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BIANNUAL PROJECT STATUS REPORT

EASTERN AFRICAN BEAN PROGRAM
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Presented by the
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Despite the problems during the initial takeoff period, it has been possible to obtain basic background information on bean production in the region, important production constraints, characteristics of the national bean research programs, their experiment stations, and staffing. This information is provided herein. More importantly, good contacts have been made with the national programs by the Project Leader/Pathologist and by the Breeder, as well as by the person sent to survey bean researchers in Africa (she could not conduct survey in Kenya). Moreover, there are now several CIAT trainees working in bean research who are valuable collaborators in the region.

General Background Data on Bean Production in Region

Kenya

Beans are planted on more than 760,000 ha, mostly in the Eastern (37%), Central (30%), and Western (19%) provinces. Yields average 750 kg/ha for monocropping and 375 kg/ha for associated cropping (mostly with maize); total production is about 475,000 t. Production has been mainly at subsistence level.

Beans are grown in three climatic zones of different ecological potential: (a) the humid to dry subhumid equatorial zone, 1500-2500 masl, annual rainfall, 1000-1250 mm (Kisii and Kakamega Research Stations); (b) the dry submid to semiarid zones with no forest potential, 1500-2500 masl, annual rainfall 750-1000 mm (Embu and Thika Research Stations); and (c) semiarid zones with marginal agricultural potential, 1500-2500 masl, annual rainfall, 500-750 mm. The long rains this semester were abundant after the last years of drought. Beans were planted everywhere, including along the roadsides and road-dividing strips, especially around Embu.

Although beans are grown mainly for the seeds, fresh leaves are eaten as vegetables. Freshly harvested seeds are preferred for cooking. The most commonly grown seed types are the Rose Cocos, Canadian Wonders, Red Haricots and Mwezi Moja. Beans are generally marketed through the local outdoor market for home consumption or through the National Cereals and Produce Board as beans are a scheduled crop covered by the Produce Marketing Act, which subjects produce to movement restrictions (surplus must be sold to the Board) and price controls. As no overall surpluses exist, export of food beans is insignificant. Only snap beans (Monel, black seed; Verdun, white) are being grown for export to Europe, both fresh and canned.

Important production constraints include beanflies; diseases such as anthracnose, angular leaf spot and rust; nematodes; and low soil fertility.

Uganda

Total production in 1977 was estimated at 252,500 t on 338,300 ha. It is difficult to estimate production because of (a) considerable yield fluctuations and (b) farmers harvest several times from the same plot to consume

fresh seeds, leaving the rest to dry. Average yields are estimated at 560 kg/ha for monoculture; 390-450 kg/ha for mixed stands.

Around Kabale (Rukiga and Ndorwa counties), the cv. Rushari, a large purple-seeded bush type, is popular. Bush types are grown as 3-4 component mixtures. Climbers predominate near Kisoro, partly because of the greater availability of staking material (bamboo forests) and partly because of local preferences. Climbers are seldom more than two component mixtures, the predominant variety being black/white striped.

Marketing of beans is primarily in pure form. The main seed types are navy, Kanyebwa (pink mottled), Kainja (Red Haricot), and a mixture (including a Canario, Mwezi Moja and K20). Kamprike (small, round, pale purple type from Toro) was also available at a higher price than the others. There was also a coffee-colored Kamporike, preferred for its flavor although K20 (less expensive) sells most. Navy beans are sold chiefly to hotels and are not exported.

Important production constraints include diseases [e.g., anthracnose, angular leaf spot (ALS), and Ascochyta blight] and availability of soil phosphorus.

Ethiopia

The government's ten-year plan emphasizes achieving self-sufficiency in food production. An expansion in pulses is projected, with more emphasis on food beans than navy beans for export.

There are several agroecological zones appropriate for growing beans: (a) the highlands with red and black soils (2400 m); (b) the Rift Valley (1550-1650 m); and (c) the red soils in lower altitudes (1600-1800 m) with high-humidity areas (2500 mm rainfall).

Production constrains include beanflies and *Heliothis*, storage pests, diseases such as Bean Common Mosaic Virus (BCMV), rust, *Phoma* blight, anthracnose and ALS.

Somalia

Research that has been done is not well documented, and there is no central repository of data. Soil maps and meteorological data appear unavailable. Animal production is of primary importance, but crops do have a role in farming systems as the Somalis are in the process of accepting settled agriculture in the face of pressure to relinquish nomadism. The nitrogen-fixing role of legumes may be particularly important. Beans are probably minor, but production estimates are available only for sorghum, maize and rice. There is some interest in soybeans for oil.

The Director of the Institute of Agricultural Research at the Ministry of Agriculture reported that cowpeas and mung beans are by far the most important grain legumes, especially in the riverine areas, which are tsetse-infested so that cattle are in short supply. Neither beans nor pigeon peas have any traditional place in Somali diets. Navy beans (introduced by the Italians) are grown on a small scale under irrigation in the central part of

the country, between the rivers Jubba and Shabelle. Beans may have potential in the north, near Borama, where the land is higher (over 200 masl) and there are pockets of montane forest. Communications to this area are extremely poor.

A World Bank agricultural sector survey is being conducted by a team of expatriates. Preliminary data suggest that production of grain legumes has increased somewhat in the 1980s as a result of area expansion (27,000-32,000 ha), only 5 to 10% of which would be Phaseolus vulgaris. Production is estimated at 15,000 t (no more than 1,000 t probably refers to P. vulgaris). It would appear there is potential for legumes (particularly soybeans and cowpeas adapted to the tropics) in rotation with rice (on irrigation projects). Beans have limited potential as a rainfed food crop. The Mogambo Irrigation Project (German and Kuwaiti support) can handle screening of introductions. Snap beans would not fit this role because of the lack of marketing and storage infrastructure.

Potential production constraints include drought, thrips, leafhoppers and powdery mildew.

Profile of the National Bean Programs

Kenya

Research Stations

1. National Horticultural Research Station, Thika, Central Province (1548 masl, 875 mm rainfall), the base of the Grain Legume Project (GLP), was set up by Dutch bilateral funding and supported by them for about a decade. The GLP has access to 14.5 ha, of which 3 ha are irrigable.

   Staffing comprises one breeder, three agronomists, one economist, two pathologists, one storage entomologist and one nematologist (MSc); three technical officers (TOs) and four technical assistants (TAs). Six of the scientists are presently studying toward a MSc in Nairobi; four of the staff are CIAT trainees including the farm manager.

   A nonresidential Training Unit (capacity for 50-60 trainees) has recently been opened; eventually a hostel is planned. Equipment is lacking.

2. National Agricultural Laboratories, Nairobi. Base of one GLP pathologist.

3. Embu Agricultural Research Station, Embu, Eastern Province (1494 masl, 1081 mm rainfall). Beans normally produced in the short rains rather than in the long rains because of fewer field problems and seeds can mature into the dry season. Beans are generally sown randomly between rows of hybrid maize, which is fertilized. It is thought that beans do not benefit from fertilizer because of its immobility in soil. CIMMYT is making extensive use of this site.

Two agronomists (1 MSc), one TO and one TA are based in this important bean-growing area.

A major production constraint is the beanfly.

4. Mwea-Tebere Agricultural Research Station, Kerugoya, Central Province (1159 masl, 800 mm rainfall). The national cotton research station possesses considerable irrigable land, divided into small panels (0.3-0.5 ha) used by the GLP for seed multiplication. Neighboring land is held by the Irrigation Board, which provides land, seed and inputs for local farmers who provide the labor for bean seed production.

   No staff are placed at this station, the principal bean seed production site.

   A major constraint is root-knot nematodes, when beans are rotated with tobacco. Bananas may also harbor Meloidogyne, which could have implications for the bean/banana associations common in Uganda and the Great Lakes.

5. National Dryland Farming Research Station, Katumani, Eastern Province (1575 masl, 718 mm rainfall), site CRSP project on beans (Univ. of Nairobi and California). Good site for drought resistance studies. CRSP is active here, and CIAT would interact with them.

   There is one TA based here.

6. Nyanza Agricultural Station, Kisii, Nyanza Province (1800 masl, 1900 mm rainfall). Cool, wet area with N-rich soils, and disease-resistance work should be important here.

   One TO and one TA are stationed here.

7. Western Agricultural Research Station, Kakamega, Western Province (1585 masl, 1935 mm rainfall). About 100,000 ha are planted to maize; about one-third of this area is intercropped with mixtures of local bean cultivars, most of which are landraces. Local scientists feel that beans should be treated as an integral part of their maize/bean intercropping system rather than as a monoculture, which is not the prevalent system. Farmers are willing to accept new varieties proven better than existing mixtures.

   Only one TA is based at this important site.

8. Alupe Research Substation, Busia, Western Province (1189 masl, 1741 mm rainfall), important sugarcane and cotton region.

   One TA is based at this minor station.

9. International Council for Research in Agro-Forestry (ICRAF) Field Station, Maruba Seed Farm, Machakos. Emphasis is on demonstration trials, not research. Anthracnose causes heavy damage to local Red Haricot type. Ally cropping of food crops (maize and/or beans) is being tried in association with a wide range of tree species.

The Director of the National Horticultural Research Station is enthusiastic about the project's development thus far and is fully supportive of the recommendation to decentralize research on a few stations (i.e., Thika, Embu, Katumani, Kakamega) and to establish a general research budget to be managed by Mr. Kanyagia, the Coordinator of the GLP.

Germplasm

The GLP's gene bank holds 1680 P. vulgaris accessions, 37% of which are of Kenyan origin and 30% from Colombia (CIAT). Of 997 accessions of local food beans, two-thirds belonged to one of four seed types: Rose Coco (red flecks on cream background, 36.5%), Canadian Wonder (13.1%), Red Haricot (9.2%) and Mwezi Moja ("one-month" type, 9.0%). There is considerable variation within these groups, indicating flexibility in market preference. Monel is the principal snap bean cultivar.

Long-term storage of germplasm is done in a chest freezer in the field lab. A working collection of the germplasm, as well as of breeder seed and selections, is maintained in wooden boxes and sacks on duckboard at ambient temperature in the gene bank at the "Old Station." Although insect control seems satisfactory, proper cold storage would be preferable as rejuvenation is presently required every third year. Plans are for duplicating the collection at a centralized national gene bank at Muguga, using IBPGR support.

Ongoing Research

Germplasm is being screened for resistance to BCMV and beanfly at Thika; 18 lines are being evaluated for drought tolerance at Katumani and at Mutumu (a hotter, drier site). In the National Bean Performance Trials, performance of 11 promising materials is being compared with one recommended cultivar in a split-plot design with four replications, in monoculture and in association with maize. A standard fertilizer application (200 kg/ha of diammonium phosphate) is being used across locations, but the incorporation of two levels of management among the treatments is being contemplated.

Thus far, the GLP has released three cultivars:

1. GLP-2 (= K 20 from Uganda, a selection among progeny from cross using Banja 2 = used as NB 510 by the CRSP in Kenya), a Rose Coco type recommended for higher rainfall areas.

2. GLP-24 (Kenya), Canadian Wonder type recommended for medium rainfall areas, specifically for sowing during Long Rains (March) in the Central Province (1230-1850 masl) and for the Short Rains (July) in Western and Rift Valley provinces (2000 masl).

3. GKP-1004 (= Katumani Local = ? Kablanketi type in Tanzania), a Mwezi Moja early-maturing type with finely speckled pinkish purple on a cream--colored background recommended for drier areas at less than 1550 masl.

Another six materials are being considered for release, including a Pinto type with resistance to halo blight (GLP-X 92), a Rose Coco (GLP-77) with resistance to angular leaf spot, a Red Haricot (GLP-585) with BCMV resistance and a Mwezi Moja (GLP-X 1127), with combined resistance to BCMV, anthracnose and halo blight.

Table 1 shows the crossing blocks, segregating populations and advanced lines as well as the VEF, EP and IBYAN trials that the CIAT Bean Program has shipped to Kenya in 1984 and 1985.

With regard to cultural practices, the effect of maize spacing on bean performance is being studied at Embu, and there are intercropping trials with maize, beans and soybeans at Kisii. The effects of use of fertilizer and organic manure and the economics of their use are being studied in a series of trials with 14 treatments, 3 replications in a randomized block design. The efficiency of six hand-weeding implements (panga, hoe, Dutch hoe, spike weeder, hand weeder and fork jembe) in controlling weeds in a maize/bean intercop is being evaluated at Thika. Methods of weed control (hand weeding vs. varying rates of alachlor) are being studied at three sites, but no account has been taken of differences in predominant weed species across sites.

Quarantine Station

Dr. D. M. Okioga was invited to visit CIAT headquarters at the end of June to discuss quarantine concerns. The main areas of concern are viruses (BYMV, BSMV, BMMV) and bacterial diseases (CBB, HB). Okioga was pleased to learn that Cornyebacterium flaccumfaciens is not present in Colombia. The fungal disease complex in Latin America is the same as in Kenya. He also appreciated CIAT's care in producing and shipping seed. Seed is being produced at a dry location in Colombia (Vijes) for commercial purposes and for segregating populations. The seed is then sampled by the Seed Health Lab (managed independently by the Germplasm Research Unit) and examined for the presence of viruses (using ELISA), bacteria and fungi.

Okioga will recommend to the Director of Research that a sampling system be adopted for CIAT bean materials in lieu of existing procedures, which prevent the direct release of introduced seeds. He also gave four additional provises to CIAT's standard plant health statement (see attached report, Appendix 1).

In order to assist in moving the large volume of CIAT materials through quarantine, Okioga requested (a) antisera of BSMV and BYMV; (b) training for a seed technologist and for a Research Officer (Virologist); (c) funds for mesh and supports for screenhouse, pots, pesticides; and (d) funds for 4 casual laborers to grow out CIAT seeds presently in quarantine procedure.

He was extremely interested in strengthening collaboration in pathology, especially in the identification and control of bean diseases.

Table 1. Bean shipments made to East Africa by CIAT's Bean Program.

Year	Shipments	Countries			
		Uganda	Kenya	Tanzania	Ethiopia
1983	Crossing Block			133	163
1984	Crossing Block	252	155	7	
	Segregating Pop.			517	
1985	Segregating Pop.	250	216	260	
	Advanced Lines		51	180	

Year	Country	VEF, EP & IBYAN Shipments[a]
1984	Uganda	IBYAN 45925, 25945A, 258408, 258409, 258410, 258411, VEF 84 Groups 25, 40, 50, 70
	Kenya	IBYAN 258407, 508403, VEF 84 Groups 25, 40, 50, 70
	Tanzania	IBYAN 25944A and 45924
1985	Uganda	IBYAN 258536D, 258529C
	Kenya	VEF 85 Group 30, EP 85, 38 lines from Group 30
	Tanzania	VEF 85 Group 50
	Ethiopia	VEF 85 Groups 25, 30, 35, 40, 45, 50

[a] VEF = Bean Team Nursery (first stage progeny evaluation); EP = Preliminary Yield Trial (second stage); and IBYAN = International Bean Yield and Adaptation Nursery (third stage)

Production Constraints

One of the major problems is soil fertility. Diseases are of less importance, except in western Kenya; however, a more systematic effort of screening for diseases is required. Beanflies are a serious problem, but no active breeding for resistance is being done as of yet. Beanfly-like symptoms have also found, but caused by galls of the striped bean weevil (Alcidodes leucogramma) at the root base. Nematodes (Melodoigne javanica, 95%; M. incognita, 5%) are an important problem for snap beans; at present farmers are using Furadan to control them.

Plant quarantine regulations will make it very difficult to include Kenya in a collaborative network in Africa. Serious efforts must be made to arrive at a means of introducing seed rapidly while meeting plant quarantine requirements.

Uganda

Research Stations

1. Kawanda Research Station. The farm has 620 ha, of which 80 are under cultivation. The station is well staffed with more than 60 graduate staff (3 PhD's, 25 MSc's). There are four substations including Buginyanya and Kalyengyere, each with a graduate officer in charge. There are more than 50 Variety Trial Centres although not in good condition. Soils have become excessively acid (pH less than 4.5) so most bean trials are being conducted at Bukalasa Experimental Farm, 30 km north of Kawanda. Lack of transport and insecurity have limited the efficiency of this work.

   Despite many difficulties, the courage and tenacity of the staff is outstanding, and morale is high. A former CIAT trainee (Mrs. Theresa Sengooba) is head of the bean program. There are two breeders, one responsible for evaluating CIAT introductions, focussing on rust and CBB; and one focussing on navy beans, nodulation, and resistance to anthracnose and Ascochyta blight.

Research Activities

Evaluation of the International Bean Yield Nursery (IBYANs) entries (see Table 1) at Bukalasa has shown that many of the red-mottled types introduced from Latin America are doing well, but harvesting has been made difficult by transportation problems.

Production/Research Constraints

1. Distribution and importance of bean diseases in Kigezi in 1985 is shown in Table 2. Farmers generally complain of disease problems more frequently in bush types.

Table 2. Distribution and importance (scale of 1-9) of bean diseases, Kigezi, Uganda, May 1985.

County	Site	Altitude (m)	ANTH	ALS	ASCO	RUST	FLS	WB	HB	CBB	BCMV	BF
Ndorwa	Kamuganguzi (S. Kabale)	1900	3	5	1	3	3	1	1	1	3?	1
Rubanda	Kachwekano	2150	3	2	5	3	3	1	7	1	1	3
	Kyabahinga (lakeshore below Kachwekano)	1920	4	7	4	1	3	1	1	1	1	1
	Kabere	2160	9	3	3	1	1	1	3	2	1	7
Kinkizi	Mateere (S. Kanungu)	1600	3	5	3	4	7	2	1	2	2	1
	Burema	1360	1	5	1	1	7	1	1	1	1	1
	Kihihi (S.E. Ishasha)	1200	1	3	1	1	3	1	1	1	1	1
Rukiga	Nyakisoroza	1800	1	3	3	1	1	1	1	2	1	1
Bufumbira	Kanaba Gap	2150	6	2	7	3	2	1	5	1	3	1
	Nyagatembe	1970	3	7	4	3	3	1	1	1	1	1
	Nyakisenyi	1960	3	7	7	3	1	1	1	1	1	1

ANTH = Anthracnose
ALS = Angular Leaf Spot
ASCO = Aschochyta Blight
BCMV = Bean Common Mosaic Virus
BF = Beanfly Damage
CBB = Common Bacterial Blight
FLS = Floury Leaf Spot
HB = Halo Blight
WB = Web Blight

2. The major limiting nutrient in soils around Kampala is probably phosphate as the soil phosporus is fixed rapidly. The project has supplied them with a consignment of agricultural lime to encourage field work at Kawanda and obviate the need for working at Bukalasa (more transportation and fuel costs).

3. The program needs support in breeding, but some crossing is more usefully done by local breeders because of the training value in doing so.

4. Transportation and fuel costs make it impossible to carry out field experiments off the station.

5. There is no economist on the bean team, which is otherwise fairly strong. There is a need to reorient agronomic research to on-farm trials. Someone needs to be trained in this area in the region once resources become available.

6. The station is isolated professionally, the library inadequate, and the national budget limited (several of the team have been using their own money to get work done, but incentives to do so have been lessened because refunding is too slow).

Ethiopia

Research Stations

1. Institute of Agricultural Research (IAR), Headquarters. IAR foresees the need to identify key production problems and to become better acquainted with existing farming systems in order to use farmers' knowledge more effectively. A farming systems team has already been established and will eventually be supported by a research-extension linkage program.

2. IAR, Nazret Research Station, Melkassa (1580 masl, 800 mm rainfall). There are 200 ha (80 ha irrigable--furrow irrigation) of flat land (rift valley floor), and the soil appears fertile. The main season begins in July.

   The Lowland Pulse Research Team is based here, focusing on beans, soybeans and cowpeas, with lesser emphasis given to pigeon peas, mung beans, tepary and lima beans. These are comparatively new crops in the country, relative to the highland pulses (faba beans, peas, chickpeas and lentils), which are more important.

   The team has four MSc scientists in microbiology, entomology, pathology and breeding. One of the team is in the US getting a PhD. The team is supported by two part-time agronomists (PhD in physiology and a MSc in agronomy), an entomologist, a food scientist, and a weed scientist. The team is well motivated and carrying out extensive work on beans, over six sites.

The team has established a sequence of trials, starting with a Nursery I (this season, CIAT's crossing block of 152 entries, see Table 1), designed to multiply seed and make a preliminary evaluation of the entries' local adaptation. Selections become entries in Nursery 2, which this season comprises 177 entries of local/introduced materials. Nursery 2 is multilocation and is subdivided into white-seed entries, large-seeded kidney types, and medium-sized colored ones. Selections from Nursery 2 enter the Variety Trials, where 7 entries are evaluated at all Nursery 2 sites, as well as settlement schemes and state farms (10 locations). Variety Trials selections then proceed to the National Variety Trials, with 8 entries tested over 15 sites.

The Forage Legume Agronomy Group is interested in dual-purpose beans; e.g., leafy climbing types that can grow on acid soils. Adaptation to low temperatures may also prove important for the higher altitude agroecological zones.

There is interest in participating in the Regional Bean Cultivar Trials in collaboration with CIAT's Great Lakes Project. It was proposed that Black Dessie (with some combined disease resistance under local conditions) and Red Wolaïta (a Red Haricot) be the Ethiopian entries.

3. Plant Pathology Lab, Ambo. This well-equipped lab is autonomous but may eventually be turned over to the IAR. However, few Ethiopian counterparts are being trained. Work is being done on bean rust resistance Black Dessie and Mexico 142 were being used as resistant and susceptible indicators, respectively. Anthracnose and some common blight were also present.

Problems

1. Despite the fact the pulse program has been functioning for a decade, the team remains small, and there has been little impact of scientific training input because of political instability. Long-term training should not be emphasized except in special cases; emphasis should be on intensive short-term training for new recruits to the national program. The team is in danger of becoming professional isolated. There is a need to bring this program into the E. African network. They require support in breeding and agronomy (on-farm research), as well as agricultural chemicals that need to be imported. Pathology should also give more attention to developing methods for the more effective evaluation of breeding materials for disease resistance.

2. Important pests are the beanfly and Heliothis. Work is being done on integrated management of these pests. Important storage pests are Callosobruchus masculatus and C. chinensis; C. phaseoli has also been identified recently.

3. The most important diseases of beans appear to be BCMV, rust (important on the widely grown navy beans, which are highly susceptible), Phoma blight, anthracnose and ALS (in humid areas, where floury leaf spot is also found). Root knot, which is important on cowpeas in the SW, could also become important on beans.

The International Bean Rust Nursery will be sent to them to solve rust problems. The project will guide them in disease resistance screening in close association with the breeding program, to develop inoculation techniques, and to focus on particular sites as "hot spots" for particular diseases.

4. The bimodal rainfall pattern with only a little rain from March to April makes it impossible to grow pulses at that time although there are certain areas (e.g., northern Shoa) where off-season crops can be grown.

Somalia

The climate ranges from tropical arid to semiarid, with three major zones: (a) subdesert wooded savanna, transitional to desert, with a small area of true desert (the horn of Africa); (b) arid wooded savanna (majority of Somalia); and (c) mild subarid wooded savanna (northern mountains). Six agroecological zones have been defined. Rainfall is bimodal (April-June and Oct.-early Dec.), with the early rains being more reliable. Average rainfall ranges from 50-650 mm.

The Central Agricultural Research Station is located at Afgoi. Work is being done on cowpeas. Chickpeas are grown around Borama in the north. There is only one scientist working in grain legume research. Expansion of the program could be encouraged through short courses for recent graduates.

Production constraints during the cooler, more humid season include flower bud thrips (Megaluretrhips sjostedti), Maruca testulalis, leafhoppers (Empoasca spp.and powdery mildew. There is a need for drought-tolerant materials as well.

Arrangements are being made to send an appropriate trial of drought-tolerant cultivars of beans from CIAT.

Status of Country Agreements

Kenya

A revised draft of the country agreement (see Annex A) has been sent to Dr. John Koehring (REDSO) and Prof. T. R. Odiahmbo (ICIPE), who will be meeting with the Permanent Secretary in early November to discuss the content and form of the new proposed agreement before CIAT officially resubmits it to the Government. Copies were also sent to Dr. F. Wangati (Secretary, National Council for Science and Technology), Mr. W. Wapakala (Director of Research, Ministry of Agriculture & Livestock Development), and Mr. S. Maturi (Director of Agriculture, Ministry of Agriculture & Livestock Development).

Uganda

The agreement with the Government of Uganda was signed by the Permanent Secretary of the Ministry of Planning and Economic Development in Entebbe on 17 July.

Ethiopia

The agreement was signed by the General Manager of IAR, in the presence of the Leader of the Lowland Pulse Research Team from IAR's Nazret Research Station in Addis Ababa on 9 August.

Somalia

A meeting was held with the Vice-Minister of Agriculture who had read a preliminary draft agreement between CIAT and the Ministry and was in accord with it. On 23 September CIAT sent a revised version of the agreement signed by the Acting Director General, and it is fully expected that the Vice-Minister will accept the new version, based on information from the Project Leader, David Allen. The possibility of some cooperative agreement to allow more input from IITA (cowpeas) and AVRDC (mung beans) was discussed. Both the Vice Minister and the Director of the Institute of Agricultural Research accepted this, emphasizing that beans in themselves could increase in significance, particularly because they were already accepted by consumers. There is a potential for navy beans in the Djibouti market and perhaps for snap beans under irrigation elsewhere.

Training/Production of Training Materials

Ms. Asinasi Fina Opio from the Kawanda Research Station in Uganda was given four months' specialized training in plant pathology at CIAT. S. K. Kanyagia, Coordinator of the Grain Legume Project at the Thika Research Station in Kenya, was invited to CIAT to learn more about the activities of the Bean Program and to visit the Genetic Resources Unit.

The project breeder has been working at CIAT on the edition of the English versions of audiotutorials for Africa. Thus far manuscripts of study guides and text of scripts have been edited and slide sets prepared for the following:

1. Induction module on the regional program on beans in Africa

2. Stages of bean plant development

3. Bean production systems, with special emphasis on Africa

4. Conceptual bases of intercropping in beans

5. Principal diseases of beans in Africa

6. The crossing of beans: a practical guide to ensuring a successful crossing program

7. Field plot design in bean experiments

Constraints to Project Development

As has been discussed in detail with the donors, especially the REDSO/USAID and CIDA missions on site in East Africa, political problems have affected the development of the project in the region. In Kenya, the agreement was unexpectedly rejected by the Cabinet on the basis that a regional program requires prior consultation among the states in the region. This was a very unfortunate reason to give as CIAT had formally consulted with the countries of the region, both collectively and individually over the past four years, including two workshops organized expressly for this purpose. In later meetings it appeared that the Minister of Agriculture had given in to a strong attack from other Cabinet members with little knowledge or interest in technical matters, but with strong political interests opposing regional cooperation. Kenya appears to be afraid of giving away to its neighbors the technology it has developed by taking part in regional cooperative activities. This is also an unfortunate attitude as one of the varieties presently being released by the national program in Kenya was developed by Uganda. There appears to have been a strong surge of nationalistic, antiregional cooperation sentiments stimulated by behind-the-scene influences.

In Uganda, on the other hand, the continuing insecurity, coupled with economic and political instability, has threatened the implementation of development projects. One week after the country agreement was signed in Uganda, there was a coup and the government of President Obote was overthrown.

Recruiting staff for the project has not been able to proceed for lack of the agreement. David Allen remains in Kenya under the ILCA umbrella; Barry Smithson is stationed at CIAT until such time the agreement was signed. T. O. Edje, an agronomist from Nigeria, was about to be hired as the agronomist for the project, but this was stopped when the Kenyan Cabinet turned down the agreement.

Interinstitutional/Regional Collaboration

ILCA fully supports CIAT's regional program and has agreed that the Project Leader can remain under their umbrella in Kenya until things settle. Tacit agreement to this arragement has been given by Kenyan Ministry authorities.

A meeting will be held in Addis Ababa the first week of December with the leaders from the national bean research programs where agreements have been signed (Ethiopia, Uganda, Somalia), as well as those of Kenya and Tanzania as observers. Talks on regional cooperation will begin on an

informal basis until such time as the Kenya situation has been settled. Specifically, the meeting will provide the opportunity for national coordinators to develop research contacts and discuss the following:

1. Germplasm exchange activities within the region, with CIAT headquarters, and with the Great Lakes regional bean program based in Rwanda, including the setting up of a regional nursery system, which would allow the countries to share advanced germplasm.

2. Documentation and training material requirements, including audio-tutorials, to provide a guide to CIAT on the priorities in these areas.

3. Preliminary discussions with national programs on training needs and development of provisional plans for training activities.

4. Quarantine matters related to germplasm exchange.

5. Refinement of regional research priorities with a view to launching network research projects in 1986.

Future Plans

The primary activities of the next period (to 30 March 1986) are outlined in the attached work plan. In summary the following are of the highest priority:

1. Get the Kenya agreement signed and formalize the status of CIAT scientists in Kenya (see also alternative scenarios in work plan).

2. Stimulate regional research cooperation and increase the tempo of work with countries that have signed agreements.

3. Produce training materials to facilitate the enormous training task that lies ahead.

4. Continue the production of new bean germplasm (at CIAT), specially tailored for the ecosystems of the region.

5. Stimulate on-farm evaluations of the best available cultivars produced in earlier research by each national program and by CIAT. Experience in CIAT's Central African Regional Project has shown the excellent feedback that such on-farm research provides to the breeders at an early stage in the research process.

REGIONAL PROGRAMME ON BEANS IN EASTERN AFRICA

WORK PLAN * 1 October 1985 - 31 March 1986

Following is an outline of the activities of the Pathologist/Team Leader, Breeder (recruited 14 April 1985) and an American Post-doctoral Fellow (recruited 29 January 1985 for the six months from 1 October 1985 to 31 March 1986. The former is based in Kenya and the two latter staff members at CIAT headquarters in Colombia. The main anticipated activities are:

1. Country agreements.

To revise and resubmit the MOA between CIAT and Government of Kenya. To conclude the MOA with Government of Somalia in early October. Country agreements were signed with Uganda on 17 July 1985 and with Ethiopia on 9 August 1985, so formal agreement should soon be reached with three out of the four participating countries.

2. Consultative visits

Visits and field surveys are planned as follows: central and eastern Uganda in late October (political situation permitting) by pathologist and breeder; Ethiopia in October by breeder and in December by pathologist accompanied by CIAT Deputy Director General; Somalia by pathologist in December. Consultative visits will be made also by the pathologist and breeder to Rwanda, Tanzania, Malawi, Zambia and Zimbabwe in November, to appraise opportunities for further collaboration in bean research. Further visits are planned for February/March by breeder and pathologist.

3. Steering Committee Meeting.

The first meeting of the Steering Committee of the project will be held in Addis Ababa in December, with national coordinators of the four countries as delegates, to discuss and assign priorities in research and training and technical details of cooperation in exchange of germplasm and establishment of regional trials.

4. Germplasm exchange and evaluation.

Emphasis will continue to be given to the definition of field research sites across the region, with a view to the judicious introduction of appropriate genotypes from among the World Germplasm Collection of *Phaseolus vulgaris* held at CIAT and CIAT bred lines. Guidance will be given to national programmes in setting research priorities, and assistance will be given in the establishment of a set of trial sites and facilities appropriate to these needs. Encouragement will be given to the conduct of on-farm trials to evaluate the performance of selected cultivars under target conditions and to diagnose and quantify constraints

* As covered by USAID and CIDA jointly

to increased productivity, as precursors to developing improved cultural practices apposite to the improved cultivars, to the cropping system and the needs of the farmer.

Substantial consignments of seed, including segregating populations, advanced breeding lines and germplasm for crossing and local evaluation, were despatched during 1985 to Kenya (where they are in post-entry quarantine) and Uganda. Parental materials, as entries in a crossing block, are also under current evaluation in Ethiopia.

5. Seed health

Establish a basis for the safe and efficient introduction of new germplasm from CIAT into the region, depending in part on the newly established seed health laboratory and quarantine area for seed production established by CIAT headquarters. The National Vegetable Research Station (NVRS) at Wellesbourne in England will function as a third party quarantine facility as an additional precaution for some exchanges.

6. Breeding support from CIAT

Specific crosses will be continued to introduce pest and disease resistance into backgrounds adapted to African conditions and their populations advanced in Colombia under selection for specific combinations of characteristics. Recessive resistance to bean common mosaic virus is being incorporated to support I gene resistance and levels of resistance to ascochyta blight, halo blight and bruchids are being improved in materials suited to African conditions. Work on halo blight will continue in collaboration with the NVRS, where the CIAT headquarters bean breeder for Africa is currently spending half his sabbatical.

Increased attention will be given to the evaluation of early generation breeding materials, including lines adapted to Mexican and Brazilian conditions, which are thought to resemble the drier, less fertile areas of Africa.

An African Bean Yield and Adaptation Nursery (AFBYAN) of the 25 current best cultivars from different countries in Africa will be grown at 14 locations in Africa and also in Colombia. The objectives are: to evaluate the performance of existing cultivars in areas outside of their countries of origin; to make existing cultivars more widely available; and to characterize environments in Africa and examine their complementarity with those of Latin America. The latter activity will assist in defining future breeding strategy.

An African Regional Beanfly Resistance Nursery will be distributed, initially from CIAT, but subsequently managed by one of the national programmes in eastern Africa.

7. Training

Training opportunities will be provided to an agronomist from Uganda to visit CIAT's project in the Great Lakes Region of Africa, and an entomolgist from Ethiopia's national programme to train at CIAT headquarters.

An in-country course for bean research scientists had been planned for this period but, owing to the current uncertainties overhanging the project, such training will be postponed in favour of placing greater emphasis on the production of audiotutorial units for Africa.

8. Audiotutorials

Audiotutorial Units in English are being developed for Africa to aid training. Each unit comprises a slide set, a synchronised commentery on cassette and with a text and a Study Guide. The following audiotutorial units are expected to be completed by March 1986.

1. Regional programme on beans in Africa (pending developments)
2. Bean production systems in Africa
3. Principles of intercropping with beans
4. Morphology of the common bean
5. Stages of development of the common bean
6. Genetic diversity in beans
7. Crossing of beans
8. Insect pests of beans in Africa
9. Principal diseases of beans in Africa
10. Evaluation of disease resistance in bean improvement
11. Bean breeding by introduction and selection
12. Experimental design
13. The conduct of field trials

Six of these (1, 2, 3, 4, 5 and 9) are almost ready for printing, and four (6, 7, 10 and 11) are in the final stages of production. The sequence shown above follows logically from a broad introduction to the project and its objectives, to a discussion of the current systems of which beans are part in Africa. Most of the crop is grown in association with maize, so the principles of intercropping are covered. The botany of the crop precedes description of the plant's development and the genetic diversity of the genus. A further unit outlines techniques of hybridization to enable the establishment of national breeding programmes. The field recognition of the principal pests and diseases of the crop is followed by instruction on the evaluation of host plant resistance in bean improvement, and by discussion of breeding by introduction and selection. Finally, instruction is given in experimental design and laying out of field trials.

Further units planned include: breeding methods, stored grain pests, nutritional disorders, weed control, biological nitrogen

fixation, varietal release and seed production and farming systems research.

9. Publications

A colour-illustrated field manual on the Pests and Diseases of Beans in Africa is in preparation, and records of bean pathogens in Africa are being collated to produce a check list for the region. A bibliography on the beanfly, the most important insect pest of beans in Africa, is nearing completion.

Contingency plans, 1 April - 30 September, 1986

In view of current uncertainty over the project, imposed by difficulties in reaching formal agreement with the Government of Kenya (GOK), one of the following alternatives will be implemented by end of March 1986:

1. If the CIAT/GOK agreement is signed and political stability in Uganda improves, the pathologist and breeder, and agronomist and economist (if the latter two are recruited) will be divided between Kenya and Uganda, as originally planned.

2. If the CIAT/GOK agreement is signed, but security in Uganda remains unsatisfactory, all three staff members will be stationed in Kenya.

3. In the event that the CIAT/GOK agreement is not signed, but that Uganda stability improves, staff will be divided between Uganda and another country, possibly Ethiopia.

4. If neither the CIAT/GOK agreement is signed nor does Uganda become sufficiently secure, consideration will be given to discontinuing the project and focussing efforts on the acceleration of the establishment of SADCC's Grain Legume Improvement Programme through which staff may be located in Arusha and/or Malawi.

A VISIT TO CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT) COLOMBIA, SOUTH AMERICA

By Dr, D. M. Okioga

(Retyped from original document, which is in Central File)

INTRODUCTION

CIAT is one of the nine international agricultural research centres under the aegis of the Consultative Group on International Agricultural Research (CGIAR). It was started in 1968.

CIAT has international mandate to work with national organizations to develop and improve agricultural technology, to increase the quality and quantity of field beans, cassava and rice in the tropics. It also conducts a programme on developing suitable pasture technology for the infertile, acid soils of Iatin America. CIAT's Bean Programme started in 1977, The programme has the followinG broad objectives;

- Identify and distribute bean germplasm which carries resistance or tolerance to most of bean problems (pests, diseases, drought, acid soils etc.) in the Latin America.
- Introduce new germplasm and collaborate to initiate bean research programmes in the Middle East and more particularly in Eastern Africa.
- Stabilize dry bean production at high levels, especially where the crop is important in human diets such as in Eastern Africa (Kenya, Tanzania, Uganda, Rwanda and Burundi).

With the support of Co-operation for Development of Africa (CDA), CIAT approached the Government of Kenya early 1985 to negotiate the setting up of a regional centre for a bean programme for Eastern Africa at Thika near Nairobi. The bean breeding materials from CIAT, which has over 33,000 accessions in the Phaseolus germplasm bank, will be introduced to Thika through the Plant Quarantine Station at Muguga. Both the CIAT bean team and national scientists at Thika and other regions of Eastern Africa will evaluate the germplasm for desirable characters and evolve a breeding programme to incorporate desirable characteristics into improved bean genotypes best adapted to local conditions.

Bean Introduction to Kenya

Plant Import regulations in Kenya require that importation of beans into Kenya must be done through the National Plant Quarantine Station (PQS) Muguga for post-entry growing and inspection. The aim is to attempt to stop the inadvertent introduction of new pests, weeds, and disease into Kenya that may be in or on the surface of the imported beans either as active pests or diseases or as passive hitch-hikes. Post-entry inspection of beans take about five months before the release of the germplasm from the quarantine to the consignee.

CIAT representative in Kenya requested the Government of Kenya whether CIAT could be allowed to import beans to its regional centre at Thika without necessarily following the strict quarantine procedure of

complete grow-out before release. A weighty argument by CIAT in favour of the proposal was that the past records have indicated that CIAT has been supplying Kenya with clean beans where neither the pests, weeds nor pathogens have been intercepted by the Quarantine Station. In view of this, a sampling procedure was proposed by CIAT in which PQS takes a smaller lot of the imported beans and the larger lot is released directly to CIAT at Thika.

Whereas the Government of Kenya has not accepted CIAT's proposals, the Government considered it prudent to send one of its official to CIAT in order to inspect the conditions in which the beans are grown in the field to verify whether not the fields are free from injurious pests and diseases of beans. In addition, to confirm whether the post-harvest.

AN OVERVIEW OF THE VISIT PROGRAMME

Friday June 21 On arrival at Bogota Airport, Dr. Okioga was met by Dr, A. v. Schoonhoven, Entomologist and the Leaderof CIAT's Bean Programme

On arrival at the CIAT Dr. Okioga was introduced to the Director General in Charge Dr. G. Nores; Dr. Nores welcomed Dr. Okioga to CIAT. Dr. Nores mentioned to Dr. Okioga that bean seeds for expert to Kenya are grown in the fields which are inspected during active growth by the Colombian Plant Protection officials and must be certified free of pests and diseases before a Phytosanitary Certificate is given to indicate that they are relatively free from injurious pests and diseases.

After a discussion with Dr. Nores, Dr. Okioga was introduced to Mr. Rodrigo Chaves, the Public Relations Officer in Charge of visitors. Mr. Chaves showed Dr. Okioga a movie show entitled, "This is CIAT" The movie highlighted the activities of CIAT as it relates to four basic commodities, namely dry beans, cassava, rice and tropical pasture

The afternoon of June 21, 1985 was left free for Dr, Okioga's rest. Some of the highlights of the movies were as follows;

CIAT is situated in an agricultural area in the Cauca Valley.

- CIAT has 3 experimental stations namely;
  (i) a 522 hectares site where CIAT's headquarter is located between Cali and Palmira.
  (ii) a 184 hectares substation, Quilichao located south of Cali.
  (iii)a 73 hectares Popayan, sited a some 110 km south of Cali.
- CIAT also maintains cooperative agreements with other national and regional institutions to help carry out international, regional and national testing activities atfnumerous locations. In some cases these agreements include the outposting of CIAT's staff members who conduct research and/or work in support of collaborative networks.
- CIAT focuses on four basic commodities, namely;
  Beans
  Cassava
  Rice
  Tropical Pastures

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THE BEAN PROGRAMME

- The objective of the Bean Programme is; (i) to breed for quality, tolerance to drought, diseases, pests (ii) to grow beans in association or relay with crops such as corn and identify the problems associated with the different cropping systems.
- Through the Bean Programmes of CIAT, bean yields have been increased in Latin America. Improved varieties developed by CIAT have been distributed to farmers in Latin America with considerable success.
- CIAT has also distributed advanced breeding lines from which national programmes can select materials that meet their specific needs.

THE TROPICAL PASTURE PROGRAMME

- The Tropical Pasture Programme aims to develop improved, low-input pasture technology for the acid infertile regions of South and Central America covering more than 900 million hectareas.
- Approx. 54.000 acres (= 2,450 hectares) have been set aside in Colombia for pasture research.
- Nutritious pastures such as Andropogon gayanus (introduced from Africa) have been planted in Colombia, Brazil and Venezuela,
- Introduction of germplasm through exchange with other institutions forms in an important aspect of the programme.

THE CASSAVA PROGRAMME

- The Cassava Programme seeks to develop improved technologies in support of increased production and utilization of cassava.
- Programme also aims to increase productivity through technology, that require only low levels of inputs but is responsive to higher input levels.
- Programme stresses development of germplasm. Presently, CIAT has 3,400 accessions in the bank.
- Methodology for pest control through an integrated system is employed by the programme.
- Biological control of disease and insect pests is also being researched. Presently control of horn-worm (Erinyis ello) is in practice.
- Through CIAT's effort cassava production in Latin America has been increased from 2 1/2 tons/acre to 3 tons/acre.
- Marketing causes a bottleneck in the cassava production due to poor storage of tubers. CIAT is currently working on a programme to improve storage of fresh tubers.

THE RICE PROGRAMME

- CIAT works in collaboration with IRRI and national programmes to develop rice varieties with high yielding capacity and adapted to agroclimatic conditions of the production region.
- Yields have been doubled in Latin America through CIAT's rice programme. Improved varieties such as CICA8 developed by CIAT have been distributed in Latin America. The afternoon of June 21, 1985 was left free for Dr. Okioga's rest.

Saturday June 22
Sunday June 23
Free period in which Dr. Okioga was invited to visit Dr. Schoonhoven for lunch and a visit to the city of Cali.

Monday June 24
SEED HEALTH LABORATORY
By Dr. Francisco Morales (Virologist) Bean Viruses
Dr. Morales explained that before the beans are sent out to various countries representative samples are drawn for indexing against bean viruses. Virus indexing is done by means of ELISA test. Dr. Morales gave a comprehensive discussion on bean viruses and among other points covered the following aspect of bean viruses;

1. Bean Common Mosaic Virus
- widespread throughout the world
- Virus spread by aphids or by mechanical means
- Seed-borne in cotyledons and embryo (but not seed coat) and hence its cosmopolitan in occurence Breeding for resistance to the virus is an effective means of control of the virus. The dominant I-gene conferes resistance to BCMV mosaic strains, and several recessive genes confer resistance to necrotic strains of the virus.
- Presently 10 different strains of the virus have been identified.
- There are basically two main strains of the BGMV namely;

1. The Necrotic inducing strain which causes the Black root in cultivars with dominant I-gene.
2. The Systemic Mosaic inducing strain which causes malfomation of leaves with reduced size and mosaic syndrome at high temperatures in cultivars without the dominant I-gene (i.e. susceptible plants).

- The systemic necrosis is followed by complete plant wilting which occurs when a resistant plant with a dominant I-gene is infected with BGMV.
  Necrosis is due to a hypersentisitive response of the resistant plant. The plant vascular system also become necrotic.
- Although dominant I-gene is monogenic, reasonable, stable resistance is conferred by this gene. It is doubtful, however, whether the dominant I-gene alone can offer resistance against BCMV in Africa where the necrosis strains are present..
- Reports from Africa show that BCMV is more serious in Africa than in the Latin America.
- In view of the high incidence of BGMV which results in plant mortality in Africa, it may be concluded that BGMV necrosis strain is endemic in Africa (perhaps Kenya excluded).

Breeding Strategy against BGMV for Africa region
- A bean cultivar, IVT 7214 (of Dutch origin) is known to contain recessive genes which cover resistance to all known strains of BGMV. The resistance genes from this cultivar have been bred into tropically adapted bean breeding lines.
- Therefore crosses of BCMV resistant breeding lines x susceptible African cultivars will be made.
- The presence of the recessive genes can be detected in the F2 and F3 generations by inoculating with specific strains of BCMV.

Once identified, the recessive genes are stable within the genotype and will not segregate further.

- The F4, generation with both dominant I-gene and the recessive genes for BGMV resistance will be sent to Africa for selection.
- At CIAT, no serological tests are carried out on crop germplasm known to be having a dominant I-gene because they are believed to be free from BGMV. This conclusion is supported by the fact that infection of these plants by recessive BGMV strains which attack the I-gene normally results in necrosis and death of the plants or the affected pods.
- Therefore all infected plants with dominant I-gene are killed before they produce any seed for export.

2. Beans Golden Mosaic Virus
- Not seed borne in beans
- Transmitted by white flies, *Bemisia tabaci*.
- Cannot be transmitted mechanically.
- Does not exist in Colombia, butknown to occur in Brazil, Central America, Caribbean and Northern Argentina.
- May occur in Africa because the virus is known to have a wide host range in weeds giving the affected weeds a yellow appearance.
- Virus incidence is increased in areas with intensive cultivation with the same host.
- Losses from BGMV may be up to 100% depending the stage at which the plant are infected e.g. before flowering.
- Little resistance available but tolerance of plant to BGMV exists.
- In the absence of a vector incidence of BGMV in the field is sporadic, with only isolated plants being infected.

3. Bean Yellow Mosaic Virus
- Has a host-range mostly in legumes
- Limited in distribution due to its association to certain legumes grown in the tropics.
- Not seed-borne in bean but may be seed-borne in Lupins.
- May be transmitted through the vegetative parts of Gladiolus
- Not seriously virulent although yields may be decreased by this virus.
- There are several strains of BYMV and the antiserum is specific to only one strain.

4. Bean Chlorotic Mottle
- Considered as a primitive form of the Bean Golden Mosaic Virus
- Spread by white flies, *Bemisia tabaci*
- Globally widespread
- Was probably introduced to new areas through ornamentals such as Abutilong
- Does not usually cause serious losses to beans

5. Bean Southern Mosaic Virus
- Occurs in many countries of Latin America.
- Spread through the seed coat and through the embryo of the seed and commonly detected by serological technique
- Has been reported in Tanzania in East Africa
- The spread of the virus is more rapid than BGMV

6. Bean Mild Mosaic Virus
- Virus difficult to detect visually through symptom observations
- Transmitted by beetles (Diabrotica and Cerotoma) - Virus mechanically transmissible - BMMV may be detected on immature pods, but on drying of the pods, virus concentration is reduced drastically on the seed.
- Work done in America show that the virus is not seed transmitted
- The work done at CIAT by a student reported that the virus is seed-borne but this findings require confirmation.

7. Bean Rugose Mosaic Virus
- Transmitted by beetles (Cerotoma and Diabrotica) - Apppear similar to BGMV NB Status of virus diseases in Colombia, see Table 1.

CIAT's SEED MULTIPLICATION FOR EXPORT
By Dr. O, Voysest (Agronomist)

Dr. O. Voysest explained that the source of seed for seed multiplication is obtained from three designated regions of the Iatin America and Africa under the jurisdiction of agronomists as follows;

Region I;
S.W. Pacific Coast, Central, and the Caribbean where selections of beans against Bean Golden Mosaic Virus is given a priority.

Region II;
Andean Zone and Africa where selections of bean lines resistant against Ascochyta phaselorum (Ascochyta leaf spot) and Bean fly is given a priority.

Region III;
Brazil, Mexico, Argentina and Middle East where selection of beans resistant to drought and low phosphorus is given priority

- Bean lines from the three regions are screened for diseases and pest at CIAT before seed production.
  Breeding lines from the three regions are taken to Vijes for seed production and the resultant seeds are sent out to other countries (including the Eastern Africa) for further trials and selections.
- Vijes is considered an ideal site for raising bean seed for export;

1. It is distinctly isolated from the bean growing area of Colombia and therefore free from contamination from bean diseases and pests. The only crops grown near Vijes are cotton, sorghum and soy bean certified seed. All these crops have no common disease with beans apart from the soil borne fungi which affect a wide host range. (These fungi are; Rhizoctonia, Sclerotinia, Macrophomina, Macrophomina and Pythium).
2. Vijes is a dry area and unsuitable for a wide range of bean pathogens. Dr. Voysest and Dr. Okioga visited Vijes, the site for seed production which was about 30 km. from CIAT headquarter.

Tuesday June 25
DISEASE NURSERY
By Dr, Marcial Pastor (Plant Pathologist) Bean diseases in Latin America are localized. For example the Web-blight. Rhizoctonia microscelerotia is only serious in Costa Rica whereas, Powdery Mildew (Erysiphe polygoni) is known to be serious in Peru.

- Disease of quarantine significance in terms of Kenya's regulations that are not known to occur in Colombia include, Bacterial Wilt (Corynebacterium flaccumfaciens,) and Bacterial Brown Spot (Pseudomonas syringae (P. Syringae pv. Syringae)), Pseudomonas tabaci (P. syringae pv tabaci). P. syringae pv syringae has been reported to occur in Brazil on beans although this work needs confirmation.
- The following bacterial diseases on beans are known to occur in Colombia;

1. Common Bacterial Blight, Xanthomonas phaseoli (X. campestri pv. phaseoli).
2. Halo Blight of Beans, Pseudomonas phaseolicola (P. syringae pv pahaeolicola)

- Summary of bacterial pathogens beans is given in Table 2.
- There are several seed-borne fungal pathogens of beans but their quarantine significance is doubtful. The list is given in Table 3.
- It should be noted that although Erysiphe polygoni, a Powdery Mildew, infect the seed and are transported,Powdery Mildew transmission to the seedling has not been demostrated.

Table 1. Virus diseases in Beans..

Virus	Mode of transmission	Colombia	Kenya
1. Beans Common Mosaic	Seed-borne, Aphids	+	+
2. Beans Southern Mosaic	Seed-borne, Beetle	+	-
3. Bean Mild Mosaic	Seed-borne	+	-
4. Bean Yellow Mosaic	Aphids	-	-
5. Bean Golden Mosaic	Whitefly	-	-
6. Bean Chlorotic Mottle	Whitefly	+	-
7. Bean Rugose Mosaic	Beetle	+	-

+ Present
- Absent

Table 2. Bacterial diseases in Beans.

	Colombia	Kenya
1. Corynbacterium flaccumfaciens (Bacterial wilt)	-	-
2. Pseudomonas syringae pv syringae (Bacterial.Brown spot)	-	-
3. Pseudomonas syringae pv tabaci	-	-
4. Xanthomonas campestri pv phaseoli (Common Bacterial Blight)	+	+
5. Pseudomonas syringae pv phaseolicola (Halo Blight) (there are possible occurrence of strains of this bacterium) (but not at CIAT)	+	+

+ Present
- Absent

Table 3. Seed-borne fungi in beans.

Fungi		Colombia	Kenya
1. Isariopsis griseols (Angular leaf spot)	+ (But not CIAT)		+
2. Colletrotrichum lindemuthianum (Anthranocse)	+ (But not CIAT)		+
3. Ascochyta phaseolorum Ascochyta leaf spot (Ascochyta boltshausori)	+ (But not CIAT)		
4. Chaetoseptoria Weilmanii (Chaetoseptoria leaf spot)		0	0
5. Erysiphe polygoni (Powdery Mildew)	+ (Not "seed-borne"		+
6. Rhizoctonia microslerotia (= R. solani) thanatephorus cucumeris (Web-blight)	+ (Not at CIAT)		+
7. Sclerotinia sclorotiorum (Whetzelinia sclerotiorum) (white mold)	+ (Not at CIAT)		+
8. Macrophomina phaseoli (Ashy Stem Rot)	+ (Not at CIAT)		+
9. Fusarium exysporum (Fusarium yellows)	+		+
10. Pythium spp. (Pythium Root Rot)	+		+
11. Rhizoctonia solani (Rhizoctonia Root Rot)	+		+

+ Present
- Absent

BREEDING PLOTS
By Dr, Jeremy Davis

- The Unit's responsibility includes exporting bean breeding material to National programme for further selection of breeding work.
- The bean material exported are:

1. CROSSING BLOCKS

These are lines with desirable agronomic traits such as resistance to specific pests or pathogens. The material are used for selection by National Programmes or for breeding purposes. Presently approximately 1000 breeding lines from crossing blocks have been sent to Kenya through the Kenya National Plant Quarantine Station.

- Specific advanced crosses are occassionally requested by the National Programmes. For example Tanzania requested the F6 - F9 generations of advanced breeding lines to plant in various regions of Tanzania.
- Crosses are made in CIAT rather than in the National Programmes in African regions because of fear of infection of the F1 hybridsBGMV which may result in necrosis and death of the plants.

2. PRELIMINARY YIELD TRIALS (E,P.)

Here the beans lines already evaluated for grain type and growth habit in the three regions (previusly discussed under "Seed Multiplication for Export") are sent out to National Programmes for further selection for evaluation for characteristics not considered in the VEF Under local conditions.

3. OBSERVATION NURSERY TRIAL (VEF)

The breeding lines for VEF are derived from lines developed at CIAT by various programs. The lines have been bred for resistance to specific

pathogens or pests, or for specific agronomic traits. The lines are evaluated at CIAT by the breeding unit and at the National Programmes.

INTERNATIONAL BEAN YIELD ADAPTATION NURSERY (IBYAN) The promising bean lines that have been evaluated at EP are further evaluated for yield and adaptation to various ecological and agro-climatic zones. The IBYAN trials are carried out at CIAT and at the National Programmes. In breeding terms, entries in the IBYAN are finished or nearly finished varieties.

GENETIC RESEARCH UNIT (G.R.U.)
By Dr. David Wood
Genetic Research Unit apart from acting as a unit for the conservation of bean genetic material also functions as a post-entry quarantine. All bean seeds coming to CIAT from the African and other third world areas (considered as "high" risks areas) must be screened by G.R.U. for pests and diseases using standard quarantine procedures. Any material found infected or infested is destroyed. All seeds exported by CIAT to National Programmes must also be checked by GRU for freedom from pests and diseases. The GRU has under long term storage in the germplasmbench some 35,000 accessions of beans comprising of land races and elite materials of *Phaseolus vulgaris* *P. coccineus* *P. lunatus* and *P. acutifolius*. GRU also hold some 17,000 accessions of tropical pasture seeds and 3,600 accession Cassava (*Manihot esculenta*).

Wednesday June 26
SEED UNIT; COMMUNICATIONS
By Jose Fernandez de Soto
The main objectives of the Seed Unit Communications are;

- To carry out seed multiplication of the breeders materials, successful hybrids under strict sanitary conditions for farmers and others at a minimal free to cover production costs.
- To certify the seed quality of the seed so produced.
- To carry out laboratory tests of the seed samples of the integral part of testing for seed quality.
- To disseminate the seed so produced to individual or institution as required.
- To train seed technologies and seed quality control techniques from the Latin America and the Carribbean.

ENTOMOLOGY
By Iulia Kornegay (Entomologist)
Dr. Kornegay showed Dr. Okioga the damage caused by stored grain insects, *Acanthoscelide obtectus* and *Zabrotes subfasciatus*. A brief mention how to distinguish between the two Bruchids beetles was also made.
The damage caused by a leafhopper *Empoasca kraemeri*, an economically important insect pest of bean in Latin America, was demonstrated by the visit to the field.

GENERAL DISCUSSIONS OF THE BEAN PROGRAMME IN EASTERN AFRICA
A discussion was held to give an overview of CIAT's Bean Programme in Eastern Africa and how it relates to Quarantine regulations in Kenya. CIAT had requested the Government of Kenya to sign a Memorandum of

Agreement whereby the Government of Kenya would allow CIAT to use the facilities at the Thika Horticultural Research Station, Thika near Nairobi as the regional Center for the Bean Programme in Eastern Africa (Kenya, Tanzania, Uganda, Rwanda and Burundi).
Equally important was the request by CIAT to use the Quarantine Station at Muguga as the entry point of CIAT's beans to Eastern Africa.
The meeting was attended by the following persons:

1. Dr. Aart van Schoonhoven (Entomologist and Bean Programme Leader)
2. Dr. D. M. Okioga
3. Dr. Barry Smithson (Bean Breeder)
4. Dr. Francisco Morales (Bean Virologist)
5. Dr. Marcial Pastor (Bean Pathologist)

At the time of this meeting, it was reliably learnt that the Government of Kenya was reluctant to favour the request by CIAT to make Kenya as the regional centre for the Bean Programme in the Eastern Africa. I, however, assured CIAT that should CIAT wish to export bean material to Kenya for National trials in Kenya, the National Plant Quarantine Station in Kenya would continue to handle the introduced material in conformity to Kenya's quarantine regulations. If bean introductions are going to be proportionally large, the, the National Plant Quarantine Station (PQS) would require the following assistance from CIAT in order to enable PQS to meet the quarantine demands of large bean introductions;

1. Construction of a screen-house for post-entry growing and inspection of the beans (The screen-house to be erected would be similar to those of the International Potato Centre (CIP) at PQS.
2. Provide PQS with 1000 plastic pots each measuring approx. 20 cm. diameter and 25 cm. deep.
3. Provide pesticides and fungicides for control of bean pests and diseases in glasshouse.
4. CIAT to assist in the training of PQS scientific and technical staff so as to meet the additional technical demands of handling the bean introductions at the Quarantine Station. In this respect, the training of a virologist to a M.Sc. level would be required. Also the training of a seed technologist would be equally desirable.
5. PQS to be included in the mailing list for technical papers distributed by CIAT.

CIAT's reaction to the above suggestions were as follows;

1. CIAT is willing to construct the screenhouse as requested and a budget for the said screenhouse has been submitted to enable the funds to be available during the 1986 period.
2. CIAT is ready to assist Kenya PQS with provisions such as pots, pesticides and fungicides to enable the bean introductions to pass through PQS.

3. CIAT is willing to train a selected research officer at PQS to M.Sc. in Virology. However, it is essential that the person to be trained is registered at the University of Nairobi and that the courses should be taken at the University of Nairobi, After the completion of theoretical courses, the trainee can then be sent to CIAT in Colombie to carry out thesis work under a CIAT's

virologist. The travel expenses to CIAT and the accommodation and subsistence allowance can at this stage to be paid by CIAT .

Since CIAT policy is to train only the post-graduate trainees, there is no likelihood of CIAT training a seed technologist without the trainee possessing a first degree.

BEAN INTRODUCTION FROM CIAT TO KENYA

Having reviewed the viral bacterial and fungal diseases that occur in Colombia (see Table 1, Table 2 and Table 3), it may be stated that there are no disastrous bacterial and fungal diseases that occur in Colombia and do not occur in Kenya (Table 2 and Table 3). Therefore, bean introductions from CIAT to Kneya pose no phytosanitary threat to Kenya agriculture in terms of introduction of new bacteria or fungi of beans to Kenya through the imported beans. This is an important point to consider when reviewing the import regulations of beans from CIAT to Kenya.

Virus diseases (Table 1) gives a rather different picture. Of the seven serious virus diseases of beans that occur in Colombia only one virus disease (the Bean Common Mosaic Virus) occurs in Kenya. Therefore the question of virus diseases of bean would require our attention if Kenya continues to receive bean introduction from CIAT. Fortunately, four of the virus diseases, bean Bean Yellow Mosaic Virus, Bean Golden Mosaic Virus, Bean Chlorotic Mottle Virus and Bean Rugose Mosaic Virus that occur in Colombia are not seed-borne. Therefore, these viruses do not constitute a real threat in our importation of beans from CIAT. The viruses that would concern Kenya when importing beans from Colombia are the Bean Common Mosaic Virus (BCMV), Bean Southern Mosaic Virus (BSMV) and the Bean Mild Mosaic Virus (BMMV) which are known to be seed-borne. Bean BGMV occrus in Kenya, and the BMMV has not been confirmed to be seed-borne. In reality then, only one virus should be of concern to Kenya this is the Bean Southern Mosaic Virus. If bean seeds from CIAT have to be processed through the post-entry quarantine growing and insepction, then the emphasis should be on this virus as no fungal or bacterial diseae in Colombia are of quarantine significance to Kenya.

PROPOSED IMPORT REGULATIONS OF BEAN SEED FROM CIAT

The current import regulation in respect of bean seeds is as follows: Importation of true seeds "from Bulgaria, Hungary, Mexico, Yugoslavia, Australia, the United States of America, and all countries where Corynebacterium flacumfaciens (Hedges) Dows occurs, will be done through the post-entry quarantine growing and inspections. However, importation of the true seeds from an area where C. flaccumfaciens is not known to occur will be by Permit only. The "Permit shall include the following conditions; (a) Phytosanitary Certificate (International model or its equivalent) (b) Additional declaration as follows; Corynebacterium flaccumfaciens (Hedges). Dowson is not known to occur in the country of origin".

Corynebacterium flaccumfaciens (the Bacterial wilt) is not known to occur in Colombia (Table 2). Therefore bean seeds from CIAT should be imported on permit. In view of the good record CIAT has maintained in sending disease-free bean seeds to Kenya, it is suggested that bean seeds imported from CIAT should be allowed into the country on permit.

The importation of beans should be accompanied by a Phytosanitary Certificate signed by the Colombian Plant Protection (Quarantine Services) officials stating; "The parent plants were inspected during the active growth and found to be free from;
Xanthomonas compestri pv phaseolicola and Pseudomonas syringae pv phaseolica and from Bean Southern Mosaic Virus".
CIAT will also provide an additional Phytosanitary Statement stating; "The representative sample of the bean seeds were indexed for Bean Southern Mosaic Virus and other virus disease and were found to be free from infection". The reasons why CIAT has to carry out the virus indexing procedure on representative seeds before dispatch are as follows;

1. The field inspection for Bean Southern Mosaic Virus, Bean Mild Mosaic Virus by the Colombian Quarantine Services may be unable to detect the virus although the virus may be present in the field. But due to unfavourable environmental conditions under which the plants are grown, the virus may not produce any disease symptoms although the seeds produced may be infected or infested.
2. Virus infection may not be detected on symptomless carriers (tolerant plants that may be present in the population).

The proposed import regulations of bean seed from CIAT will be one of the agenda items for discussion during the nextmeeting of the Kenya Standing Technical Committee on Import and Export (KSTCIE) of plants.

Thursday June 27
CASSAVA PROGRAM
Cassava Pathology - by Dr, Carlos Lozano
Frogs Skin Disease

- Disease was considered serious seven years age because it was not properly characterised. Now it is appropriately characterized and can be identified by serological methods.
- Frogs skin disease is eliminated by temperature above 30.C.
- Temperature lower than 28.C favour disease development.

Bacterial diseases and Fungal diseases

- Cassava adapted to high altitude areas are very susceptible to cassava bacterial diseases. They are however resistant to Phoma, Anthracnose, Cercospora and Phaeramularia manihots (Brown leaf spot).
- Diversity in ecological niche in Colombia give rise to diversity to attack of cassava by various specific pathogens, pests and other microorganism. Therefore it cannot be generalized that any specific pathogen disease which occurs in Colombia is serious in terms of quarantine significance because it all depends where in Colombia the material was collected.
- Superelongation caused by Sphaceloma manihoticola has recently been reported but generally does not occur in Colombia.

Psedumonas putida

- Diplodia manihotis, the Dry root and stem root disease is controlled by inoculation of infected plants by Pseudomonas putida (i.e. Biological control).

- Diplodia can also be controlled by spray application of a mixture of Orthcide + Benlate at 300 ppm of each chemical.
  and Phythium.
- Degree of control by P. putida is 80% - 100% effective.

Cassava Virology
By Dr. Barry Nolt
The African Cassava Mosaic Virus is characterised as a different virus from the Carribbean Cassava Common Mosaic virus for the following reasons:

1. The virus particles are different.
2. Carribean Cassava Common Mosaic Virus is not transmitted by insect vector but mechancally. On the other hand the African Cassava Mosaic Virus is spread by white flies (Bemisia sp.).
3. There are different types of antisera for African Cassava Mosaic Virus from Carribean Cassava Mosaic Virus (see No. 1 above).
4. The African Cassava Mosaic Virus is more destructive than the Caribbean Cassava Common Mosaic Virus which is considered mild.

Cassava pests
By Dr. Anthony Bellotti
Cassava mites
- Biological Control of cassava mite using the predator mite (Phytoseid).
- 25 different predator mites have been recognized in Cauca Valley of Colombia.
- Predator mites are normally specific, attacking only cassava mites.
- Predator mite are easily recognized fromthe pest mites because thepredator mite is seen to move robustly as opposed to sedentary parasite mite.

Cassava Mealybug (Phenococcus spp.)
- Several species have been identified in Africa and Brazil.
  P. manihotis occurs in Africa where it causes serious problem in cassava since 1970.
- In Latin P. manihotis occurs only in Brazil.
  Other cassava meanlybugs species include P. gospii and P. grenadensis.
- Control of cassava mealybug by use of parasites of the cassava mealybug, Epidinocarsis.
- Biological shipment of Epidinocarsis should be done with caution since they are known to carry hyperparasites.
- Epidinocarsis are very specific even more than the predators; specific Epidinocarsis are even known to attack specific species of mealybugs.

Cassava Tissue Culture
By Dr, William roca
Minimum Growth Medium for Long Term (approx. 2 years)
Storage of cassava germplasm

1. M,S, Basal Salt	g/500 ml
A. NH_4NO^3	82.5
KNO_3	95.0
B. $CaCl_2$ 2H2O	22.0
KI	41.5
CaCl 2H2O	1.25
C. MgSO4 $7H_2O$	18.5
MnSO4 H2	0.845
Z_nSO_4 $7H_2Og$	430 mg.
Cu^{SO4}	1.25 mg.
D. Na-EDTA	1.865
$Fo.SO_4$, 7H2O	1.392
E. KH_2 PO_4	8.5
H_3 BO_3	310 mg.
Na_2N O_4 $2H_2O$	12.5 mg.
2. Sucrose	30 g/l
Inositol	100 mg/l
BAP	0.05 mg/l
NAA	0.01 mg/l
Agar	8 g/l

3. Adjust pH to 5.7

Storage conditions for tissue cultures 1, Temperature; Day 21,.C
(NB; lower temperatures less than 15.°C may kill the plants).
2. Photoperiod 12 hr.
3. Light intensity 500 lux

Procedure

Place nodal cuttings in the minimum growth medium. Let the plantlets establish before storing the plants for long term storage.
Use 5 test-tubes (size 25 x 150 mm) per accession. Storage period is between 18 to 24 months before transfer. (NB; In storage, plantlets may drop leaves but is normal since the stem will remain healthy).

COMPOSITION OF MURASHIGE AND SKOOG MEDIUM

Stock solutions:		g/500 ml.
A.	$NH_4\ NO_3$	82.5
	KNO_3	95.0
B.	$Cacl_2\ 2H_2O$	22.0
	KI	41.5 mg.
	$CoCl_2\ 6H_2O$	1.25 mg.
C.	$MgSO_4\ 7H_2O$	18.5
	$MnSO_4\ H2^0$	0.845
	Zn^{SO4}.	430 mg
	$CuSO_4$	1.25 mg.
D.	Na-EDTA	1.865
	$FeSD_4\ 7H_2O$	1.302
E.	KH_2PO_4	8.5
	$H3BO_3$	310 mg
	$Na2^M\ O_4\ 2H_2O_0$	12.5 mg.
F.	Thiamine hydrochloride	20 mg)
	Pyridoxine hydrochloride	100 mg)
		Store in freezer
	Nicotine acid amide	100 mg)
	Glycine	400 mg)

to prepare 1litre of culture medium, take 10 ml. each of the stack A, B, C, D, and E and 5 ml. of stock.

PASTURE PROGRAMME

By Dr. Jose M. Toledo (Pasture Agronomist and Coordinator).
- Dr. Rainer Schultze-Kraft (Agronomist)
- Dr. Jillian M. Lenne (Plant Pathologist).

Dr. Toledo gave an over-view on Pasture Program of CIAT. He thanked the Kenya Government for allowing a CIAT scientist, Dr. Keller-Grain, to carry out Brachiaria spp. collection in Kenya. Dr. Toledo assured the Kenya Government that should the pasture scientists in Kenya need any pasture germplasm from CIAT, the request would be met without delay.

It was agreed during the discussion that the Tissue Culture workon Brachiaria spp. at Plant Quarantine Station, Muguga, should be carried out in July/August, 1985 with the technical assistance from CIAT's personnel. Through this co-operative, the Brachiaria accession now being held at PQS would be released to CIAT as tissue cultures.

On return to Kenya, Dr. Okioga would ensure that the Brachiaria accessions are cut down and "dressed" with a nitrogenous fertilizer to encourage growth of young shoots for tissue culture.

Friday June 28; Free

Saturday June 29; Dr. Okioga leaves for CIMMYT, Mexico.