CIAT'S APPROACH TO COLLABORATIVE RESEARCH FOR BEAN PRODUCERS IN AFRICA[1]

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Bean Production in Africa

Annual production of beans (Phaseolus vulgaris L.) in Africa amounts to approximately 2 million tonnes. Production tends to be concentrated in cooler highland areas of Eastern and Central Africa, particularly in Burundi, Kenya, Rwanda, Tanzania, Uganda and Zaire, although the crop is also important in other countries and in semi-arid environments.

Beans play a critical role in human nutrition in the region. About 45% of total dietary protein in Burundi and Rwanda is derived from the consumption of beans (an importance exceeding that found in any country of Latin America, the crop's centre of diversity). Dietary complementarity of beans with staple starch crops is important in maize/bean and sorghum/bean cropping systems, and is crucial where, as in Uganda, diets based on cassava or on banana have been associated with severe protein deficiency symptoms.

Small farmers are the principal producers of beans, most of which are intercropped in maize, sorghum or banana. Most production is for subsistence consumption, coupled with some production for sale to urban populations, for whom beans normally constitute a relatively low-cost source of protein. Use of fertilizers and pesticides in bean production is rare in this region, yields are less than one t/hectare and increases in production are being achieved primarily through expansion in the area cropped.

Bean Research in National Programmes

Research on beans has a long history in Africa and has continued to increase in importance during the past few years. Genetic improvement of beans generally is the responsibility of grain legume programmes, while the improvement of cropping systems, bean agronomy and crop protection are variously organised as separate research programmes or integrated into the responsibilities of grain legume programmes.

The adequacy of human resources available to these national research programs varies greatly. Uganda, with an estimated 450,000 hectares of beans grown in several distinct agroecological zones, has twelve graduate staff of the Ministry of Agriculture devoting on average 70% of their research time to the bean crop. Not all countries are so well endowed. In recent years agronomy in general appears to have received less attention than breeding and crop protection. All countries, however, have placed priority on improving the training of their research staff, both graduates and technical assistants.

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[1] Paper presented at Senior Research/Extension Administrators Workshop, Lilongwe, Malawi, 5 - 8 May 1987.

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National research coordinators generally have identified seed storage, transport for on-farm research, and field equipment not available for local purchase as infrastructural limitations to the efficient deployment of the available research manpower.

Opportunities for exchange of research methodologies, bean germplasm, literature and other results among national bean programmes have been lacking in general until recently. A questionnaire survey of all bean researchers known to CIAT in Africa in 1985 identified a critical need for improved access to information and documentation. One bright spot was the emergence three years ago of the Phaseolus Bean Newsletter for Eastern Africa, compiled and published by Kenya's national programme at Thika.

Adoption of research results has been inadequately documented, but appears to have been moderately successful in certain cases of new varieties. For example, a recent survey suggested that up to 40% of bean production in the Kabale District of S.W. Uganda comes from the varieties k20 and Kabanima, released between 1968 and 1972.

Objectives and Organization of CIAT Bean Programme Activities in Africa

Guided by an initial meeting of national bean researchers held in Malawi in 1980, CIAT's Bean Programme aims to support national efforts particularly in the areas of genetic improvement, the development of more productive cropping systems and the training of staff.

Three separately funded regional bean programmes are implemented by CIAT in a manner that is intended to combine advantages of decentralisation (daily contact with a large number of national programmes and agroecological zones, and smaller groups of expatriates less likely to dominate national programme decisions) with those of centralisation (easier interdisciplinary teamwork and a critical mass). The distribution of regional staff is shown in Table 1; in each case, CIAT staff are assigned by agreement to work with a host national programme while retaining regional responsibilities which, in some cases, extend beyond the borders of a single subregion.

Table 1. Staffing and Location of CIAT Regional Bean Programmes

Sub-Region (Donor)	Position	Location
Great Lakes	Breeder/Coordinator	ISAR-Rubona Rwanda
(Swiss D.C.)	Cropping Systems Specialist/ Anthropologist	ISAR-Rubona Rwanda
	Pathologist	ISAR-Rubona Rwanda
	Cropping Systems Agronomist	ISAR-Rubona Rwanda
	Nutritionist	ISAR-Rubona Rwanda
Eastern Africa	Cropping Systems Agronomist/ Coordinator	IAR-Nazret/Debre Zeit Ethiopia
(USAID and CIDA)	Breeder/Pathologist (1)	NAP-Kawanda, Uganda
	Agronomist (1)	NAP-Kawanda, Uganda
	Economist (1)	TARO-Arusha, Tanzania
Southern Africa	Pathologist/Coordinator	TARO-Arusha, Tanzania
	Breeder	TARO-Arusha, Tanzania
(CIDA)	Cropping Systems Agronomist(1)	TARO-Arusha, Tanzania
	Entomologist (1)	TARO-Arusha, Tanzania
	Breeder (1)	Bunda, Malawi

(1) To be recruited in 1987

In order to encourage the strengthening of national programmes that are more likely to remain effective after the withdrawal of external support, CIAT's regional programmes usually do not run separate field trials. Instead, every effort is made to support national teams in conceptualising, planning and carrying out field research.

Organisation of Collaborative Research

As neighbouring countries often share similar agroecological zones and production constraints at the farm level, CIAT considers purposeful collaboration among national programmes towards solving common research problems to be a further potential of a regional programme. Not only are limited resources used more efficiently through concentration of effort by different national programmes upon complementary aspects of a problem shared by them, but also the planning and analytical abilities of national program scientists are enhanced through collaborative planning sessions and peer group review of research progress.

The role of the regional programme in these "network" activities is twofold. Firstly, the programme can catalyse collaboration among countries so that their understanding of shared problems and their rate of progress in exploiting research opportunities are greater than would be likely through national research conducted in isolation. Secondly, a regional programme should have the technical backup to be able to feed into national programmes the new germplasm, research methods and scientific documentation that is required and requested.

Each regional programme is monitored by a steering committee, which comprises the national bean research coordinators, the regional coordinator and a donor representative. Annual meetings of the steering committees select research priorities having regional importance, guide the implementation of regional activities in research, training and information exchange, and authorise the allocation of discretionary line items within regional budgets.

Technical meetings focussed on priority problems are proving their value in collating research results across countries and regions, in identifying the limits of present knowledge and in planning collaborative research. A meeting of entomologists and bean breeders, focussed on the beanfly (Ophiomya spp.), was held in 1986. This year's specialist meeting will focus on strategies for breeding for disease resistance in beans, and next year's meeting will discuss strategies for agronomic research.

Three kinds of collaborative research have been recognised by the regional steering committees, and are being supported technically and (in part) financially through the regional programmes:

1. Across-countries evaluation, e.g. the African Bean Yield and Adaptation Nursery (AFBYAN). This regional variety trial not only permits each national programme to evaluate promising or released varieties from other national programmes, but also enables the identification of homologous locations or agroecological zones for possible future transfer of varieties and research information.

2. Division of effort on a common research topic, e.g. regional strategy for beanfly research. National programmes vary in their present abilities to tackle the integrated control strategies of host-plant resistance breeding, ecological research leading to a degree of cultural and/or biological control and use of insecticide. Some specialisation of effort and pooling of results has been agreed among national programmes.

3. Regional leadership roles on selected priority topics, e.g. bean breeding

for disease resistances. National programmes are hard-pressed to devote adequate attention to all the important bean diseases, and ideal conditions for specific screening of germplasm are found only in certain locations. Within Eastern Africa, Uganda is taking a leadership role on ascochyta blight, while Ethiopia will do the same for bean rust. Key research techniques are being developed by the leading programme, which will proceed to conduct initial screening of germplasm to identify effective sources of resistance, and assist informally with training for other programmes. However, other interested national programmes are encouraged or assisted to conduct yield loss assessments and to use resistance sources in their own breeding programmes.

On-Farm Research

The past three years have been marked by a considerable improvement in understanding of farmers' constraints in bean production and of the types of innovation that show promise at the farm level. While the encouragement of on-farm research has received considerable attention from regional bean programmes and from CIAT scientists of all disciplines, the methods used have varied. The staffing and organisational structure of national research institutions, as well as the relative importance and complexity of bean production within local farming systems, have influenced the nature of CIAT's involvement in different countries.

For example, where farming systems research (FSR) teams have been developed in bean-producing areas, support has been offered as needed both to the FSR team and to its linkage with local commodity research programmes. Commodity researchers based on an experiment station generally need some personal experience of on-farm research if they are to appreciate and make use of information gathered by an FSR team. In the absence of a specific programme for FSR, commodity teams need to be able to diagnose farmers' requirements and to test their technology.

Diagnostic work in the Great lakes region has made extensive use of factorial trials conducted on farms to identify and rank specific constraints and interactions among them. Bean diseases have proven to be especially important, and breeding for resistance is receiving particular emphasis in national and collaborative research activities. Complementing the initial diagnosticresearch, intensive surveys of farmers' practices and decision-making on varietal mixtures(often comprising 10 to 20 grain types) have shown that the proportions of different components of a mixture are adjusted by the farmer according to expectations of growing conditions in the coming season and knowledge of varietal differences. Varieties that cook quickly are also preferred in areas where the firewood problem is acute. Further experiments are evaluating the yield-stabilising potential of traditional mixtures and are assisting the development of breeding strategies. Information that farmers in this region traditionally test newly acquired varieties in pure culture before mixing acceptable acquisitions will also affect extension techniques for varieties released by breeders.

Diagnosis of bean research needs in Ethiopia, by contrast, has relied heavily upon the results of general surveys of farming systems in selected areas, followed immediately by verification trials of promising new varieties. The latter type of trial provided additional opportunity to understand farmers' management practices related to the priority problem of weed control. While a shortage of labour at

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the annual peak of farm activities prevents hoeing of pulse crops, broadcast planting at a density higher than the recommended density appears to reduce crop loss to weeds. With this knowledge, extension recommendations for row planting have been modified and the possibility is being investigated for gaining some control of weeds through selection of a variety having a more vigorous growth habit.

The design of technology to resolve priority problems in bean production is demonstrating increasingly the value of collaborative research and information exchange. A case in point is the development of control of Beanfly, the principal insect pest of beans in Africa. A wide-ranging programme for insecticidal control in Zambia, conducted over the last few years, identified seed treatment with endosulfan as an effective and inexpensive means of control. On the basis of these experimental results, Rwanda has moved straight to on-farm testing of this seed treament, including an assessment of farmers' abilities and extension requirements related to the safe application of an insecticidal slurry.

The development of novel cropping systems also requires on-farm testing at a fairly early stage if the risk of rejection by farmers following a long development period is to be minimised. Within the Great lakes region the introduction of an agroforestry system that incorporates a change from bush beans to climbing beans is showing considerable promise. The increase in bean yield potential concommitant upon this varietal change is made possible only by the convenient production of stakes from associated shrub or tree species, while the erosion problem is expected to be lower in the new system.

Collaboration among International Centres

Insofar as activities of any international centre strengthen a particular national programme, associated programmes (e.g. on another crop at the same station) generally receive some indirect benefit. In this respect, activities supported by the various centres are complementary. CIMMYT's sustained support for regional training in on-farm research has influenced many programmes, and other centres are often able to provide followup support when it comes to the application of the concepts and methods learned in workshops.

However, the increasing number of regional programmes poses the risk of competing demands on national programme time and of duplication of effort in certain fields. Collaboration among regional programmes is probably an effecient aid to strengthening national programmes in the areas of agronomy, on-farm research in general, and in extension. In the area of crop varietal improvement many opportunities appear to exist for taking into account cropping system interactions, an approach exemplified by the Burundi Maize Programme's concern for varietal requirements imposed by double cropping with legumes (Zeigler, 1986).

Recent collaboration among centres in this region has included training for on-farm research (Rwanda/CIAT/CIMMYT), training of agronomists (Ethiopia/CIMMYT/CIAT/ILCA) and training of grain legume research technicians (SADCC/CIAT/IITA).

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Acknowledgements

For discussions and examples that have assisted the development of this paper, I am especially grateful to: Amare Abebe, Kidane Giorgis, Tilahun Mulatu, Teshome Regassa and the Institute of Agricultural Research, Ethiopia; P. Nyabyenda and the Institut des Sciences Agronomiques du Rwanda; and M. Dessert and J. Voss of the CIAT Great Lakes Bean Programme. However, the opinions expressed are my own and I remain responsible for any errors of fact of interpretation

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