

REVIEW OF THE AFRICAN BEAN NETWORK

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Background

Origin

The African Bean Network is formed from activities of three interlinked regional research programmes for the improvement of this agricultural commodity in Africa.

These programmes were developed to help implement priorities identified at a first meeting of bean researchers in Africa, held in Lilongwe in March, 1980. After some years of negotiation, it became apparent that no single donor was prepared to support the entire region of Eastern and Southern Africa. CIAT therefore sought to establish projects in geographical subregions, identifiable on agroecological and/or politico-economic grounds, for which funding could be found.

By 1983 CIAT was able to set up a regional programme for the Great Lakes region of Burundi, Rwanda and Zaire with Swiss support and coordinating centre in Rwanda. Towards the end of 1984, CIDA and USAID funds (through CDA) became available for establishing operations in the rest of Eastern Africa, including Kenya, Uganda, Ethiopia and Somalia. A coordination centre for Eastern Africa is now established in Ethiopia. Further funding from CIDA enabled CIAT to establish a third regional programme based in Arusha, Tanzania to serve the SADC countries, and a regional coordinator was posted there in July, 1986. Each of the three regional programmes is located, by agreement with the respective national research institution, with a national bean improvement programme. The Southern Africa programme is a joint programme with the Southern Africa Centre for Cooperation in Agricultural Research (SACCAR).

Bean Production in Africa

Production of common bean, *Phaseolus vulgaris* L., in Eastern, Central and Southern Africa is estimated to be between 2.0 and 2.5 million tons annually. 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 low, usually less than one tonne per hectare, and increases in production are being achieved primarily through expansion in the area cropped (CIAT, 1981).

Diseases and insects, low soil fertility and, in some areas, deficits in soil moisture form the principal natural constraints associated with the low average yields. Anthracnose (*Colletotrichum lindemuthianum*), bacterial blight (*Xanthomonas phaseoli*), angular leaf spot (*Isariopsis griseola*), bean common mosaic virus, and rust (*Uromyces phaseoli*) are the most important diseases across countries. The beanfly (*Ophiomyia* spp.) is the principal insect problem.

Although sources of genetic resistance to the above problems have been identified, they often occur in materials with grain types lacking consumer acceptance, or are in poorly adapted materials. For example, the most important released cultivar in Ethiopia, Mexican-142, is susceptible to most of the above pathogens. To reduce disease pressure, farmers in many countries plant at suboptimal densities and accept a lower potential yield by planting beans dangerously close to the next dry season.

The impact of bean improvement research has been mixed. The variety K20, released in Uganda in 1986, now comprises up to 40% of bean production in Kabale District of S.W. Uganda, according to a recent farmer survey. Not all varieties have proven so popular, although the factors determining adoption of bean technology are less well understood than for principal cereal crops.

Large red, mottled or speckled seed types are preferred in many areas, but seed colour preferences seem less stringent than in Latin America. Short cooking time is very important where, as in Rwanda, the firewood problem is acute. Beans, being slower to cook than most other common food stuffs in the diet, largely determine the amount of firewood used (CIAT, 1986b). Taste is also important in helping to determine acceptance of a new variety, although, here too, generalization is difficult: a commercially non-preferred, small grained variety was found to be popular with the poorest sector of the rural population of Kirinyaga in Kenya, because seed for planting was less expensive (Frauzel, 1983).

National research programmes on beans tend to be stronger in Eastern Africa than elsewhere. Access to, and the utilisation of, new germplasm has been uneven within the region. Opportunities for exchange of research methodologies, germplasm and other results among national bean

programmes have been lacking in general until recently. A questionnaire survey of bean researchers in Africa in 1985 identified also a critical need for improved access to information and documentation. One bright spot was the emergence in 1983 of the Phaseolus Bean Newsletter for Eastern Africa, compiled and published by Kenya's national programme at Thika.

More recent meetings of national bean research coordinators have emphasised two particular needs: training of research staff, both graduates and technical assistants; and infrastructural limitations to the effective deployment of the available research manpower, especially in the areas of seed storage, transport for on-farm research and field equipment not available for local purchases.

### Objectives

The objectives of the African bean networks are to support national efforts:

1. To increase the productivity and production of food beans by breeding and selecting higher yielding genotypes identified from among a more diverse germplasm base. Such cultivars are selected for yield stability, relying on resistance to biotic and abiotic stresses, and for consumer acceptability.
2. To develop more productive systems of cropping, utilizing promising new cultivars and varietal mixtures when appropriate, while ensuring that innovations of cropping systems and cultivar remain acceptable to producers and consumers and do not disrupt existing farming systems adversely.
3. To assist strengthening of national research programmes, to a degree that is both appropriate and sustainable nationally, through giving substantial emphasis to training. Opportunities are offered for postgraduate study at universities within or outside the region, with thesis research often being conducted with CIAT programmes. Short-time training is provided within Africa and outside the region. On-the-job training for Objectives 1 and 2 is an important role for regional staff who are attached to regional networks and who together cover a range of disciplines.

## Organisation and Operation

### General Model and Membership

The general operation of the African Bean Network may be illustrated by a series of interacting wheel rims (Figure 1). The first-order rim is pan-African; second-order rims are regional; and third-order rims are encouraged to develop at the national level whenever several institutions share responsibility for bean research (e.g universities and parastatal research organisations operating in different ecological zones within a large country).

Direct cross-linkages between two or more member countries facilitate concentration of limited research resources and opportunities upon a specific, shared problem.

All countries within a region are eligible for membership if they so desire, although their levels of participation vary with interest and the importance of the crop. Beans are scarcely grown in Botswana, which has indicated an intention to withdraw progressively from the Southern Africa network as a proposed regional cowpea network is developed by IITA. On the other hand, bean-producing countries at the periphery of present regional networks, such as Madagascar, have requested to participate in some activities and are being incorporated gradually.

### Coordination Mechanism

The management of each regional programme is guided by a Steering Committee, which includes the coordinator of each national programme in the region and CIAT's regional coordinator. A representative of SACCAR is also a member of the Southern Africa steering committee, and donor representation on committees is common. Meeting venues rotate among countries, and each national coordinator serves as chairman for one complete year, and is available for consultation with the regional coordinator.

The specific functions of the steering committee are:

1. To consider an annual workplan for the region;
2. To approve and monitor regional research;
3. To approve the use of regional budgets for:
  - collaborative research projects
  - workshops and visits
  - training
  - equipment for national programmes;
4. To advise on consultancy visits.

Regional research is conducted through national programmes. Scientific staff of the regional programmes are attached to four national programmes in Africa (Ethiopia, Rwanda, Tanzania and Uganda), where much of the preliminary research is conducted. However, each regional scientist retains regional responsibilities in his/her discipline for working with national programmes outside the base country. Field research of an agreed regional importance that is conducted by regional staff normally passes through the review process of one or more national programmes, so that most regional trials or studies are integrated, rather than standing alone as "CIAT" activities. The strategy strengthens the points along the wheel rim.

Funding for the regional programmes and network activities are provided to CIAT by the Swiss Development Cooperation (for the Great Lakes region), by the Canadian International Development Agency (CIDA) for Southern Africa, and by CIDA and USAID jointly for Eastern Africa. Certain budget line items in each project are specifically managed by the steering committee. Contributions of national programmes to regional research vary according to local circumstances, from provision of local scientists' time and research facilities to almost complete funding for

local currency costs of regional research. Foreign currency requirements for small equipment and training are generally the most difficult to meet without external support.

CIAT's inputs include germplasm, research methods, some consultancy visits from headquarters on its core budget (some are also met from special project funds), literature and assistance in producing a French language edition of Kenya's newsletter. Consultants hired from the region or elsewhere are being considered currently in order to carry out specific assignments, such as assembling and interpreting base-line data on soil fertility and production/marketing statistics.

### Collaborative Research

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.

As neighbouring countries often share similar agroecological zones and production constraints at the farm level, the encouragement of purposeful collaboration among national programmes towards solving common research problems is a further potential of a regional network. Limited resources are used more efficiently through concentration of effort by different national programmes upon complementary aspects. The planning and analytical abilities of national programme scientists are enhanced through collaborative planning sessions and peer group review of research progress.

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

- Across-countries evaluation, e.g. the African Bean Yield and Adaption 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 future transfer of varieties and research information.
- Division of effort on a common research topic, e.g. regional strategy for beanfly research. National programmes vary in their present abilities to tackle integrated control through host-plant resistance breeding, ecological research for cultural and/or biological control, and use of insecticide. Some specialisation of effort and pooling of results has been agreed among national programmes.
- Regional leadership roles on selected priority topics, e.g. bean breeding for disease resistance. 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 in ascochyta blight, while Ethiopia is

doing the same for bean rust. Key research techniques are developed or tested by the leading programme, which conducts initial screening of germplasm to identify effective sources of resistance, and will assist in training other programmes. Other interested national programmes are encouraged or assisted to conduct yield loss assessments and to use resistance sources in their own breeding efforts.

### Linkage Mechanisms

#### Africa-Wide Strategic Workshops:

A workshop on beanfly was organised in Tanzania in November 1986. This workshop united bean entomologists and others from Africa and elsewhere to assess the state of knowledge concerning the principal insect pest of this crop in Africa, and to design a strategy for collaborative research leading to its control. Participants were invited for their experience and research interest rather than to represent a particular country or institution. The proceedings of the workshop are expected to serve several purposes, including training in species identification and for planning research strategies.

A second workshop in this series, on the topic of bean diseases, was held in Rwanda in November, 1987 under the auspices of the Great Lakes bean program. A third workshop, dealing with issues in agronomy, is planned for 1988, and the 1989 meeting will focuss upon bean breeding needs, strategies and methods.

#### Multidisciplinary Regional Workshops:

A regional workshop for scientists working on beans in Eastern Africa was held in June, 1987, and will be repeated after two years. A similar francophone workshop is held for the Great Lakes region annually. Researchers from all member countries are invited, and about 35 usually attend in each region.

#### Monitoring Tours:

Three members of the Uganda programme made visits to the Rwanda programme to take advantage of the similarity in environmental conditions between the two countries. Germplasm was selected in the field and approaches to varietal improvement and on-farm research were discussed. Selected germplasm was sent to Uganda after harvest. Other tours focus on collaborative research projects undertaken by national programme scientists on behalf of a region. Some tours also serve a formal or informal training function.

Regional visits by small groups of scientists working on related aspects of a single problem are to receive particular attention.

#### Travel by Regional Staff:

Extensive travel by regional staff, both within the host country and elsewhere in the region, serve many functions including research, assistance in planning new activities, coordination and training. Travel

across regional boundaries within Africa, both by regional staff and by national scientists, is often necessary to treat adequately certain widespread problems and particularly to ensure coverage by disciplines in crop protection, nutrition, and social science.

#### Bean Information Services:

CIAT operates a Bean Information Centre at its headquarters, utilising core funding and special project funds from IDRC. In addition to publishing Abstracts on Field Beans, the centre has compiled and distributed three bibliographies on bean research in Africa (Lopez 1983; CIAT 1984; CIAT 1986a). The most recent volume includes "fugitive" literature obtained by means of personal visits by a consultant to bean researchers throughout the region.

A free monthly service provides researchers and libraries with current contents lists for a wide range of agricultural journals, and regional coordinators update mailing lists and distribute coupons for purchase of photocopies. Regional publishing opportunities are offered by the Phaseolus Beans Newsletter for Eastern Africa, edited and produced at low cost by the Kenya national programme. A French language version is also produced, with assistance from CIAT's communications section.

#### Germplasm Exchange:

Beans have been much less researched in Africa than the major cereal crops, and centres of genetic diversity are in Latin America. Consequently, the majority of recent promising introductions have come from outside Africa. Regional scientists facilitate access to appropriate germplasm and work with each country to assist its utilisation. The network may be useful later in across-country interpretations.

A short term approach to identifying some new varieties to revitalise extension programmes is also being used successfully. A regional variety trial series allows national programmes to evaluate each other's released or promising material. Direct bilateral introductions or exchanges between neighbours that share agroecological conditions have also been useful, as in Uganda, to increase quickly the genetic base for selection. Increasingly, steering committees expect scientists responsible for disease-related collaborative research projects to assemble regional nurseries that enable other member countries to benefit from preliminary results in the lead country.

#### Output

A principal technical output from networking activities so far is the identification of new varieties. The first on-farm trials of bean varieties in Uganda, an activity that started only in 1987, included entries received through the African Bean Yield and Adaptation Nursery and which had been contributed to that nursery by Rwanda and Zambia.

An example of benefits arising from regional dissemination of other

types of research information is the progress being made in beanfly control. As very little research had been conducted on this pest prior to 1982, Zambia started with an insecticides trial. Future developments built on this experience and avoided duplication of work across countries, as follows:

#### Chemical Control:

- Zambia 1984-85 insecticides trials identified endosulfan as seed dressing
- Rwanda 1984-85 exploratory trials indicated beanfly a priority problem
- Tanzania 1986 strategic workshop on bean fly
- Burundi 1986-87 optimum rate for endosulfan identified as being 2-3 g/kg
- Rwanda 1987 on-farm verification of seed dressing, based on research station results from above countries
- Burundi 1987 extension bulletin produced (to guide safe use of new recommendation) and to be made available to other countries

Introduction of seed dressing at low rates of chemical in several countries has gained time for the development of more sustainable technology. The following two areas of research are now in progress on a cooperative basis, and hold out prospects for pest management adapted to the ecology of the pest in different agroecological zones:

#### Crop Genetic Resistance:

- CIAT 1985 bean fly resistance nursery assembled  
1986 evaluated in 4 countries in Africa
- Burundi 1987 identified resistant lines in regional nursery
- Ethiopia 1987 screened 300 CIAT lines
- SADCC/CIAT Tanzania 1988 taking responsibility for organizing Bean Fly Resistance Nursery

#### Agronomic & Ecological Studies:

- PhD thesis at 2 locations in Ethiopia 1987-88
- MSc thesis at 3 locations in Tanzania 1988

### Effectiveness of the Network

National programmes look to the network as sources of preadapted technology, for using research resources more efficiently, and for means of strengthening research capacity. CIAT and the donors have similar objectives. On-farm research has received considerable attention and is showing results. Additionally, CIAT believes in modest decentralisation of research to appropriate environments and in the utility of peer group example and critique in improving national programmes performance.

Results so far support these objectives and methods. However, it is often difficult to separate network effects from those of increased financial support (for equipment, training and, to a lesser extent, for operational expenses) which well-funded regional programmes can bring

indirectly to national programmes. Guidance in research priorities and use of network funds by strong steering committees, and integration of regional research into national programmes whenever possible, are felt to minimise risks of distorting national priorities and of increasing the likelihood of long-term benefits to national programs.

The flexibility offered by the collaborative research mode also contributes in this regard. For example, Somalia produces few beans but has a very serious storage problem affecting all grain legume crops; being relatively strong in the field of entomology, Somalia has taken responsibility for bruchid research but has relatively little involvement in many other areas of network activity. Collaborative research of this type can only be fully effective because adequate funds are available from donors for visits of various types, and in many cases also for specialised short-term training.

In the Great Lakes and much of Southern Africa except Tanzania, the present acute shortage of well trained scientists will severely limit the sustainability of networks as well as their short-term performance, unless support is also available for considerable long-term post-graduate training. Although some funds are already provided for this purpose, it appears to be an area that donors do not always associate with network development.

Indicators of network progress include an awareness on the part of researchers that research in neighbouring countries can be complementary. Awareness should be accompanied by evidence that researchers are prepared to accelerate or miss out a step in the development of a technology, where relevant results are available and communicated from another institution or country. That bean steering committees are composed of active researchers rather than administrators, is an advantage in developing this complementarity. On the other hand, it imposes a greater burden upon national and regional coordinators to convince directors of NARS that real efficiencies are being gained from cooperation, increased travel, and so on.

The effects of peer group evaluation of collaborative research is also a useful indicator. Offering constructive criticism and acting upon it require not only individual maturity but also the development of mutual respect and the familiarity that comes from repeated contact through network activities. Within the Eastern Africa steering committee, national coordinators now show no hesitation in rejecting research proposals that do not meet regional priorities, in returning some proposals for improvement in specified areas, and in stating their expectations of regional activities/benefits (e.g. a new regional nursery) from an activity that may have started out with all work concentrated in the researcher's home base.

## Future Direction

While most interaction has taken place within regional subgroupings, a gradual increase in contacts across Africa is being encouraged wherever priorities and interests overlap. Increasing use will be made of research persons from within the network for training and consultancy work, and the network would like to make more specific use of local newsletters and journals (from Kenya, SACCAR, etc) for announcements and technical communications.

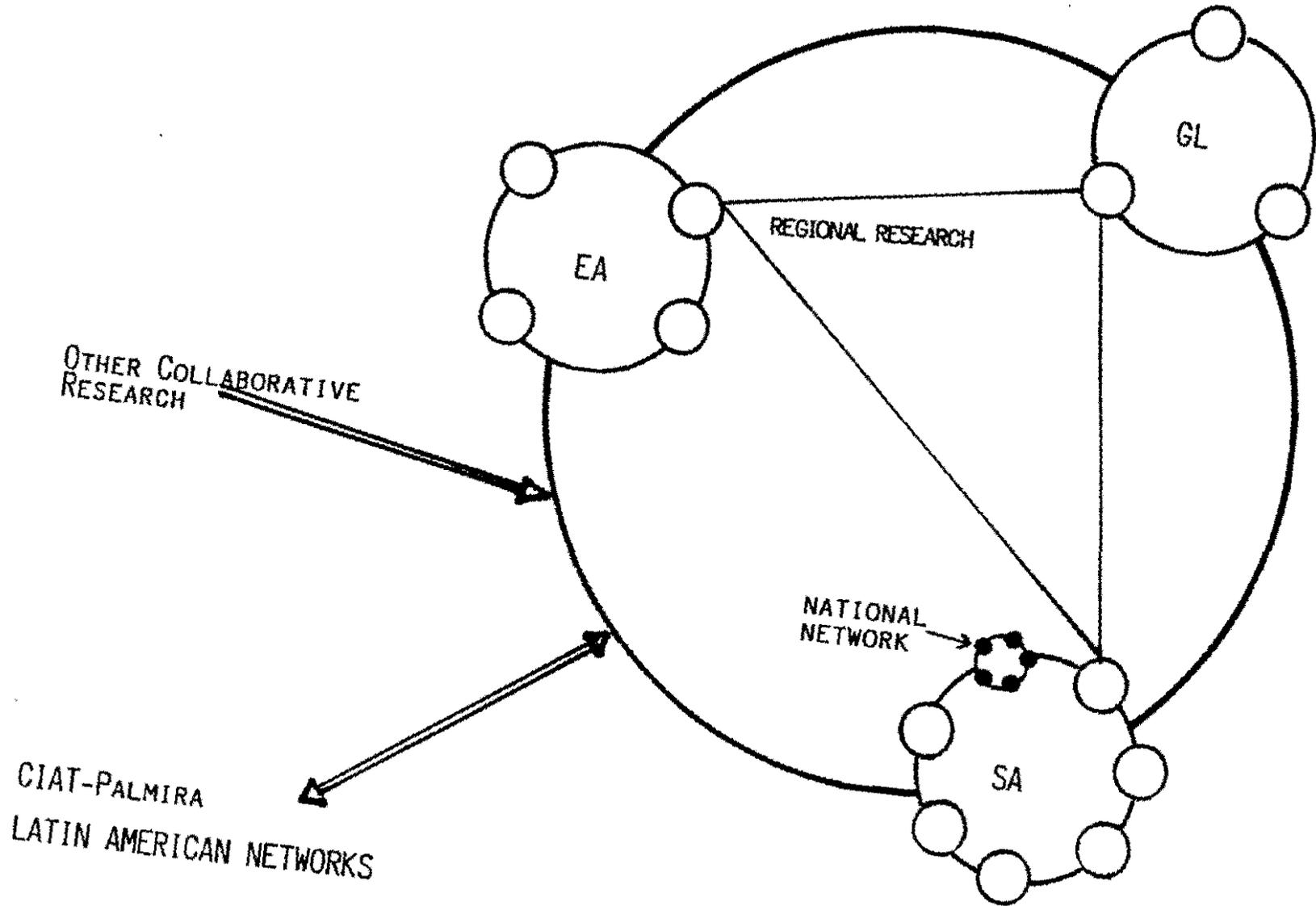
Training will continue to be a very active function of the regional programmes, and will become more specialised as basic research techniques improve. Evaluation of training effectiveness may become a new network activity.

The main lines of cooperation are expected to remain appropriate for at least the next five years, and probably much longer in regions having less well developed national programmes. Experience with Latin American bean networks suggests that the network should pass increasingly to local management and staffing. In the meantime, some direct interaction among African and Latin American networks will be encouraged.

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FIGURE 1. AFRICA BEAN NETWORK



EA: EASTERN AFRICA REGION  
GL: GREAT LAKES REGION  
SA: SOUTHERN AFRICA (SADCC) REGION