can affect a wide range of commodities within farming systems. Also, the generally low priority accorded by CGIAR commodity programmes to breeding for resistance to storage insects and diseases should be reviewed.

The close interaction of researchers in crop protection within and outside the CGIAR System and with those in other fields at the IARCs and in national programmes is mutually beneficial in the efective development of international and national capability in crop protection research. Whether a formal CGIAR supported network is the best way to strengthen such interaction needs to be further examined amongst other options.

There appears to be no compelling evidence to move away from the notion that crop protection research should remain distributed among CGIAR Centres as a component of their multi-disciplinary programmes. However, centralized facilities for basic and strategic entomological, pathology and weed research at specialized institutions in the developing and developed countries could continue to support the evolving needs of the CGIAR Centres. A specialized CGIAR Centre on crop protection research would lead to polarization and fragmentation of research, as well as duplication of efforts.

In the case of ICIPE there might be opportunities for a closer cooperation with CGIAR Centres. Support for such cooperation could continue to be provided through individual CGIAR Centres. Alternately, ICIPE could be considered for conducting research on insect pests which are multi-commodity in scope and currently not adequately covered by CGIAR commodity Centres.

CGIAR support to crop protection research at AVRDC might be best considered within a CGIAR-led global mechanism for vegetables research in which AVRDC could act as a major research resource base whose research services and expertise could be utilized in a collaborative and contractual mode.

INIBAP's crop protection research activities do not as yet conflict with those of IITA, and there is close cooperation between the two institutions. However, INIBAP is developing a global coverage of its service activities and is committed to grow into a major catalytic institution with in-house research capabilities. Probabilities of conflicts between INIBAP and IITA could increase as both programmes grow. There appears to be no strong case for CGIAR support to INIBAP's service and networking activities in pathology, although support to INIBAP's research activities either directly or through IITA could be considered.

Appendix A-1

RESEARCH AND RELATED ACTIVITIES

Proportion (%) of budget allocated to:	ICIPE	AVRDC	INIBAP
Crop protection research:	32	28	7
- Strategic	30	-	-
- Applied	35	100	100
- Adaptive	35	-	-
Development of research capacity:	28	22	35
- Training	37	62	29
- Technical assistance	-	-	8
- Financial assistance	-	-	-
- Information & communications	33	15	63
- Networks	34	23	-
Proportion of budget allocated to:			
- All research	59	56	49
- Related activities	23	16	27
- Administration	18	28	25
Total budget in US $ million	10.78	7.50	1.43

RELATIONSHIP WITH NATIONAL PROGRAMMES - ICIPE

A. COLLABORATION WITH INDIVIDUAL COUNTRIES

	Country and project			
	1	2	3	4
Purpose of collaboration				
- Strategic research				
- Applied research	x	x	x	x
- Adaptive research	x	x	x	x
- Extension				
- Institution-building	x	x	x	x
Types of relationship:				
- Collaboration	x	x	x	x
- Contracting				
- Enabling				
Role(s) of Centre in the collaboration:				
- Leader/controller				
- Customer				
- Partner/collaborator (no funding from Centre)	x	x	x	x
- Donor				
- Channel for funding				

1 - Kenya; 2 - Somalia; 3 - Zambia; 4 - Philippines

LIST OF ICIPE'S COUNTRY PROJECTS

1. Kenya Ministry of Agriculture: Comparative efficacy and economics of recommended pesticides vs. alternative control measures against stem borers.

2. Somalia Ministry of Agriculture: Population distribution and patterns of stem borers on maize, sorghum and cowpea.

3. Zambia Ministry of Agriculture: Development and utilization of maize genotypes resistant to stalk borers and maize streak virus as component of IPM.

4. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) and Philippine Rice Institute: Collaborative research project on the management of borers of rice and maize.

RELATIONSHIP WITH NATIONAL PROGRAMMES - ICIPE

B. PARTICIPANTS IN NETWORKS

	PESTNET
Main purpose of network:	
- Strategic research	
- Applied research	x
- Adaptive research	x
- Extension	
- Institution-building	x
Type of network:	
- Collaborative	x
- Research contracting	
- Research enabling	
Role(s) of Centre in the network:	
- Administrator/controller	x
- Scientific coordinator	x
- Partner/collaborator (no funding from Centre)	x
- Scientific consultant/ provider of germplasm	
- Channel for funding	

PESTNET is the Pest Management Research and Development Network. Its objectives are to develop and apply integrated pest management strategies for the control of major crop pests and vectors of livestock and human diseases. Participating countries in Africa (18 in all) are: Kenya, Tanzania, Mozambique, Zimbabwe, Zambia, Lesotho, Uganda, Rwanda, Burundi, Somalia, Sudan, Ethiopia, Ivory Coast, Senegal, Nigeria.

TRAINING AND INFORMATION SERVICES - ICIPE

1. TRAINING

ICIPE's education and training activities in crop protection are: (a) graduate training, (b) postdoctoral research fellowships, (c) research associateships, and (d) short group training courses. Being a discipline-oriented Centre, ICIPE does not offer training on crop production research. On-farm research training appears to be offered within the research associateship scheme.

Graduate training at the Masters and Ph.D. level, geared towards leadership training in insect science, is facilitated through the African Regional Postgraduate Programme in Insect Science (ARPISS) which is a network of 14 universities in Africa created in 1986. Fifty-nine Ph.D. students from 13 African countries have now registered with ARPPIS, of which 31 have obtained their Ph.D. and 28 are presently studying. A special graduate programme for entomologists specializing in biological control has been developed by ARPISS, with 6 Ph.D. and 10 M.Phil level participants.

Postdoctoral research fellowship scheme seeks to provide young scientists with an opportunity to work with ICIPE scientist for periods of upto 2 years on some of the major pests of Africa. Since 1987, there have been 15 postdoctoral fellows of whom 5 have been attached to Crop Pests Research Programme and 5 to Research Support Units.

The research associateship scheme provides scientists from national programmes and universities to work at ICIPE for short periods of time. This programme is considered to be of particular value to PESTNET participants on aspects of pest management technologies. Nine research associates have been trained of whom four were attached to Crop Pests Research Programme.

Since the first group training course in insect science, 464 scientists and practitioners from 41 developing countries have attended a range of courses including those on IPM, pest and vector management systems, and microbial pathogens as biological control agents of insect pests and vectors.

2. Information Services

ICIPE does not appear to be involved in generating extension-type of information. Its main focus has been on scientific publications in refereed international journals - 400 since 1983. This is apart from the series on crurrent themes in tropical science, Workshop and Conference Proceedings, and publications for the general public. ICIPE also manages the editorial, publishing and distribution responsibility of the bimonthly international journal Insect Science and its Application.