

PROGRESS REPORT

CONTRACT NO. 525-0180-C-00-2015

PANAMA AGRICULTURAL TECHNOLOGY DEVELOPMENT

PROJECT No. 525-0180

for the period

October 1, 1983 to December 31, 1983

## DESCRIPTION OF ACTIVITIES OF PERSONNEL

Dr. Pedro Argel, Tropical Pastures Agronomist

During the reporting period it has been possible to initiate a number of projects which were approved for various areas of Panama. These projects are as follows:

### 1) Chepo (Eastern Region)

A Regional Type A experiment (Adaptation Experiment) was established on the farm of a collaborating farmer in the area with germplasm from CIAT and selected for Humid Tropical Rainforest ecological conditions. A total of 45 species of grasses and legumes were planted along with a number of local native species. This experiment was initiated the last part of September and some germination problems have been noted due to the high rainfall which followed planting. The experiment was replanted however, and now appears to be developing normally.

Seed production plots were established in the same field in early September and include two hectares of Andropogon gayanus and one hectare of kudzu (Pueraria phaseoloides). These species have established normally and the most notable problems are related to the high rainfall in the area and poor drainage prevalent in some areas of the field.

### 2) Calabacito, Los Santos and Soná (Central Region)

#### 2.1 Calabacito

A pasture adaptation experiment (Regional A) was established on IDIAP's research farm in Calabacito during the week of July 4 with CIAT germplasm selected for Tropical Rainforest conditions (subecosystem Derived Savannah). A total of 48 species were established, including a number of native species from the surrounding area. The experiment appears to be establishing well.

A uniform cutting was made the week of October 31 and the first dry matter evaluations will be made in February 1984.

Another experiment was established in Calabacito the week of September 4. This experiment is designed to evaluate the response of A. gayanus to low levels of phosphorus (P), potassium (K), magnesium (Mg) and sulfur (S) when grown alone and associated with Stylosanthes capitata. The levels of the elements in kg/ha. are: P: 0, 15, 30, 60; K: 0, 50; Mg: 0, 20; S: 0, 20. The experiment was designed jointly with Dr. Tom Scott prior to his departure from Panama.

The establishment of the experiment has been normal with the exception of some wash-out of seed in some areas of the plots due to high rainfall. Germination is generally good, and early indications suggest a response to phosphorus by both species, however the dry weight measurements will not be made until January or February of 1984.

Another project proposed for Calabacito will evaluate animal production on A. gayanus associated with S. capitata 'capica'. The parcel consists of 9.5 ha. of land previously in Digitaria swazilandensis, which was poorly adapted to the area. The study will use three stocking rates in an alternate grazing system and will last two years. The land has been prepared for planting but the seeding has been delayed until the rainy season stabilizes in 1984.

## 2.2 Los Santos

The IDIAP operates an experiment station in the Villa de Los Santos but the soils are fertile and better utilized for annual crops. A Regional A Type experiment was established in the middle of September on the farm of a collaborating farmer in the area. The germplasm originated from CIAT and was selected for Dry Tropical Forest ecosystem conditions. Native species of the area were also included in the experiment along with five ecotypes of Cenchrus ciliaris, a grass known for its adaptation to dry areas like the Azuero Peninsula. A total of 63 species were planted initially but drought adversely affected the germination. The plots were recently replanted and establishment is expected to be normal.

## 2.3 Soná

The IDIAP is planning to establish a sub-station in the area of Soná but a variety of research is now coordinated out of the office in Santiago.

A Regional Type A experiment was established in early September utilizing CIAT germplasm selected for Tropical Rainforest conditions. A total of 34 grass and legume species, including a number of native species of the area were established in these plots. The germination was normal with one or two exceptions and these species were replanted.

### 3) Gualaca, Finca Chiriqui, Bugaba (Western Region)

#### 3.1 Gualaca

In mid- June the following species were planted in seed-production plots:

	CIAT No.	Area(ha.)
<u>A. gayanus</u>	621	2.0
<u>Pueria phaseoloides</u>	9900	1.0
<u>Stylosanthes capitata</u> capica		0.5
<u>S. guianensis</u>	136	0.3
<u>Centrosema macrocarpum</u>	5065	0.3

Germination was normal in these plots and disease problems are not now apparent. There were initial problems with fungus disease(Sclerotium rolfeii) in the two Stylosanthes plots but the problem has disappeared. Leaf feeding insects have also presented minor problems to the kudzu.

The Andropogon began flowering the last week of September and the flowering period continued normally with development of a large number of flowering stems, good plant vigor, and high seed production. The plots were harvested the last week of September.

The capica variety of Stylosanthes capitata also flowered at about the same time. It continues to flower and appears to be growing vigorously. Flower and seed production were high and the plots were harvested in mid-December.

The CIAT 136 Stylosanthes guianensis demonstrated vigorous establishment and great vigor. It began flowering in early November. Compared to S. capitata, however it is less fertile and more vigorous vegetatively. The seed harvest is planned for the end of December or early January.

The Centrosema macrocarpum (CIAT 5065) is developing normally although it has notably lower plant density and greater weed competition. Support stakes are being built to support the plants to favor nmore vigorous seed production. It remains vegetative at this time.

The kudzu continues growing vegetatively also but shows a dense vigorous vegetative growth and competes well with weeds.

### Grazing Experiments Type C and D

These two experiments are financed by CIID(Canada) and are conducted with assistance from CIAT and under the direction of IDIAP. The Type D experiment is comprised of an evaluation of animal production on A. gayanus, H. rufa(faragua) and B. humidicola alone and in association with kudzu under a two animal stocking rate. This is a relatively expensive experiment that will last three years and will involve 24 hectares. The Type C experiment is comprised of an evaluation of persistence under alternate grazing and utilizes three grass species(Andropogon, faragua, and humidicola ) alone and associated with kudzu, Desmodium ovalifolium CIAT 35 or Centrosema macrocarpum CIAT 5065. This experiment will involve 3.6 hectares and will last three years. The land has been prepared and some plots established. If irrigation is available during the dry season, the experiment establishment will continue in the near future with planned grazing treatments to begin in June, 1984.

### Bracharias

A total of 49 vegetative samples of Brachiaria ecotypes were introduced from CIAT. Of these, 21 have survived in the greenhouse and have recently been transplanted to 3 X 5 plots in the field. A second shipment from CIAT is planned to complete the collection and the group of ecotypes will be evaluated under various Panamanian ecological conditions as soon as sufficient plants are available.

### 3.2 Finca Chiriqui

During the month of June, the seed production plots of B. humidicola and B. decumbens were harvested. Owing to an especially productive harvesting period, an additional, unplanned 5.0 hectares was also harvested. To accomplish this, a machine combine was utilized and the improved seed harvesting efficiency is apparent from Table 1.

Table 1. B. humidicola harvest- Finca Chiriqui-June, 1983

Harvest Method	Yield (kg./ha.)	Total Harvested(kg.)	Purity (%)		Germination (%)
			crude seed	processed seed	
Manual	53.0	15.0	--	--	---
Mechanical	75.0	286.0	96.7*	97.6*	8.3**

\* Irish or modified purity

\*\* scarified 15 minutes with 98% H2SO4

25.9 kg. of B. decumbens crude seed was harvested providing 0.5 kg. of pure seed.

An area was hand harvested for comparison and this harvest indicated that at least 21 man-days of eight hours would be needed to harvest 1.0 hectare. The yields were greatly reduced compared to the machine harvesting and this is contrary to what is normally seen in forage production. It is possible that the area chosen for manual harvest had an unusually low seed production or that the machine harvested area was underestimated. This estimation was based on time of operation. Nevertheless, the high yield potential and seed purity of the species is evident. The germination is low at this time, but this is not unusual for this species given the length of the latent period.

The harvest of B. decumbens was made totally manually. Reduced seed formation and low fertility is apparent, possibly due to nitrogen or phosphorus deficiency. The population and flower size was normal but the majority of the seed heads did not set seed. This is a problem that should be investigated in more detail.

All of the seed thus far produced has been processed in a forced air cleaner that IDIAP maintains in Santiago. The seed is currently stored in a seed storage cold room at Gualaca.

#### 4). Bugaba

A small experiment was established in early June to investigate control of the weed Sida sp. on a private farm in Bugaba. The objective of the experiment was to determine the effectiveness and selectivity of a wiper-wick applicator in a dense stand of Sida sp. The herbicides tested included Roundup at 10% and 20% and the mixture of 2,4-D and 2,4,5,-T at the farmer's usual dosage and applied with a backpack sprayer or at 10% with a wick applicator. Observations at 15 and 30 days after application indicated good control of the weed species with both Roundup dosages but considerable damage occurred to the pasture (Digitaria swazilandensis) and to the native legumes present. The 2,4-D and 2,4,5-T mixture showed little effective control and also considerably damaged the native legumes present.

The poor Roundup selectivity was due to errors in application with the wick applicator due to poor flow control. The two dosages of commercial product used were excessively high even though these are the manufacturer's recommended dosages. This experiment will be repeated in the coming year.

#### Release of Andropogon gayanus

As a result of various discussions among IDIAP, the National Bank and the Agronomy Faculty, the grass Andropogon gayanus has been released and named "Veranero" by agreement among these institutions. Two field days have been held--one at the Agronomy Faculty facility in Chiriqui and one in Chepo, east of Panama City, where the species was formally presented as a new forage grass for Panama. There is great demand for seed of the grass which reflects the high expectations which Panamanian livestock producers have for it.

#### Agronomy Faculty

As a result of a previous Type B agronomic experiment conducted by the Agronomy Faculty in collaboration with CIAT, a Type C experiment is planned at the Agronomy Faculty in Chiriqui. The species to be planted are the grasses

5

A. gayanus, H. rufa and B. humidicola associated with the legumes kudzu and Stylosanthes capitata 'capica'. An area of 3.6 ha. will be used in alternate grazing with a three animal stocking rate. The land has been prepared but planting has been delayed until the rainy season begins in 1984.

#### Leucaena Experiment

Sixteen ecotypes of Leucaena from CIAT are being evaluated agronomically at INA in Divisa in collaboration with INA researchers. The seeds have been planted in small pots initially and will later be transplanted to the field. Germination has been very low in some cases but an effort is being made to obtain more seed. Leucaena is a species with great potential for the dry area of the Azuero Peninsula and it is hoped that ecotypes with greater productivity than those now used in the area will be found.

#### GREDPAC (Central America and Caribbean Regional Pastures Group)

Dr. Argel actively participated in the FAO-GREDPAC inaugural meeting in Panama the week of October 17. The regional group will have the responsibility of promoting information, research methodology, germplasm, and technical assistance to member countries. Panama will coordinate the group for the first two years. The group will promote its functions in such organizations as FAO, universities, regional and international centers such as CIAT, CATIE, etc., or others that request advice, financing of courses, germplasm, etc. The member countries will work through ministries or research institutes. The ratification of the agreement by member countries is now in progress. Generally, the meetings were very positive and it is hoped that GREDPAC serves to more rapidly and effectively promote forage technology in the region --taking advantage of the relative technology advantages which some countries have over others.

Dr. Mark Gaskell, General Agronomist

Dr. Gaskell's permanent relocation to Chiriqui Province on October 1, 1983 has enabled him to concentrate his efforts in two priority geographic areas of Bugaba and Renacimiento Districts. As outlined in the amended work plan which Dr. Gaskell prepared prior to his relocation his primary focus is in agronomic research and in-service training of researchers associated with dry bean and corn production in the Caisan area and onion production in the Cerro Punta/Bambito area. Dr. Gaskell is also working closely with the Regional Crops Coordinator, Ing. Jose Roman Arauz in on-going monthly technical reviews of the four crops research sites in Chiriqui Province.

#### Dry Bean Production--Caisan

New dry bean research projects are underway and are being conducted by IDIAP researchers Ings. Miguel Acosta and Ruben Degracia under the direction of Dr. Gaskell. Previous research on dry beans in the area of Caisan had focused on a wide range of production factors including, pest control, varieties, planting date and spacing, and fertilization practices. Promising technology has been developed in recent years and some of these improved practices have already been adopted by farmers in the area. Previous preliminary research indicated little or no response to applied nitrogen or phosphorus and the current recommendation is for relatively low levels of phosphorus ( 28 kg/ha. P2O5) and nitrogen (12kg/ha.N ) application, even though bean market prices (\$47.50/100 lbs. ) would justify higher fertility levels if a response exists. Circumstantial information from research on dry beans on similar soils in Costa Rica and Colombia suggest that there should be a response. Mineralogical samples and other preliminary research suggests that these soils should have a considerable ability to fix phosphorus and the high rainfall coupled with phosphorus deficiency may have limited the nitrogen response in previous studies.

With these factors in mind a series of more extensive studies were planned and planted on four farmer's fields in the Caisan area during the month of November. These experiments are investigating in greater detail the overall responses of dry beans to nitrogen and phosphorus fertilization with special attention to the interaction among these factors and to the effect of repeated nitrogen application as a means of reducing leaching losses from the high rainfall in the area.

An intensive sampling program is now underway to follow dry bean development under the various treatment regimes. Growth analysis measurements indicate that there is a very strong response to nitrogen and phosphorus in terms of total plant growth but that the two elements must both be present in optimal amounts for this response to be expressed in bean yields. Final measurements and statistical analysis will not be made until bean harvest in February 1984 and thus, these are only preliminary observations.

The dry bean research in progress will provide important new information on fertilization practices for bean growers in the Caisan area. But, the work is also important from a different standpoint. Key IDIAP researchers are closely involved with the work underway on a daily basis. These studies were designed not only to provide important information on dry bean production but also to demonstrate alternatives for research data management and analysis.

It is important that IDIAP researchers be exposed to methods of managing large amounts of data reliably and to mechanisms for improving research efficiency, i.e. amount of data generated per research dollar invested. These bean experiments now underway in Caisan will be generating more than ten times the amount of data of a similar number of experiments in previous crop cycles with few additional resources beyond Dr. Gaskell's time. In the 10 to 12 weeks prior to harvesting these studies in late January or early February these IDIAP researchers will have been exposed to various processes for handling the more than 1600 individual samples in the experiments. From these samples, over 4,000 measurements on 30 different bean development parameters are being recorded. Maintaining the experimental plots and managing and manipulating this data on a daily basis are tasks at the heart of effective research. After harvest is complete the accumulated data will be put through numerous statistical and economic analyses. These are all important links in the technology development process and this in-service training is a valuable fundamental educational opportunity for these IDIAP researchers.

Other problems continue to limit dry bean production in the area and these include the absence of appropriate tillage and harvesting machinery and IMA's practice of delaying payment for beans for six months after delivery. The new agricultural minister has recently named a National Dry Bean Commission of which IDIAP researcher Ing. Miguel Acosta is a member. The minister recently stated that Panama produces enough beans to feed itself for 20 days out of the year and the rest are imported. He has charged the commission with developing incentives and MIDA policy changes are underway to stimulate greater domestic dry bean production. The technology which IDIAP is generating is sound and when coupled with an increased technology transfer effort and increased production area should stimulate rapid improvement in production.

Dr. Gaskell has recently made plans with Dr. Dave Mears, a Rutgers Agricultural Engineering faculty member to visit the Caisan area to provide technical advice on tillage and harvesting machinery needs. The visit is tentatively planned for late January or early February 1984.

#### Onion Production - Cerro Punta/Bambito

The focus of the onion research program is in two primary areas--agronomic problems of production during the rainy season and the development of on-farm drying capability for individual small growers. There is considerable over-production of onions in Panama during the dry season and a domestic shortfall in production during the rest of the year. Although there are dry season production problems, the pressing need to amplify production over more of the year dictates the current research focus with the limited resources that exist.

Franklin Atencio, the IDIAP agronomist assigned originally to work with Dr. Gaskell in onion research was reassigned to a potatoe seed production program in December but a new agronomist is being named to the onion research program in the near future. Thus, the research program in onions will be reduced until a new IDIAP collaborator is named in the area.

Research to extend production in the rainy season is presently concentrated in two agronomic problem areas; a screening of experimental and commercial varieties for improved production during the rainy season and the development of improved seedbed management practices. Five varietal trials are currently underway on cooperating grower's fields in different locations in the Cerro Punta/Bambito onion production area and one in Boquete. Onion growers in Boquete have repeatedly asked IDIAP for more research and technical assistance in the area. It has not been a priority area in the past however,

and it is difficult to initiate an effective research program without someone located in the area permanently. It was difficult to convince some growers to plant outside of the normal planting period and some were not prepared to plant at the pre-arranged time. This limits an effective comparison of off-season onion production in some sites but plans are underway to repeat the experiments in 1984.

The other important agronomic area that limits production during the rainy season is the management of the seedbed prior to transplanting. Seedling losses may reach 50 to 75 percent or higher due to high rainfall and diseases. Onion seed currently sells for \$40 to \$60 per pound and it is not unusual for growers to plant two to three times a normally recommended seeding rate to provide sufficient seedlings for transplanting. And, due to these same environmental conditions, the seedlings are less vigorous and need considerable time to reach transplanting size. Research was conducted in July, August, and September to compare the relative merits of various seedbed treatment practices. The treatments included a control with no treatment, a combination of Orthocide(captan) and Furadan - a common farmer practice-, disinfection with Basamid, and disinfection plus covering of the seedbed. Seedling survival(%) and seedling weight increased and time to transplant decreased in the order control, Furadan/Orthocide, Basamid, Basamid plus cover.

There is a very clear advantage to covering the seedbed in addition to disinfection in these preliminary results. These early experiments utilized a seedbed cover design that was limited to experimental plots. Dr. Gaskell and IDIAP agronomist Franklin Atencio have recently designed a different type of seedbed cover that appears to have promise on a commercial production scale. The seedbed cover is currently being evaluated at the Cerro Punta Research Station and the seedbed experiments will be repeated when the rainy season returns in 1984. The seedbed will also be evaluated on a collaborating farm to determine its value on a production scale. The cover can be established for \$0.79 per M<sup>2</sup> of seedbed with materials available locally. Continuing costs would be low and it is thought that the seedbed costs would be more than compensated for by seed savings and price advantages for rainy season onions.

On farm drying of onions during the rainy season is another focus area of Dr. Gaskell. A solar onion drier was constructed on the farm of a collaborating grower. The drier utilized clear plastic tunnels covering black plastic for heating and a passive wind-powered air extractor for exhaust because the area lacks electricity. The drier was tested in August on onions that had been produced during the rainy season. The drier did not function well even though the solar collectors appeared to generate sufficient heat. Dr. Gaskell consulted with Rutgers University agricultural engineers about the drier design and as a result of these discussions, the design has been modified to include a more powerful fan utilizing a diesel motor. It is thought that the humid mass of onions creates too much of a load for the air extractor and thus, exhausting of humid air is insufficient. The collaborating grower remains enthusiastic and the drier is being modified for the next onion harvest in early February. Although this will be a dry season harvest, the grower would also like to utilize the drier during the dry season and this trial will enable a prior evaluation and possible remodeling if necessary, prior to the next rainy season harvest in July or August. Dr. Mears will also be reviewing the drier design during his visit in early 1984.

Dr. Gaskell and IDIAP Regional Crops Coordinator Ing. Jose Roman Arauz have developed a program for on-going technical reviews of the four crops research sites in Chiriqui Province. The reviews will involve one full day per month in each of two sites, thus reviewing each site every two months.

Specific subject themes to be covered include:

- 1) research theory and the overall emphasis of the area,
- 2) planning of research and interpretation of previous results,
- 3) management of field plots and research data, and
- 4) additional technical assistance needs in the areas.

The reviews will be of an informal nature with emphasis on field work in progress as a training tool. It is intended that these reviews improve the effectiveness of research and offer real support to individual researchers. Ing. Arauz is developing a specific program schedule for reviews to begin in January 1984.

#### Soil Productivity Specialist

This position is currently vacant pending the arrival of Dr. Luis Manrique on January 2, 1984.

#### Livestock Research Specialist

An additional specialist will be added to the Rutgers/Cornell team in Panama in January 1984 to assist the IDIAP Livestock Directorate in animal health and livestock production research.

#### RESULTS OF RUTGERS/CORNELL MEETINGS IN THE U.S.

Drs. Argel and Gaskell accompanied Dr. Rodrigo Tarte, IDIAP Director General and Dr. Gaspar Silvera, Chief of IDIAP's Crops Research Directorate on a visit to Rutgers University in October. Drs. Armand Van Wambeke and Larry Zuidema, members of the project technical committee from Cornell were also present at Rutgers. The purpose of the visit was fourfold:

- 1) to enable Drs. Tarte, Silvera, Argel, and Gaskell to participate with Rutgers faculty and students in a "Panama Day" symposium as part of International Horizons Week at Rutgers,
- 2) to allow Drs. Tarte and Silvera the opportunity to meet personally with the Rutgers/Cornell technical committee and other faculty members to discuss such issues as; current project progress, replacement candidates for the Soil Productivity Specialist vacancy, other technical assistance needs, student degree training programs for the IDIAP staff already at Rutgers and Cornell, and other areas of possible collaboration between the universities and IDIAP,
- 3) to allow Drs. Tarte and Silvera the opportunity to meet with the three IDIAP staff now in graduate training at Rutgers and the one now at Cornell to discuss the progress of their graduate programs, and
- 4) to allow Drs. Argel and Gaskell the opportunity to consult with Rutgers faculty over specific aspects of their on-going work in Panama. Dr. Argel also presented a seminar for Rutgers faculty and students on livestock production in Panama.

One new area of collaboration which was discussed was the development of joint research projects outside of the Technology Development Project. As a result of these discussions a number of concrete projects are taking shape. At

least two collaborative research proposals involving Rutgers faculty and IDIAP researchers will be submitted to USAID's Program in Science and Technology Cooperation in early 1984 for funding consideration.

Drs. Tarte and Silvera continued on to Cornell University to meet with faculty and visit research facilities in a number of departments.

#### OBSERVATIONS ON THE AREA FOCUSED RESEARCH PROGRAM

The project technical specialists are concentrating their work in the priority areas originally identified for the project. There is continual pressure to extend beyond these priority areas but an effort must be made to avoid overextending the limited time and physical resources available. For the research to be of sufficient quality so as to be useful, these resources should not be further diluted.

There are discussions underway to selected two additional areas with funding provided from additional sources. It is important that consideration be given to subsequent funding to maintain these new areas in the future. If not, the research programs in the current priority areas will suffer from diminished resources.

#### RECOMMENDATIONS FOR IMPROVING THE PROJECT

The IDIAP can take maximum advantages of the Rutgers/Cornell resident specialists by making certain that sufficient IDIAP collaborating staff are strategically placed to work closely with the specialists and provide continuity to the research in progress. It may be that a simple review of the current work of the specialists and the IDIAP manpower in the area could improve the utilization of the technical assistance provided by the specialists.