

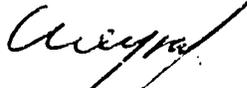
PROGRESS REPORT N°18

PROJECT: AGRICULTURAL TECHNOLOGY DEVELOPMENT IN PANAMA
 CONTRACT: USAID/PANAMA N°525-0180-C-00-2015
 PERIOD: OCTOBER TO DECEMBER 31, 1986

This report is submitted as part of the requirements of the USAID contract on the project "Agricultural Technology Development in Panama" for the Technical Assistance component provided by Rutgers University to IDIAP. Activities and accomplishments of the project and the Technical Assistance component for the period covered between October 1, and December 31, 1986, are described here, in detail.

This report is subdivided into five main sections following the reports from each five (5) specialists components of the Rutgers Technical Assistance Team. These sections are:

<u>AREA</u>	<u>SPECIALIST</u>
I. Tropical Pastures	Pedro Argel, Ph. D.
II. General Agronomy	Mark Gaskell, Ph. D.
III. Soil Fertility and Management	Alvaro Cordero, Ph. D.
IV. Livestock Research and Production	José Zorrilla-Ríos, Ph. D.
V. Administration and Management of Agricultural Research	Carlos A. Neyra, Ph. D. (Chief-of-Party)


 CARLOS A. NEYRA, ATD PROJECT
 (CHIEF-OF-PARTY)

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ATD - PANAMA PROJECT

CONTRACT: USAID/PANAMA N°525-0180-C-00-2015

REPORT N°18

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I. TROPICAL PASTURES

PEDRO ARGEL, Ph. D

RE. QUARTERLY REPORT N°18

PROGRESS REPORT

PERIOD: OCTOBER 1 TO DECEMBER 31, 1986

PREPARED BY: PEDRO J. ARGEL/PASTURES AGRONOMIST

BACKGROUND

The diversity of ecological niches in Panama, justifies the existence of a great number of forage species that vary in production and persistence according to soil conditions, rain distribution and pest incidence, apart from the type of pasture management given by the farmers. On the other hand, there exist species with a wide range of adaptation and less variability of dry matter yield as affected by climate and soil conditions, they are more aggressive at establishment and potentially more productive than traditional species. The genus Brachiaria, Centrosema and Stylosanthes, have shown to have species aggressive enough as to be considered of high priority in future selections, however it is necessary to quantify in field experiments the productivity of such species. Work research in that direction has been carried out lately in Panama. Relevant results during the period of this report are presented below.

GERMPLASM

The selection of pasture species concentrate progressively in those highly promising and seek to define low levels of fertilizer response, and dry matter yield potentials in cutting experiments. An additional advance includes the species utilization finally selected in grazing trials to quantify production in animal terms.

A. Brachiaria humidicola 6369

This ecotype of B. humidicola, together with B. dictyoneura 6133 and B. humidicola 6707, have shown a wide range of adaptation in Panama, besides good tolerance to spittle bug and soil water stress. Potentially are considered more productive than the traditional grasses for acid soils. B. humidicola 6369 is stoloniferous and aggressive during establishment, covers adequately the ground surface, and maintains a high proportion of green foliage up to well advanced the dry season. A field experiment on species response to low levels of phosphorous (P), nitrogen (N) and sulphur (S) is carried out presently in Gualaca, Finca Chiriquí and Hornito. Results of four successive harvest during the rainy season are presented in Table 1. So far a marked effect of nutrients on yield

TABLE 1. Response of Brachiaria humidicola
 CIAT 6369 TO NITROGEN (N), PHOSPHOROUS (P) AND SULPHUR (S)
 IN AN INCEPTISOL IN GUALACA - PANAMA 1986

Treatments	Yields (Kg DM/ha) *			Crude Protein Content (%) **	
	<u>N</u>	<u>P</u>	<u>S</u>		
1.	0	0	0	1701	10.3
2.	50	0	0	1621	10.6
3.	0	30	0	1893	10.9
4.	50	30	0	1643	10.4
5.	0	0	20	1854	10.3
6.	50	0	20	2028	10.4
7.	0	30	20	1223	10.4
8.	50	30	20	1785	10.3
9.	25	15	10	1804	10.4
10.	75	15	10	2319	10.6
11.	25	45	10	1719	10.6
12.	25	15	10	1913	10.5
13.	150	90	60	2387	11.1

* Mean yield of 4 harvest during the rainy season at 35 days interval.

** Mean of 2 harvests.

is not observed, at least for the first 50 Kg/ha of N applied; the species shows good capacity to yield - 1701 Kg DM/ha in this conditions without the application of soil nutrients, and this confirm the good species adaptation to the ecosystem. Light increases on yield are observed with applications of P and S, but considerable effect occurs with the interaction of these elements with N, particularly with the level of 30 Kg/ha of S; the effect on yield (1233 Kg DM/ha). Sulphur seems as the Key element when N is present, thus yields observed with 50 Kg/ha of N and 20 of S are very close to those observed with the highest levels of all nutrients. Crude protein content was very similar for all treatments being around 10%, except a light increase when highest levels of N, P and S were applied. This experiment will continue for an additional growth period; simultaneously this species has been selected for a preliminary grazing trial during the same period.

B. Andropogon gayanus 621 and Centrosema macrocarpum 5062

A. gayanus is a grass selected and released by IDIAP and other national institutions; presently its utilization expands to acid soils with prolonged dry season. Meanwhile C. macrocarpum 5062 is a forage legume that has shown both good adaptation and dry matter yield in several ecosystems of Panama. Therefore it is considered highly promising, for this reason it has been included in seed multiplication plots and grazing trial experiments. Besides is a forage legume very compatible with A. gayanus.

An experiment was established and evaluated in Finca Chiriquí (Ultisol, pH 4.5, 70-80% aluminum saturation) to observe response to P, S, and potassium (K) during the establishment of both species planted in association. Table 2 shows results 90 days after planting. Although the information is not statistically analyzed yet, it can be seen the good response of both the grass and the legume to 100 Kg/ha of P; less grass response occurs with 60 Kg/ha of S and 40 of K, but this does not apply to the legume that increased the yields from 253 to 435 Kg DM/ha with the latter nutrient. High yield increase occurs with the interaction P and K and somehow less for P and S and Sand K for both species; however, the interaction of P and K and S increased substantially the yields of both species, particularly the treatment 150, 30 and 20 Kg/ha of the P, K and S for the grass and 100, 60, 40 Kg/ha of the elements for the legume. A detailed analysis of this experiment will allow to quantify high yielding and more economic treatments for this association. It is worth to observe the high biomass production of both species only three months after planting and without nitrogen application, this demonstrate the good species adaptation to infertile soils.

TABLE 2. Response of *A. gayanus* and *C. macrocarpum* CIAT 5062 TO PHOSPHOROUS (P), POTASSIUM (K) AND SULPHUR (S) DURING ESTABLISHMENT IN AN ULTISOL OF CHIRIQUI - PANAMA

TREATMENTS				YIELD Kg DM/ha *	
	<u>P</u>	<u>K</u>	<u>S</u>	<u>Grass</u>	<u>Legume</u>
1.	0	0	0	1882	253
2.	100	0	0	3835	462
3.	0	60	0	2660	332
4.	100	60	0	4023	620
5.	0	0	40	1958	435
6.	100	0	40	3403	506
7.	0	60	40	2489	283
8.	100	60	40	3480	681
9.	50	30	20	3976	599
10.	150	30	20	4253	654
11.	50	90	20	4062	481
12.	50	30	60	3884	391

* Mean yield observed 96 days after planting.

WEED CONTROL

Activities in this regard seek for efficient weed control methods to eliminate pasture weeds that compete with desirable forage species both at establishment and under production.

FERN CONTROL (Pteridium aquilinum)

This is a weed widely distributed in Panamá, particularly in hilly degraded pastures and acid soils with high organic matter content. Apart from competing and replacing desirable forage species, it intoxicates bovine animals that consume it, producing in many cases animal death.

An experiment on weed control of this weed was established in Volcan (Chiriquí), at 1,400 msnm and mean temperature of 21°C. Herbicides applied and dosages in percentage were: 2,4-D amine 3.0, 6.0 and 9.0; picloran + 2.4-D amine 1.5, 3.0 and 4.5; glyphosate foliar application with knapsack sprayer 1.0, 2.0, 3.0 and 5.0, and glyphosate foliar application with rope wick applicator 10.0 and 15.0%. An additional mechanical treatment using a "machete" and hitting and breaking the fronds and superficial rhizomes with a stack was also used. Figure 3 show control evaluation results 30 and 90 days after treatment application; none of which controlled effectively the weed because regrowth capacity of this plant. However, outstands the high control percentage of picloran + 2.4-D amine at 3.0 and 4.5% kept up to 90 days with reduced regrowth for the high level. Medium and high levels of 2.4-D amine showed good initial controls, but these decreased lately; contrary occurred with glyphosate that showed successive control increases up to the 3.0% dosage for the foliar application with Knapsack Sprayer; it reduced regrowth to low levels and maintained its herbicide action after 90 days. Similarly occurred with the rope wick applicator, particularly at 15.0% of glyphosate, besides of being more selective toward the established grasses in these plots. At the end of the experiment it was obvious that high dosages of 2.4-D and picloran + 2.4-D amine, had a high grass proportion and this did not occurred with glyphosate applied with Knapsack Sprayer. A second application of hormonal herbicides was considered necessary 90 days after to eliminate weed regrowth.

PASTURE EVALUATION

A first grazing cycle ended of the animal production experiment (ERD) established in Gualaca, that evaluates the grasses B. humidicola, H. rufa and A. gayanus pure and associated with Kudzú in a rotational grazing system of 14 days grazing, 42 days rest and 2 and 4 AU/ha. Table 4 shows animal liveweight changes for the dry period (111 days) and the rainy season (224 days) for the different

TABLE 3. FERN (Pteridium aquilinum)
CHEMICAL CONTROL IN VOLCAN - PANAMA

Treatments	Dosage (%)	Control Percentage		Regrowth Percentage 90 days
		30 days	90 days	
2,4-D amine	3.0	50	34	73
2,4-D amine	6.0	85	60	69
2,4-D amine	9.0	90	66	61
Piclorán + 2,4-D amine	1.5	37	43	49
Piclorán + 2,4-D amine	3.0	69	75	31
Piclorán + 2,4-D amine	4.5	86	84	19
Gliphosate	1.0	22	44	10
Gliphosate	2.0	30	54	13
Gliphosate	3.0	60	81	6
Gliphosate	5.0	12	44	10
Gliphosate	10.0 (rope)	20	50	10
Gliphosate	15.0 (rope)	43	78	8
Machete		85	0	100
Stack		7	0	100
Check		0	0	100

TABLE 4. ANIMAL LIVEWEIGHT GAINS IN PURE
GRASSES AND ASSOCIATED WITH KUDZU ESTABLISHED
IN GUALACA (PANAMA, 1986)

Pastures	Stocking rate AU/ha	Daily Gain Per Season		Annual gain (Kg)	
		Dry (111 days) (g/animal/days)	Rainy (224 days)	Animal	ha
H. rufa	2	177	633	161	322
H. rufa	4	87	528	128	512
A. gayanus	2	359	578	169	338
A. gayanus	4	-80	593	124	496
B. humidicola	2	199	611	159	318
B. humidicola	4	154	483	125	500
H. rufa + Kudzú	2	145	736	181	362
H. rufa + Kudzú	4	50	536	126	504
A. gayanus + Kudzú	2	502	561	181	362
A. gayanus + Kudzú	4	210	508	137	548
B. humidicola + Kudzú	2	339	517	153	306
B. humidicola + Kudzú	4	212	548	146	584

pastures. A marked effect of stocking rate obviously exist on animal liveweight, increases, this is more evident in grass pure stands during the dry season. Stocking rate of 2 AU/ha produced the better animal liveweight gains with A. gayanus during the dry period, but when stocking rate doubled animals lost weight in the same type of pasture. This did not occur with H. rufa and B. humidicola, giving the latter less variability for stocking rate effect.

As expected the larger Kudzú contribution occurred during the dry season, giving daily animal liveweight gains of up to 502 g for A. gayanus at 2 AU/ha; this gain is very similar for the rainy season of the same association. Less differences in weight and between stocking rates and type of pastures are observed for the rainy season, suggesting probably a less consumption of the legume. In general the contribution of the latter total animal liveweight gains was approximately 30 Kg/ha, based in total gain per hectare of the pastures. This experiment will continue under evaluation for another grazing cycle.

TRAINING

In collaboration with the Centro Internacional de Agricultura Tropical (CIAT), IDIAP and Rutgers University organized a workshop on Tropical Soil Management for pasture establishment during the week 10-14 November 1986. The workshop was held in Gualaca (Chiriquí Province), with the participation of 17 agriculture technicians representing the following National Institutions: IDIAP, 9 participant; ISA (Instituto de Seguro Agropecuario), 1 participant; BNP (National Bank of Panama), 3 participants; MIDA (Ministry of Agriculture), 1 participant; FERTICA (Fertilizer of Central America), 1 participant; BDA (Banco de Desarrollo Agropecuario), 1 participant; and FAUP (Faculty of Agriculture), 1 participant. The topics developed covered tropical pasture management in acid soils of Panama; important characteristics of rhizobium-legume symbiosis; germplasm evaluation in acid soils of Panama, pasture establishment, herbicides use, management and utilization of Tropical pastures. The evaluation of this workshop showed that 15 participants considered it useful, specially for extensionists; with good coverage of the topics presented, relevant to present needs of the country, very well prepared with speakers knowledgeable of the topics presented, but too short in duration. It was suggested that a workshop of this type will need at least two weeks duration.

FUTURE PLANS

Concentration of efforts will continue on seed production of promising species with the objective of having enough material of at least 2 grasses and 3 legumes, for evaluation in research

stations or for introduction in small scale at the farm level. Weed control trials will be validated in large plots and another outstanding species will be included in coming weed experiments, such as C. macrocarpum and S. guianensis, particularly during the establishment phase. Attention will be given to grazing trials, so that the evaluation in Gualaca and Finca Chiriquí can continue and initiate the one in Calabacito.

II. GENERAL AGRONOMY

MARK GASKELL, Ph. D

RE. QUARTERLY REPORT N°18

PROGRESS REPORT

for the period

October 1, 1986 - December 31, 1986

Dr. Mark Gaskell, Agronomist

Work activities during the reporting period were concentrated in the vegetable research program in the highlands. Additional collaboration was given to different areas in other western region crops research programs.

BACKGROUND

On July 1, 1986, IDIAP opened a new area research office in Boquete in the facilities of the Agricultural and Industrial Cooperative. The onion research program was formally transferred from Cerro Punta to the Boquete area and the new IDIAP area office is headed by Ing. Sanchez with the assistance of Agr. Campo Serrano and with the collaboration of Dr. Gaskell.

The program revolves around a formal memorandum of understanding between IDIAP and the AGRICOLA and HORTICOLA cooperatives in Boquete and provides for the two cooperatives to financially support the research program established by IDIAP in the area. A Research Advisory Committee has been established to guide and support the research program. The committee is composed of one representative from each cooperative and two from IDIAP, with Dr. Gaskell serving as an advisor. IDIAP assigns personnel to be permanently stationed in the area and the two cooperatives provide office facilities, transportation, and research materials and supplies. The research program follows the guidance of the Research Advisory Committee and ultimately is accountable to the Committee, the cooperative membership, and to IDIAP with research results that respond to priorities established by the Committee.

In addition to the on-going work with onions, opportunity also exists for vegetable crop diversification in the highlands and based on marketing opportunities as perceived by the HORTICOLA marketing cooperative, broccoli, cauliflower, peppers, and table tomatoes have been identified as crops where a research effort could have a high payoff for area producers. The marketing cooperative has a demand for broccoli and cauliflower which

is in excess of supply much of the year and tomatoe supply is very low during the rainy season. Therefore, a new effort is being initiated on recommendation of the Research Advisory Committee to investigate the critically limiting factors in year-around production of broccoli and cauliflower and the possibilities of improving rainy season tomatoe production.

ACTIVITIES DURING THE REPORTING PERIOD

On-going Research - Onion Agronomic Problems

In late October, an experiment to evaluate the role of nitrogen and phosphorus on rainy season onion production was harvested. This experiment was similar to the experiment harvested from the Cheva farm in August and discussed in Progress Report # 17. The results of this experiment are shown in Figure 1 and are particularly interesting when compared to the results from the Cheva farm shown in Figure 2.

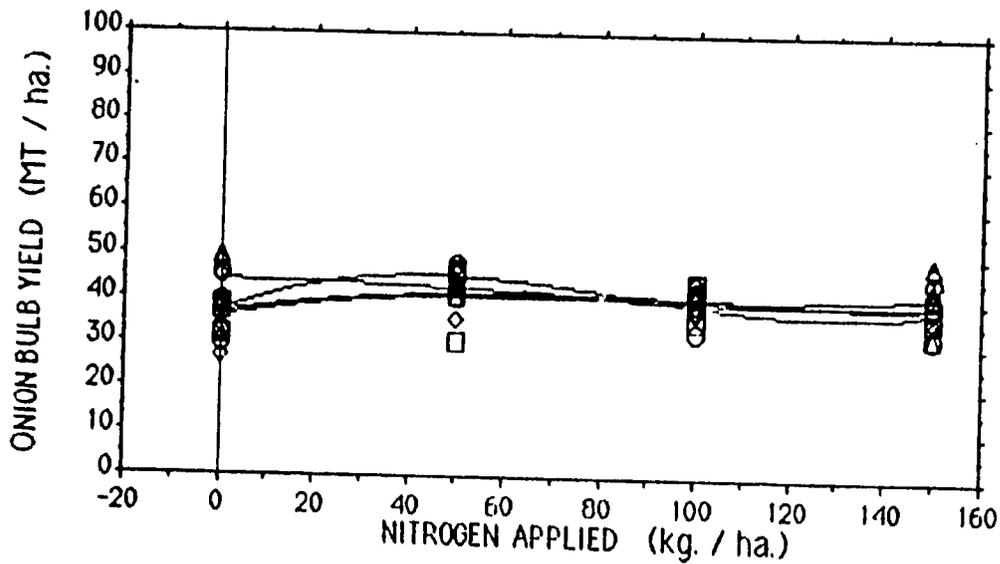


Figure 1. Yield response of rainy season onions to nitrogen (N) and phosphorus (P) fertilization. Harvested October, 1986 Marciacq Farm, Boquete, Panama. P rates = 0 (○), 25 (□), 50 (△), and 100 (◇)kg. P₂O₅/ha.

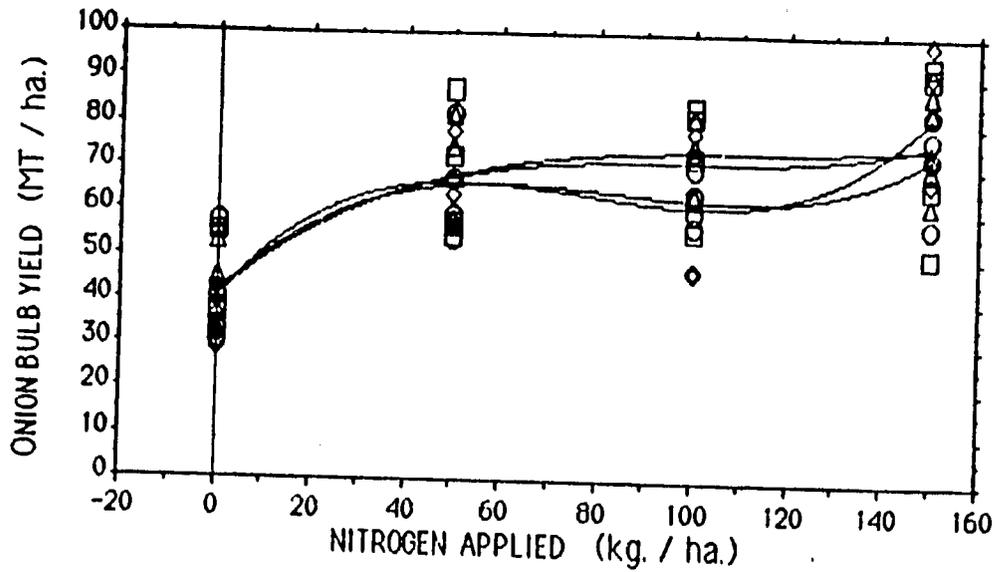


Figure 2. Yield response of rainy season onions to nitrogen (N) and phosphorus (P) fertilization. Harvested August, 1986 Cheva Farm, Boquete, Panama. P rates = 0 (O), 25 (□), 50 (Δ), and 100 (◇) kg. P₂O₅ /ha.

The management levels on the two farms were similar but the effect of the rainy, cloudy weather conditions of September and October is clearly evident from the dramatic differences in potential yields during October and the lack of a fertility response during that period (Figure 1) compared to the August harvest. Previous work in 1984 and 1985 had hinted at the reduced yield potential during the October rainy period and this work confirms those earlier observations. New experiments have been established to compare these responses and yield potentials of the rainy season with dry season response patterns.

Broccoli, Cauliflower and Tomato Agronomic Trials

Broccoli, cauliflower, peppers, and tomato have been identified by the Research Advisory Committee as priority crops for which a research effort would have a high payoff for area producers. Calendarized plantings of broccoli and cauliflower are needed to provide a continual year around harvest and much management research is needed for tomato and pepper production during the rainy season. The first broccoli variety trials which were established on the Martinez farm in August were harvested during the reporting period and those results are shown in Table 1.

Table 1. Commercial yields of broccoli cultivars grown at the end of the rainy season. Harvested December 1986, Martinez farm, Alto Quiel-Boquete.

CULTIVAR	COMMERCIAL HEAD WEIGHT (gm.)	HEAD DIAMETER (cm.)
Packman	394 a *	13.9
Green Duke	376 a	15.8.
Mercedes	365 a	14.0
It. Green Sprout	356 ab	15.1
Premium	342 ab	14.1
Green Beret	314 ab	14.9
Bravo	301 b	14.9
Gen	281 b	12.9

* weights followed by the same letter do not differ significantly with 95% confidence.

These early trials with broccoli are showing some interesting aspects. First, through the use protected seedbeds, it is possible to advance the harvest date considerably in the Boquete area and there are several cultivars well suited to Boquete conditions. Secondly, the most appropriate cultivars are not necessarily the cultivars available locally. These results will serve as the basis for the AGRICOLA cooperative to plan seed orders for broccoli. Finally, producers are not accustomed to repeated cutting of broccoli because the HORTICOLA cooperative has not marketed broccoli reshoots in the past. An effort is underway to test market broccoli reshoots in Panama City and plans have been made to investigate the management factors important in repeated harvest of broccoli. This simple management factor has the potential of nearly doubling broccoli yields on an area basis, and appears to be a very promising alternative for area growers in the short run.

Harvest of the cauliflower experiment first planted at the end of August was beginning in late December. Two or three points are of interest. First, the more precocious cultivars flower too quickly and do not have time for sufficient plant development to produce good head size. And, as has been generally observed elsewhere with cauliflower, these cultivars are also more sensitive to transplanting time, fertilization frequency, and other management factors and thus are probably not the cultivars best suited for producers who have limited resources and/or experience with the crop. The longer season varieties will likely prove to be the most productive and adaptable to Boquete conditions.

The seedbeds on the Martinez farm have been established under a covered seedbed structure that is a modification of the structure which has been shown to be valuable for onion seedbed establishment. The protected cropping structure proved to be extremely useful for continued seedbed plantings during the October - December period.

OTHER ACTIVITIES

Dr. Gaskell attended a group from the Panamanian National Investment Council who visited Boquete in early December accompanied by Mr. Harry Mannion, an American marketing specialist who was helping the Investment Council put together a profile list of potential fresh fruit and vegetable export crops. Dr. Gaskell met with the group and led them on a tour of production fields in the area.

In late December, Dr. Gaskell hosted Ing. Pedro Suarez of PROMACOOOP and Eduardo Matheau of the ACDI consultant team assisting the IPACOOOP in the Cooperative Marketing Project. Several area production fields, packing facilities and onion storage facilities were visited and plans were discussed for further cooperation between the two projects.

III. SOIL FERTILITY AND MANAGEMENT

ALVARO CORDERO, Ph. D

RE. QUARTERLY REPORT N°13

PROGRESS REPORT N°6

ALVARO CORDERO (Ph. D)
Soils Specialist

PROJECT: AGRICULTURAL TECHNOLOGY DEVELOPMENT IN PANAMA
RUTGERS UNIVERSITY - USAID.

PERIOD: OCTOBER 1 TO DECEMBER 31, 1986

A. INTRODUCTION

As in the previous report, activities are subdivided into three subsections:

- a) Training and Technical Advise
- b) Meetings, Conferences, Seminars and Field Tours
- c) Support to research

Also, we must mention that during the last quarter (October-December), we dedicated more than one third of effective time to participate in three workshops and meetings planned on december to determine the priorities for research that IDIAP should carry out on the Central Region.

B. TECHNICAL ADVISE AND TRAINING

As in previous quarters we provided in-service training and assistanship to the technical staff as requested while they developed their routinary activities on agricultural research, like: planning; processing of their experimental results and their discussion, with a focus to soils productivity and proper soils management.

We included a list of technical personal who received the assistance by the Soils Advisor:

Eng. José Aguilar	Eng. Rolando Sánchez D.
Eng. Esteban Arosemena	Eng. Lineth Carranza
Eng. Eric Batista	Eng. Santander Jaramillo
Eng. Araiz Cajar	Eng. Lucas Tasón
Eng. Lourdes Charles	Lic. Alfonso Singh
Eng. Andrés Marquéz	Eng. Gregorio Quintero
Eng. Luisa Martínez	Lic. Rodolfo Morales
Eng. Benjamín Name	

We also provided assistance to Eng. Ezequiel Espinosa from the University of Panama (Ex-General Director of IDIAP) on his work on rice research in the site of Alanje (Province of Chiriquí) that he is carrying out together with IDIAP.

In accordance with the Working Plan, the Soils Specialist from Rutgers University spend great part of his time providing technical assistance to the Soils Laboratory. This assistance was coordinated with Eng. Benjamín Name. Also we discussed with Eng. Name and other partners from IDIAP, about amendments related to the new building as follows: Departures for the escape of fluids arising from the drums; there they will work with chemicals that generate toxic fluids, that we have to prevent or safely eliminate from the laboratories. The same advice is about the exhaustion of hot air arising from the atomic absorption equipment. The observations and other amendments were presented by Eng. Name to the Architect, Gladys de Isturaín, to seek solutions.

During this quarter we reviewed several technicals papers, but only two of them were relevant. The titles are the following:

- a) "Project for a study on the Soils of Panama", author: Santander Jaramillo. Eng. Jaramillo prepared a proposal on soils research for IDIAP with the purpose of obtaining financial support. The soil studies who exist, are for the most part incomplete or with errors and outdated. Eng. Jaramillo in his project looks for a detailed soils study to update it according with modern knowledge on soils classification. The Soils Advisor congratulated the author for the high quality of his proposal.
- b) "Evaluation of different sources and dose of nitrogen in rice cultivation": Eng. Luisa Martínez, (Principal author) submitted her article for review by the Soils Advisor.

The agronomic data generated by Eng. Martínez and her collaborators in this research with nitrogen fertilization on rice are very valuable and ready to be published. We provided suggestions to improve the abstract, the introduction, materials and methods, discussion, results and general suggestions. The main author of the document was very grateful with the help received from the Soils Advisor.

C. FIELD DAYS, SEMINARS, CONFERENCES, WORKING REUNIONS AND TECHNICAL TOURS TO EXPERIMENTAL FIELDS.

a) Field Days:

On december 12, 1986 we participated in the Field Day organized at the Experimental Station of Calabacito. The Field Day was called under the title " New Options on Acid Soils". There were more than a hundred persons between producers and professionals related with the agricultural and livestock activities of the region. The goal was to demonstrate to the attendants new options being generated by IDIAP (and) with the collaboration of the University of Rutgers on the site of Calabacito, an area of great importance, characteristic of the acid,infertile soils of Panama.

The work intended by the Soils Program of IDIAP, on the Central Region, is the generation of proper technology for this type of soils, for use in agriculture, livestock or forestry. Inside this frame of reference, is very important, the germplasm evaluation, and proper soil management.

As part of the Calabacito field day, this specialist lectured on the "Importance of Research on Acid Soils" Also, we collaborated with Eng. Name on the presentation and explanation of experiments conducted on:

- (1) Experiment on species of wood on timber.
- (2) Evaluation of manioc species.
- (3) Evaluation of cajanus species.
- (4) Evaluation of grain legumes (soybean, beans, vigna, kidney beans and peanut).
- (5) Trials of fertilizer to the association Andropogon gayanus and Centrosema macrocarpum.

- (6) Evaluation of sorghum varieties.
- (7) Evaluation of tharo lines.
- (8) Agrosilvo-pastoril trials.

b) Seminaries and Conferences

During this quarter we participated on three seminars related with activities carried out by IDIAP. The seminars were on:

- (1) "Workshop of Comparative advantages of the Panamanian Agriculture", date: October 14, 15 16, 1986. Place: Panama City. Sponsored by: IDIAP, Rutgers University and ISNAR.

The Soils Advisor participated in the discussions and joined the working group "Comparative Advantages of the Panamanian Agriculture". The group was formed by the following persons:

Lic. Hermel López from IDIAP

Dr. Howard Elliott from ISNAR

Lic. Helda Puga from the National Council of Investment

Lic. Nuvia Z. de Jarpa - MIPPE

Lic. Naira Camacho from the National Committee of seeds.

Dr. Alvaro Cordero from IDIAP-Rutgers University

Subsequently the group presented their report for discussions.

- (2) Workshop about "Management of Tropical Acid Soils for the Establishment of Pastures" Date: November 10-14, 1986. Place: Gualaca, Chiriquí. Sponsored by: IDIAP-CIAT and the Rutgers University.

The general objective of the course was to provide training to 17 panamanian professionals from different governmental institutions or private enterprises which are related with the management of pastures in Panama.

The Soils Advisor, Dr. Alvaro Cordero, collaborated with Dr. Pedro Argel from Rutgers University and with the Engs. Oscar Sierra from CIAT and Bolivar Pinzón from IDIAP, in the aspects of organization and coordination of that event.

Likewise the Soils Advisor participated as a lecturer on "Acid Soils of Panama, Management and Research". Also, Eng. Santander Jaramillo from IDIAP collaborated on the description and classification of the soils profile of the Chiriquí Farm.

Together with Dr. José Salinas from CIAT, prepared for the mathematic processing of trials results, about the production of green and dry matter, originated from the test of adjusting the fertilization of the association of Andropogon gayanus with Centrosema macrocarpum.

We made tables of results and figures representing the responses of the legume and the grass to the application of fertilizers. It is appropriate to say that users, in this case the students of the course did an evaluation, and all the students coincided that the themes offered were first class and expressed their feeling that this course should be offered on an annual basis.

- (3) Regional Agronomic Workshop to Elaborate the First Draft for the "Guide to the Agronomic Diagnosis on Maize".

Date: November 24-27; Place: Villa de Los Santos; Sponsored: IDIAP-CIMMYT, Participants: Representatives of 8 nations of Central America, Panama and Caribbean area, with a total of 28 professionals. The Soils Advisor of Rutgers, was requested by the organizers of the event Dr. Jorge Jonas from IDIAP and Dr. Fred Kocher from CIMMYT to participate extensively on the discussions and preparing of the draft in all the soils subjects involved on the agronomy diagnosis of the maize.

The seminar met the goals pursued, and a first draft of the agronomic diagnosis on maize, was produced and submitted for review with the purpose of preparing a final draft around the middle of march, 1987, to be presented as a report on the Annual Reunion of the PCCMCA.

the document may be useful as an instrument to be used for agronomic studies of maize and as a source of information. It may also help with the rapid diagnosis of production constraints and the specific problems of maize cultivation.

One of the direct uses, of the guide for the agronomic diagnosis, could be to provide help on the planning of trials and interpretation of results, to help expedite the generation of viable technological options for farmers.

c) Technical Field Tours

Together with Eng. Name we visited the Chiriquí Region, with the purpose of observing and discussing in the field the research in which is directly involved or collaborating the Soils Advisor. The first visit was to the experiment of application of phosphorous fertilizer in two promising lines of rice (1048 and 1537) on the Alanje Farm. We evaluated this trial jointly with Cesar Martínez from CIAT and Eng. Eric. Batista from IDIAP. According to the evaluation the two lines positive responded to the maximum level studied of 270 kg of P_2O_5 /ha. Previous studies on phosphorous fixation on these soils, demonstrated that the fixation of the element (F) was about 84%. Also we observed that the line 1537 is more demanding to phosphorous than line 1048.

We advised Eng. Eric Batista, also, that he should take foliage sample at level of treatment (with a dosage of P), with the purpose to evaluate the concentration of P on the foliage (at 85 days on the flowering and at harvest). Also, Dr. César Martínez from CIAT considering the phosphorous response by the new genetic material of rice, requested for support of the Soils Specialist: Eng. Name and Dr. Cordero, on the management of application of fertilizers for future research on the Experimental Farms Alanje, in 1987.

We used the visit of the Farm of Alanje, to observe the research work that they are carrying out on the Soils Laboratory, from the Sugar Mill of Chiriquí.

We observed the Regional Trials of rice with advanced materials from the aluvial soils of the Chiriquí River. Also, we analysed the genetic materials of rice in the different

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selection processes that they are carrying out under the auspices of IDIAP together with the University of Panama, CIAT and the CEIACHI (Center of Studies and Agricultural and Livestock Research on Chiriquí). We evaluated the experiment on N (nitrogen) on 4 varieties of rice (CICA 8, 1048, 16404 and UP 1537), that is conducted by Eng. Tirso Solís of the University of Panama and Eng. Ezequiel Espinosa in collaboration with the Soils Advisor in the planning and definition of the doses of nitrogen and their management. We made an agronomic evaluation and we observed that all varieties responded to N, but on different ways. An example, the variety CICA 8, of wide use in Panama, on the last few years, shows great susceptibility to Piricularia, that is most acute with the applications of nitrogen, inclusive at low doses. We observed too, that the new promissory line 1048, has a lesser demand, than both, line 1537 and 16404, to the application of nitrogen fertilizer.

In the same Farm of Chiriquí (on the phase of acid soils), we observed the genetic material, with adoption qualities to the acid soils and infertility, the lines are F₂ ordinary from the savannahs of Santa Rosa, Colombia and the research is directed by Eng. Eric Jaén from the CEIACHI with the collaboration of CIAT that contribute with his phytogenetist Dr. Surapon Sarkarng. We discussed the possibilities of extending and testing the best materials at the Experimental Station of Calabacito on 1987. In the same phase of acid soils and infertility, we evaluated the experiment of "adjustment of the application of fertilizers to the association of Andropogon gayanus and Centrosema macrocarpum. Comparing the treatments without and with different doses of P, we did observe positive response of the legume and the grass to the application of P. With sulphur (S) the response was less dramatic, but positive. In relation with the third element, we observed that (K) gave a positive response only with the presence of the others elements P and S. This experiment was set up as part of the Workshop on management on Acid Soils for the Establishment of Pastures.

In the same province of Chiriquí on the IDIAP'S Experimental Station of Gualaca, Eng. Bolívar Pinzón from IDIAP attended the soils specialists, Eng. Name and Dr. Cordero, and pointed out the experiments on fertilization of pastures, that they are carrying out on this site. Within these experiments,

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stand out the experiment of application of fertilizers on Brachiaria humidicola 6133 and the establishment for a future experiment of fertilization on B. dictyoneura. Also, we observed the experiment of legumes with and without inoculation, the experiment of application of nitrogen and without nitrogen on Kudzu and with Arachis pintoii. Eng. Pinzón, pointed out other experiments of Dr. Pedro Argel from Rutgers University, on weeds control.

We also visited the Bromatology Laboratory, with the purpose to observe and propose collaboration if necessary to Lic. Singh and his assistant Vasco N. Centella, who came from the Soils Laboratory of Divisa to make the lectures on the Atomic Absorption Equipment.

During the visit to the Chiriquí, we visited the IDIAP'S Central Office on David and we talked with different professionals, specially with Dr. Pedro Argel and with Dra. Elizabeth de Ruiloba.

Identically we proceeded with the pineapple experiment, that IDIAP is guiding in collaboration with MIDA on the site of Lola de Las Palmas, in which is involved the Soils Specialist. During one of these tours to the experimental fields, we evaluated the development of the fruits visually and we might conclude, that one of the best treatments studied, were when we applied 5 ton/ha of lime and 28 qq of the formula 12-24-12/ha. Another tour to the experimental fields, was organized with the purpose of determining the harvest time of the trial. We rated the maturity stage of the pineapple crop, and decided to harvest the experiment on the first week of december.

In October, we went to San Jose de Las Tablas, province of Los Santos, together with the Engineers Rolando Sanchez Diez-Director of the Central Region, Benjamin Name and Alfonso Martínez of the Central Region and the Soils Advisor. The purpose of this technical tour was a demonstration of Dr. Jonas and Collaborators on the positive response to the applications of sulphur (S) to maize. We visited 2 fields of producers from the region and we confirmed, by examination of the plots with and without sulphurs (S), the positive effects

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of the application of sulphur on maize. We discussed together with the technical team, on the severe sulphur deficiency appearing on 1986, and the possible solution by the use of fertilizers that contain sulphur (s). It is also necessary to set up experiments on maize grown on that site, to study the proper dose of S. Also, the Soils Advisor, hinted the feasibility of making a diagnostic study of the area by means of analysis of sulphur (S) on the soils.

Thereinafter, joined with Eng. Lineth Carranza, Horticulture Specialist and Eng. Araiz Cajar, both of the staff of the Sub-Centre of IDIAP on Azuero and visited more than 100 has. of melons to be exported at the producer Manuel Haito. In part of the cultivation, we observed a generalized yellowness resembling sulphur deficiency. However, Eng. Carranza and Eng. Cajar, showed to the Soils Advisor, plots with and without S melon, 15 days after the application, the crop did not show any positive effect of the S application on melon plants. As a matter of fact, the Soils Advisor suggested to Eng. Carranza, the possibility of setting up on farms of another 4 producers (as a minimum) plots with and without S, and taking soils samples of these sites, in order to determine S and other elements. We also visited the Sub-Centre of IDIAP on Guarumal, South of Sona, where Eng. Sanchez Diez, showed to the Soils Advisor corn plants with yellowish leaves. Dr. Cordero and Eng. Name from IDIAP coincided that the symptomatic signs of the corn plant, seems a deficiency of sulphur (S).

The three earlier technical tours showed as a common factor the possible deficiency of S. for that reason, IDIAP for 1987 shall include research of sulphur on the priority crops.

In november, another technical tour to Chiriquí was conducted. In that opportunity, we traveled with Eng. Santander Jaramillo, specialist on soil genesis and soils classifications from the IDIAP staff with the purpose to make studies of the soils profile and classification of soils on the Experimental Farm on Chiriquí, on the Phase of Acids Soils of the University of Panama. Afterwards, we studied the soil profile, and Eng. Jaramillo and Dr. Cordero classified

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the soil tentatively as Tropudult. We used again this visit to Chiriquí to observe the experiment on phosphorous level on rice located on Alanje. Also, we gave advise to Eng. Eric Batista on the third foliage sampling.

Immediately after conclusion of the workshop on acids soils we received on the Experimental Station of Calabacito the specialist on management of acid infertile tropical soils from CIAT, Dr. James Spain. He was scorted on this tour by Dr. Pedro Argel from Rutgers University. The visitor was attended by Eng. Esteban Arosemena from IDIAP and the Soils Advisor who demonstrated to Dr. Spain recent experiments with pastures, crops and forest tree plots that IDIAP is conducting as experiments on Acid and Infertile Soils.

d) Working Reunions

During this quarter conducted on the Soils Laboratory in Divisa, meetings with the staff to better organize the personnel and obtain the best operation of the laboratory to fulfill the committments acquired with producers, technicians and agricultural institutions as CATIE that send soils samples to be analyzed.

We resolved the following:

- a) Better distribution of work load assigned to the laboratorists.
- b) Prepare all extracts of soils and their dilutions on Divisa and taken to the Bromatoloty Laboratory of IDIAP in Gualaca, Chiriquí, to use the A.A. equipment on this laboratory.

We pointed out, on the reunions held on the Soils Laboratory, that the Soils Advisor verified that the part (capillary) for the equipment (A.A.) send by the company, was not suitable and it could not be mounted on the IDIAP'S equipment A.A. This situation is regrettable, since we invested time on the request and the arrival of the replacement to Panama (city). This anomaly had caused, that the equipment A.A. of the laboratory is out of service. Affecting upon the normal working of the laboratory.

Also, on the quarter, the Soils Advisor, participated on meetings with the Technical Assistance Team of Rutgers to discuss on: a) Advances on the Project ATD in Panama, b) Working Plans for 1987, c) Policy calendars to present quarterly and annual reports. d) Statement of the extension of the Project ATD in Panama.

During the month of December, 1986 the Soils Specialist provided support and technical assessment to the Planning Exercise for agricultural and livestock research to be defined for 1987 on the Central Region. Eng. Rolando Sanchez D, Director of this region, assembled the professional staff, during days 1-2-3-4-5 and 9 (even later there were little changes on the programme) to search the priorities on research at products level under the different areas of influence of IDIAP on the Central Region. Included on these influence areas were: a) Penonome (La Pintada and Nata), b) La Villa de Los Santos (Parita-Los Santos, Tres Quebradas, San José, Las Tablas La Onda-Guarare, El Ejido), c) Santiago (Calabacito, Montijo, Ocú, Santa Fé), d) Sub-Centre of Guarumal, South of Soná (Guarumal, La Soledad, Río Grande).

It is important to mention that in the searching of these priorities participated technical personal of MIDA involved on the agricultural and livestock development of the Region and leaders of the programs of this institution, joined with the research personal from IDIAP at level of area or agricultural products.

The reunions were positive and high quality, technically speaking and also there were surprises, since the working groups, on some occasions, found research priorities on agricultural products or areas where IDIAP ever had influence (an example: citrus fruits).

The definition of priorities on research, were eminently at the regional level, and subsequently we verified its validity, when the National Agricultural Direction and the Planning Direction from IDIAP programmed with the technical staff of the Central Region, during the 10 and 11 of december, the definition of research priorities taking into consideration national and institutional policies.

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It was surprising the great resemblance of the research priorities with the two models.

With the purpose of preserving the planting on the Silvo pastoril plots on the Experimental Station of Calabacito we held reunions with Eng. Benjamín Name from IDIAP and the Eng. Luis Pitty from RENARE to obtain more shoots from the forestal nursery on Macaracas. We made all the arrangements and at the end of October we finished to sow all the plot.

Dr. Pedro Argel from Rutgers, Eng. Benjamín Name from IDIAP and Dr. Cordero discussed together the mechanics on the statistical calculation when they are using the experimental design, denominated "San Cristobal".

D. RESEARCH

On the course of October, November and December 1986, we continued given support to experiments on soils, application of fertilizers to crops, pastures and forestry trees that appeared enumerated on the previous Report N°17.

The most important activities included:

- On the Region of Los Llanos de Ocú, we made an evaluation together with the technical personal from IDIAP, on the experiments on cassava, principally on fertilization, as follows: a) Phosphorous fertilization on the association cassava/maize b) study of liming on cassava (Manihot esculenta crantz), c) study on management of N on cassava.

An evaluation conducted on October, revealed that the last two experiments b and c were found badly developed because of an attack of insects (trips) and laminated erosion produced by a hard draining off. We advised the staff from IDIAP commissioned of the trials the following: a) To make channels for drainage in order to diminish the hard draining off and b) To control the attack of trips. In addition, we recommended to apply foliage fertilizer to the trial on liming on Cassava.

In Chiriquí, we evaluated in two occasions the experiment of phosphorous fertilization on two lines of rice. At the beginning of October we sowed the experiment of adaptation of varieties of sorghym (25) on acid soils.

Chief on Research: Benjamin Name. Collaborator: Dr. Alvaro Cordero from the University of Rutgers; international collaborator institution: CIAT, which is contributing with the genetic material.

- We harvested three experiments; two of them for adjusting the fertilization on the Association Andropogon gayanus and Centrosema macrocarpum located one on Chiriquí and another one on Calabacito. The third experiment we harvested was on the "liming and fertilization on Pineapple Cultivation on Acids Soils on Lola de Las Palmas".
- We confronted situations out of the human control, on the management of some experiments, situations that affected the stages of the cultivations. An example, a hard draining off caused by a high rainy precipitation fell down during October (more than 700 mm) affected the establishment and development of the plants on the fertilization trials on kudzu and that of evaluation of the varieties of sorghum. The two trials were recently sown.
- Another experiment heavily affected was the trial on management of phosphorous on maize. On this trial the cause of the damage were animals. Since this experiment is of long term, after some of the objectives is to study the residual effects of the phosphorous applications, we resolved it will be sown during the first period (may) when the rainy season starts off.

E. OTHER ACTIVITIES

We prepared audio-visual material for the talks or conferences in which the Soils Advisor participated on the course of the quarter.

On November 16 to 18, we participated on the activities and reunions programmed on occasion of the visit to Panama by the President of Rutgers University, Dr. Edward J. Bloustein. Included on those activities, there was a reunion held by the President with the Technical Assistance Team to personally know of the activities and projections of each team member of the ATD project from Rutgers.

IV. LIVESTOCK RESEARCH AND PRODUCTION

JOSE ZORRILLA-RIOS, Ph. D

RE. QUARTERLY REPORT N°18

REPORT OF ACTIVITIES CONDUCTED BY DR. JOSE ZORRILLA-RIOS, LIVESTOCK SPECIALIST WITHIN THE AGRICULTURAL TECHNOLOGY DEVELOPMENT PROJECT OF THE UNIVERSITY OF RUTGERS, TO THE NATIONAL AGRICULTURAL RESEARCH INSTITUTE TO PANAMA, PERIOD OCTOBER - DECEMBER/86.

This last Quartely Report of 1986, describes activities conducted on:

- I. Research.
- II. Publications.
- III. Institucional Support and others.

I. Research.

Out_lines of seven research activities are included. Three con_ducted at an Experiment Research Station, three at on - Farm level an one, as a Regional survey - extension.

Title.- STRATEGIC SUPPLEMENTATION TO DUAL PURPOSE CATTLE.

Counterpart researcher.- E. Arosemena; J. L. Alba.

Location.- Finca Experimental Calabacito.

Duration.- July - November/86.

Objective.- Study the effect of a strategic supplementation (first 90 days of lactation) on sellable milk and reproductive performance.

Procedure.- Cows with less than 90 days after parturition, and those calving within four months of initiated the experiment, will be assigned alternatively, to one of three treatments:

1. Control. No supplementation. 24 h Grazing of Brachiaria humidicola (B.h.)
2. Cassava-molasses-urea. Individual supplementation, during the time of milking (once a day), with 2 kg of cassava and 0.5 kg of molasses-urea.
3. Legume Kudzú (Pueraria phaseoloides). Restricted grazing (5 h a day; 8 a.m. - 1 p.m.) of Kudzú, and B.h. the rest of the day.

Results.- Some partial results were already presented in the previous Quartely Report. Current results corresponding to 15 cows are presented in Table 1, Graph 1.

This trial had to be finished before schedule, due to the removal (selling) from the herd, of pregnant cows near parturition, programmed to be used ⁱⁿ the trial.

Title.- EVALUATION OF RESTRICTED GRAZING OF THE LEGUME KUDZÚ (PUE-
RARIA PHASEOLOIDES), IN COMPARISON TO AN ENERGY-PROTEIN
SUPPLEMENTATION TO DUAL PURPOSE COWS.

Counterpart researcher.- E. Arosemena.

Location.- Finca Experimental Calabacito.

Duration.- September - Novemeber/86.

Objectives.- 1. Identify nutritive characteristics of Kudzú, when used as a Protein-Bank to dual purpose cows.
2. Obtain experience and knowledge in the performance of Kudzú under direct grazing conditions, for the Calabacito area.

Procedure.- Twelve cows at a different stage of lactation, were ran-
domly assigned to one of four treatments:

1. Control (C). No supplementation. 24 h Grazing of Brachiaria humidicola (B.h.).
2. Cassava-molasses-urea (CMU). Individual daily supplementation during milking (once a day) with 2 kg of cassava and 0.5 kg of molasses-urea. 24 h Grazing of B.h.
3. Cassava-molasses-urea + fishmeal (CMU-FM). Same as CMU, plus approximately 220 grams/cow/day of FM.
4. Kudzú (K). 5 h a day grazing on Kudzú. Grazing on B.h. the rest of the day.

Partial results.- General means of nine observations/treatment on sellable milk are shown in Table 2. Statistical analysis of data according to experimental design (Switch-Bak) is in progress.

Title.- EVALUATION OF A PROTEIN BANK (KUDZU, Pueraria phaseoloides) IN THE REARING OF CALVES IN A DUAL PURPOSE SYSTEM. I. WET SEASON.

Counterpart researcher.- E. Arosemena.

Location.- Finca Experimental Calabacito.

Duration.- Two years. Initial date: November/86.

Objective.- To evaluate the effect of a Protein-Bank (Kudzú, Pueraria phaseoloides), in the growth performance of calves, managed under a controlled suckling programme.

Procedure.- Depending on availability of calves, those already present and those to be born, will be randomly assigned to two treatments:

1. Kudzú. Restricted grazing to e Protein-Bank, 5 h daily (8 a.m.- 1 p.m.).
2. Grama. 24 h grazing of Pangola (Digitaria decumbens).

All calves are reared under a controlled suckling system, where calves promote the milk-release effect and are allowed to suck the residual milk. After that, they grazed according to treatment, separately from the dam the rest of the day, except for a midday (apx 1 p.m.) suckling period (full milk) of 30-45 minutes.

Partial results.- Till December/86 (two months observation period), there has been 8 calves/treatment. This period (November-December) has been considered as the "Wet Season Period". The trial will be continued through the Dry Season, depending on Kudzú availability (persistency). Partial results in terms of sellable milk and calves growth for the Wet Season, are presented in Table 3.

Title.- EFFECT OF FISH MEAL SUPPLEMENTATION ON PERFORMANCE OF DUAL PURPOSE COWS. I. WET SEASON.

Counterpart researcher.- J. L. Alba.

Location.- "On-farm".Ocú, Herrera Province.

Duration.- Wet Season: September to November/86.

Objective.- Study in terms of sellable milk and reproductive performance, the effect of fish meal supplementation to dual purpose cows.

Procedure.- According to stage of lactation, cows were distributed among two treatments:

1. Molasses-urea (MU). The traditional practice.

2. Molasses-urea plus fishmeal (MU-FM).

Both treatments were offered individually, during the time of milking (once a day).

Partial results.- These include nine weekly record of individual milk production (sellable), and are shown in Table 4. Mean supplement intakes are shown in Table 5. Reproductive status of the herd at the end of the wet season will be recorded in February/87.

This trial is intended to be continued during March-April/87, to see the response during the dry season.

Title.- ESTABLISHMENT OF A PROTEIN-BANK OF CENTROSEMA MACROCARPO AND ITS EFFECT ON THE REARING OF CALVES IN A DUAL PURPOSE SYSTEM.

Counterpart researcher.- L. Tasón; Pedro Argel.

Location.- "On-farm". Ocú, Herrera Province.

Duration.- Three years. Starting date: September/86.

Objective.- 1. Obtain agronomic data on establishment and persistency of Centrosema macrocarpo, as a protein-bank for calves.

2. Study the effect of C. macrocarpo on the performance of calves in a dual purpose system.

Partial results.- After one re-seeding, approximately half an hectare is under an establishing process. This area is planned to be grazed during the next wet season (June onwards/87).

Title.- REPRODUCTIVE PERFORMANCE OF A COMMERCIAL BREEDING HERD IN THE COCLE PROVINCE, PANAMA.

Counterpart researcher.- M. Jaén.

Location.- "On-farm".Coclé Province.

Duration.- Finished.

Objective.- Determine environmental and managerial factors influencing the reproductive performance of beef cows, in the Coclé Province.

Procedure.- Records of 427 calving dates (1981-1985) of a commercial breeding herd were analyzed. This herd was kept under a continuous mating program during this period.

Results.- Yearly calving percentage, calving and fertility pattern distribution over months, after calving open-days and post-parturition intervals were determined and related to rainfall pattern and management practices. Results are presented in Tables 6-11, and Figure 2. Statistical analysis of data is still pending.

Title.- MINERAL SUPPLEMENTATION OF CATTLE IN THE TROPICS.

CategoryCooperative research with the Department of Animal Science, University of Florida, Dr. Lee R. McDowell.

Counterpart researcher.- M. Jaén.

Location.- Central Provinces.

Duration.- Two years.

Objective.- 1. Study mineral composition and its variation on commercial mineral supplements.

2. Develop a suitable mineral box to supplement cattle under grazing conditions.

Partial Results.-

- Samples of four commercial mineral supplements, obtained with a 3-4 months interval, were sent to the U. of Florida for laboratory analyses.
- A mineral-box was designed and constructed. Several boxes are under testing, either at on Experimental Farm or with producers. This design is beleived to accomplish most of the desired requirements:

- a. It is cheap (\$10.00 in parts for the most).
- b. Easy to built by any producer.
- c. Portable. Can be used to favor a more even grazing of paddocks.
- d. Reduces supplement losses due to rain/wind.
- e. Facilitates the continuous supply of supplement, without requiring frequent loads (takes up to 125 lb. of mineral supplement).

Note: A diagram (tentative) is included.

II. Publications.

- A Research in Progress Note on the topic: IMPROVEMENT ON THE NUTRITIVE VALUE OF FORAGES. I. CHEMICAL COMPOSITION AND INTAKE, was approved for publication.
- A technical Note on: DESIGN OF A MINERAL BOX FOR GRAZING CATTLE was submitted for publication.

III. Institutional support and other activities.

1. Seminars/Workshops.

- a. Invited speaker at the Second Symposium on Milk Pro-

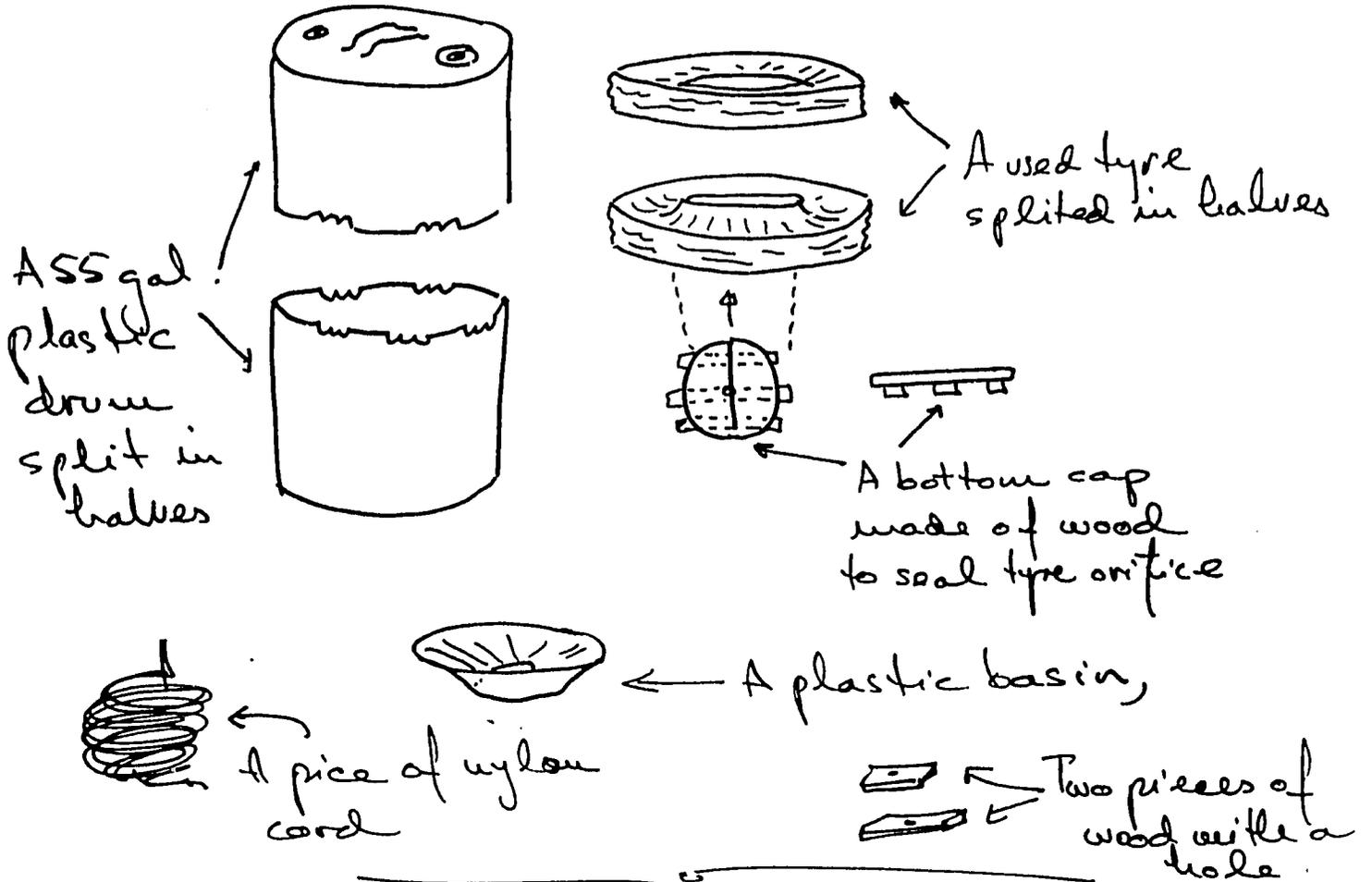
- duction at the Central Provinces, organized by NESTLE Co.
- b. A workshop was organized by the Directorate of the National Livestock Program, within the Ministry of Agriculture, to evaluate the manuscript about Alternative Strategies for Livestock Management During the Dry Season, submitted to their consideration. After thorough discussion, the manuscript was accepted and the General Director of Livestock Program requested to be encharged on its publication.
2. Official visit. University of Rutgers President and collaborators visit to Panamá Agricultural Sector was assisted, according to our assignments.
 3. Working Plan. A final version of the working plan was presented to IDIAP, AID/Panama Mission and U. of Rutgers authorities.
 4. IDIAP Research Activities Plan-1987. There was participation in the consultation meetings organized by the Central Region IDIAP Director, with the Agricultural (Livestock) Technical staff of the Ministry. This strategy was undertake as a procedure to identify research priorities on which to focuss IDIAP activities.
 5. A weighing box for suckling calves was designed and built. After several modifications, a suitable model was achieved. This tool partially fullfills a defficiency at the Experimental Station Calabacito, as well as "on-farm" research.

Sketch of mineral box.

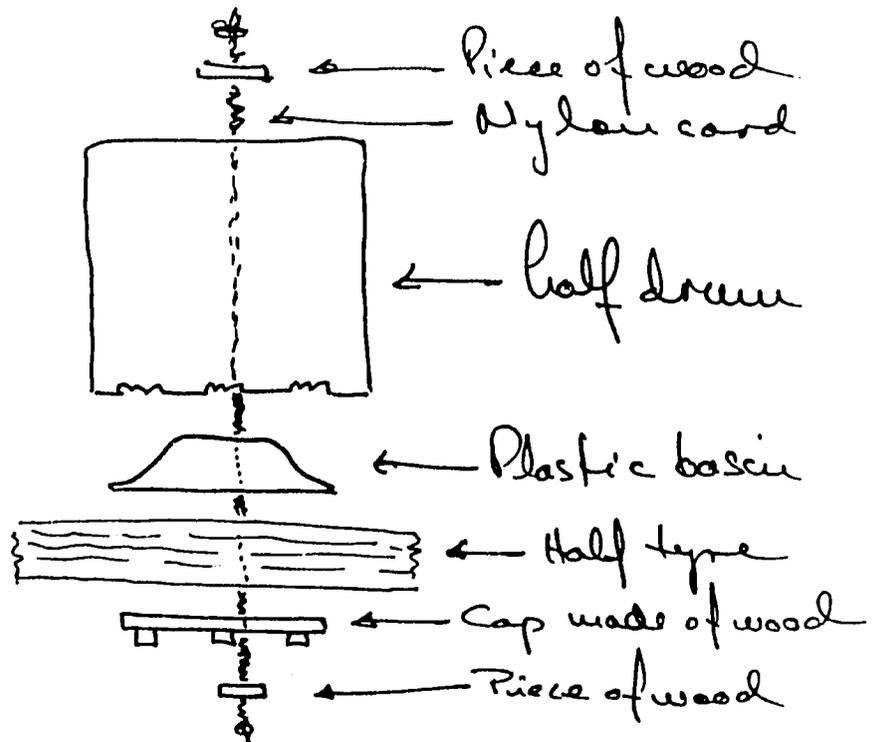
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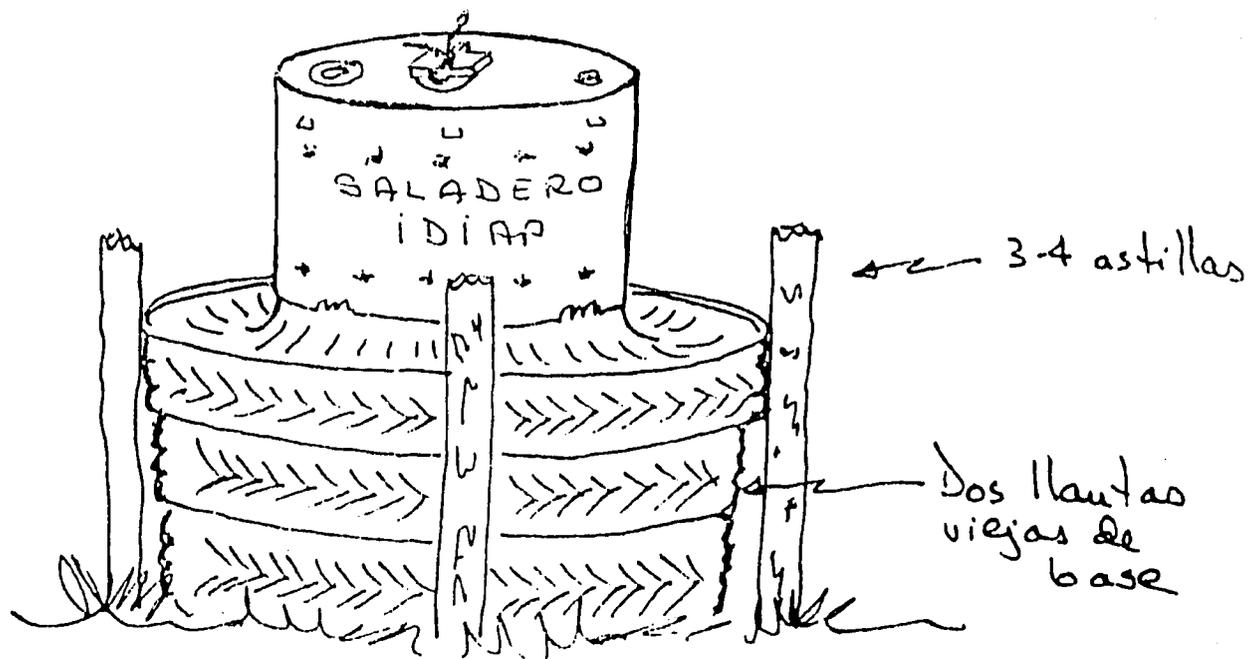
Parts -



Assembly -



III. INSTALACION. -



IV. INDICACIONES PARA SU USO

1. Apriete el tanque dándole vueltas al tapete de madera superior amarrado al hilo de nylon a manera de un torniquete.
2. Llene el tanque con sal mineralizada.
3. Aplique un movimiento circular al tanque, para obligar a la sal mineralizada a derramarse sobre la llanta. Repita esta operación cada 3-4 días.
4. Permita al ganado el libre acceso a la sal mineralizada. Su consumo se estabilizará en aproximadamente 3-4 onzas/cabeza al día, en el curso de 2-3 semanas de adoptar esta práctica.

Table 1. EFFECT OF SUPPLEMENTATION TO DUAL PURPOSE COWS, DURING THE FIRST 90 DAYS OF LACTATION, ON MARKETABLE MILK (Kg/cow/day).

Week of lactation ^{1/}	TREATMENTS ^{2/}					
	Control	Obs. ^{3/}	CMU	Obs.	Kudzu	Obs.
2 ^a	3.75	2	4.95	2	5.3	1
3 ^a	3.95	2	4.77	3	5.35	2
4 ^a	4.10	1	4.27	3	5.70	2
5 ^a	-	-	4.90	2	5.45	2
6 ^a	-	-	5.0	1	5.0	1
7 ^a	2.80	1	5.2	1	4.2	2
8 ^a	3.40	1	4.95	2	3.9	2
9 ^a	3.10	1	4.65	2	3.8	3
10 ^a	3.55	2	4.30	2	4.17	3
11 ^a	3.83	3	3.47	3	3.67	3
12 ^a	3.87	3	3.45	2	4.0	3
13 ^a	3.85	2	3.20	2	3.85	2
Promedio	3.62 ± .41		4.43 ± .67		4.53 ± .76	

1/ No milk production is recorded during the first week of lactation.

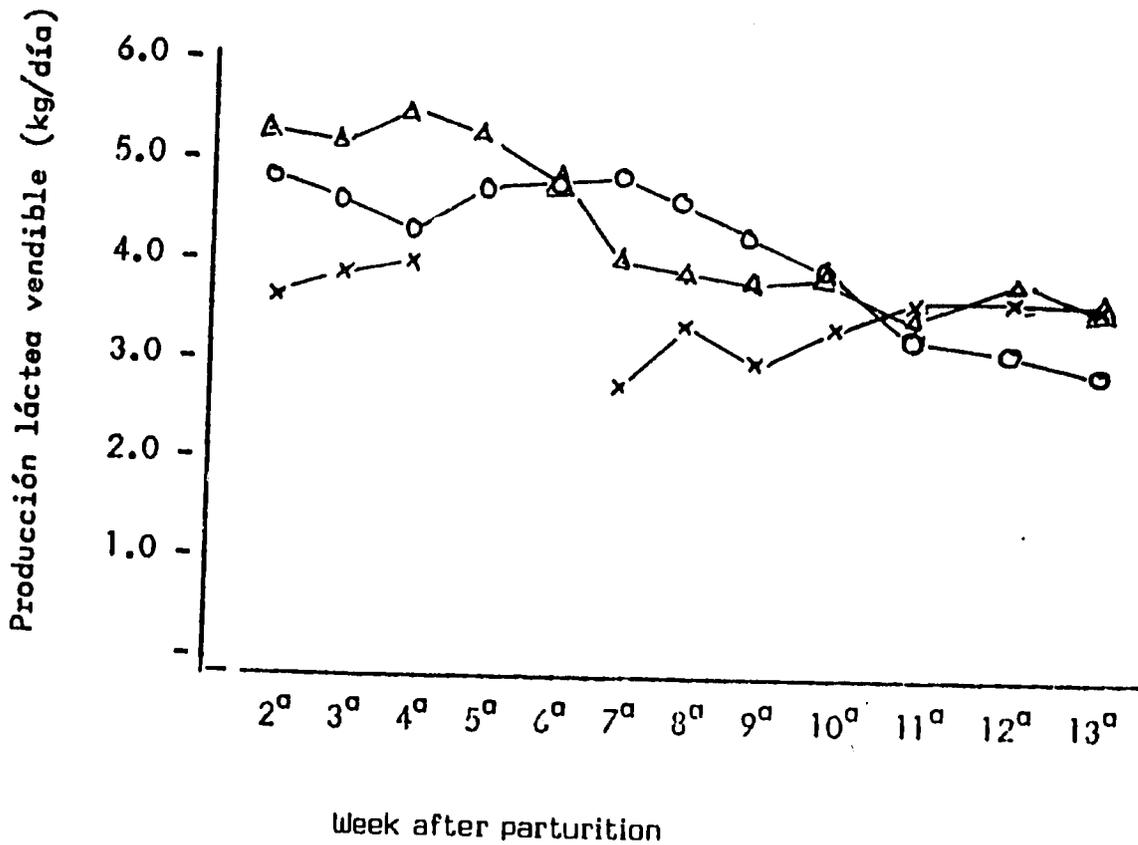
2/ Control: Without supplementation.

CMU: Cassava-molasses-urea= Cassava (dried) 2 kg+molasses-urea 0.5 kg/cow/day during milking (once a day).

Kudzu= Grazing of kudzu during 5 h/day.

3/ Number of cows/week.

Graph 1. MARKETABLE MILK PRODUCTION PATTERN OF DUAL PURPOSE COWS AS INFLUENCED BY SUPPLEMENT.



- x — x Control (no supplement).
- 0 — 0 Cassava-molasses-urea.
- Δ — Δ Kudzu (protein bank).

Table 2. EVALUATION OF A PROTEIN BANK (KUDZU, PUERARIA PHASEOLOIDES) vs AN ENERGY SUPPLEMENTATION (CASSAVA-MOLASSES-UREA) OR ENERGY-PROTEIN SUPPLEMENTATION (CASSAVA-MOLASSES-UREA + FISH MEAL) IN MARKETABLE MILK PRODUCTION OF DUAL PURPOSE COWS.

Treatment ^{1/}	Marketable Milk (kg/cow/day; X _s DS)
CONTROL	2.58 ± 0.40
CMU	2.70 ± 1.04
CMU+FM	3.22 ± 0.49
KUDZU	3.90 ± 1.41

^{1/} Control = Without supplement. 24 h Grazing of *Brachiaria humidicola* (B.H.)

CMU = Cassava-molasses-urea. Grazing 24 h of B.H.

CMU+FM = CMU + FISH MEAL. Grazing 24 h. of B.H.

KUDZU = Grazing of kudzu 5 h/day and the rest on B.H.

Table 3. A COMPARISON ON THE REARING OF CALEVS ON A BANK OF PROTEIN (Kudzu, Pueraria phaseoloides) vs GRAMA (Pangola, Digitaria decumbens), UNDER A RESTRICTED SUCKLING SYSTEM^{1/}, OF A DUAL PURPOSE HERD. (N=8).

Period	Marketable milk (kg/cow/day)		Caleves average daily gain (g/day)		
	KUDZU ^{2/}	GRAMA ^{3/}	Period	KUDZU	GRAMA
12-15/Nov.	4.4 ± 1.05	3.6 ± .84	Nov. 11		
16-22/Nov.	3.8 ± .83	3.3 ± .64	Dic. 10	451 ± 180	393 ± 120
23-29/Nov.	3.7 ± .74	3.3 ± .84			
30-6/Dic.	3.0 ± .75	2.8 ± .67	Dic. 11		
			Enero 6	475 ± 180	392 ± 90

^{1/} Restricted suckling system- Calves are used to promote "milk let down", to suck residual milk after milking (once a day) and full suckling for 30-45 minutes again at mid day.

^{2/} KUDZU- Calves graze on kudzu 5 h/day (8 am-1 pm), and Pangola for the rest of the day.

^{3/} GRAMA- Calves graze Pangola the whole day.

Table 4. EFFECT OF FISH MEAL SUPPLEMENTATION ON MARKETABLE MILK FOR DUAL PURPOSE COWS, DURING THE WET SEASON (lb/cow/day).

Week	MONTHS AFTER PARTURITION:							
	ONE OR LESS TREATMENTS ^{1/}				THREE OR MORE TREATMENTS			
	No		No		No		No	
	Obs.	MU	Obs.	MU+FM	Obs.	MU	Obs.	MU+FM
1	8	8.9±1.8	6	9.3±1.1	4	7.4±1.0	4	8.6±2.0
2	8	8.8±1.8	6	9.0±1.5	4	7.5±1.1	4	9.5±2.8
3	8	9.3±2.0	6	9.6±0.6	4	7.9±1.6	4	10.9±3.0
4	8	9.0±2.1	6	8.7±1.8	4	8.4±2.4	4	9.3±2.0
5	8	9.6±2.5	6	9.8±1.5	4	7.9±1.3	4	10.1±2.8
6	7	8.9±2.2	6	9.1±1.0	3	8.8±2.9	4	9.8±2.0
7	7	9.0±1.8	6	9.3±0.9	3	9.2±3.3	3	10.75±1.5
8	7	9.9±2.7	6	10.1±2.1	3	9.4±3.3	4	9.8±2.7
9	7	9.8±2.6	6	10.0±1.4	3	9.3±3.4	4	9.3±2.5
MEAN		9.25±0.4		9.43±0.5		8.43±0.8		9.78±0.7
DIFFERENCE				+ 0.13				+ 1.35

^{1/} MU= Molasses-urea

MU+FM= Molasses-urea + Fish Meal

Table 5. AVERAGE DAILY INTAKE OF SUPPLEMENTS BY DUAL PURPOSE COWS DURING THE WET SEASON.

SUPPLEMENT	T R E A T M E N T ^{1/} :	
	MU	MU+FM
Molasses-urea	1.5 lb	1.12 lb
Molasses-urea		
Fish meal	--	212 g

^{1/} MU = Molasses - urea

MU + FM = Molasses - urea + fish meal.

Table 6. MONTHLY RAIN DISTRIBUTION FROM YEARS 1972 - 1984 (Milímetros; $\bar{X} \pm SD$)
AT THE COCLE PROVINCE, PANAMA.

MES	ESTACION METEOROLOGICA					
	LAS LAJAS DE COCLE (Tierras Bajas)		LLANO GRANDE (Tierras de Transición)		LA PINTADA	
Enero	4.6 ±	14.0	50.1 ±	28.3	23.9 ±	32.9
Febrero	1.0 ±	2.9	21.9 ±	19.9	10.9 ±	12.6
Marzo	15.2 ±	26.2	19.5 ±	17.0	15.2 ±	20.3
Abril	39.5 ±	51.2	61.7 ±	63.4	54.4 ±	44.4
Mayo	146.0 ±	82.5	205.5 ±	81.0	169.2 ±	45.4
Junio	200.8 ±	106.2	162.9 ±	70.9	168.1 ±	76.1
Julio	135.6 ±	49.2	129.0 ±	45.8	116.7 ±	53.1
Agosto	160.1 ±	89.2	200.0 ±	78.3	208.7 ±	80.4
Septiembre	185.3 ±	77.1	260.9 ±	73.9	271.0 ±	123.4
Octubre	295.0 ±	120.4	300.6 ±	83.8	341.8 ±	116.8
Noviembre	193.0 ±	141.8	197.1 ±	114.2	186.2 ±	104.0
Diciembre	38.4 ±	39.8	85.2 ±	53.4	73.4 ±	83.9
Total	1414 ±	604	1694 ±	362	1640 ±	418

Table 7. CALVING PERCENTAGE OF A BREEDING HERD AT COCLE PROVINCE, PANAMA

YEAR	NUMBER OF COW. S :		PERCENTAGE
	BRED	CALVED	
1981	154	100	64.9
1982	160	99	61.8
1983	134	67	50.0
1984	157	80	50.9
1985	145	82	56.5
TOTAL	750	427	56.9

Table 8. MONTHLY DISTRIBUTION OF CALVINGS AND CONCEPTIONS OF A BREEDING HERD AT COCLE PROVINCE, PANAMA (Monthly percentage of anual total).

MONTH		YEAR					TOTAL	
CALVING	CONCEPTION ^{1/}	1981	1982	1983	1984	1985	No ^{2/}	%
Enero	Mayo	15	9.1	6.0	10.1	10.9	45	10.5
Febrero	Junio	21	4.0	14.9	3.8	7.3	44	10.3
Marzo	Julio	15	8.1	7.1	7.6	12.2	46	10.8
Abril	Agosto	8	3.0	13.4	11.4	4.9	33	7.7
Mayo	Septiembre	5	8.1	6.0	19.0	9.8	40	9.4
Junio	Octubre	8	5.1	7.1	8.9	4.9	31	7.3
Julio	Noviembre	5	13.1	4.5	5.1	3.7	28	5.6
Agosto	Diciembre	2	11.1	7.5	3.8	6.1	26	6.1
Septiembre	Enero	10	5.1	7.5	8.9	10.9	36	8.4
Octubre	Febrero	1	15.2	4.5	11.4	2.4	30	7.0
Noviembre	Marzo	4	12.1	7.1	8.9	17.1	44	10.3
Diciembre	Abril	6	6.1	4.5	1.3	9.8	24	5.6
Total Anual ^{3/}		100	99	67	79	82	427	100

1_/ Month of conception previous . calving, estimated as a gestation length of 280 days.

_2/ Total number of monthly calvings for each year.

_3/ Total number of calvings per year.

Graph 2. PATTERN DISTRIBUTION OF MONTHLY PERCENTAGE OF CONCEPTION OF A BREEDING HERD AND RAINFALL AT COCLE PROVINCE, PANAMA.

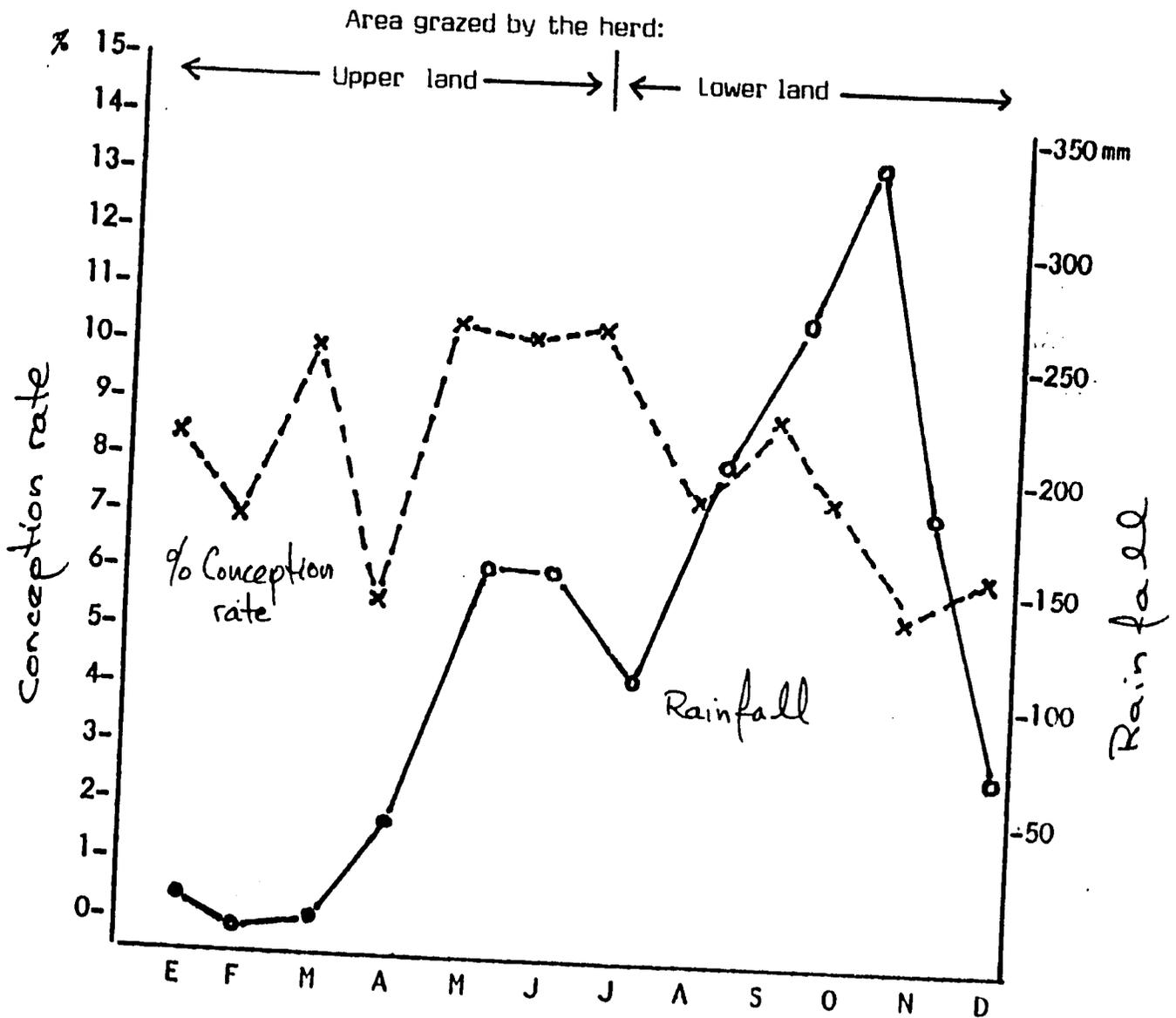


Table 9. DISTRIBUTION OF OPEN DAYS AFTER CALVING, ACCORDING TO MONTH OF CALVING, FOR A BREEDING HERD AT THE COCLE PROVINCE, PANAMA.

MONTH	J	F	M	A	M	J	J	A	S	O	N	D
.No. Obs.	28	24	25	15	15	15	15	10	13	17	16	15
Days	340	322	328	345	311	280	328	259	281	299	343	299
Average:	January - June = 321 ± 23.5						July - December = 302 ± 30.5					

1/ Open days after calving - Subsequent calving intervals minus 280 days of gestation

Table 10. MONTHLY PRESENTATION OF OPEN-DAYS AFTER PARTURITION^{1/} OF A BREEDING HERD AT THE COCLE PROVINCE, PANAMA.

Month	No Obs	length of open-days:		
		120	121 - 220	221
January	28	0	10.7	89.3
February	24	4.2	8.3	87.5
March	25	0	12.0	88.0
April	15	6.7	0	93.3
May	15	6.7	20.0	73.3
June	15	20.0	6.7	73.3
July	15	0	0	100.0
August	10	10	20	70
Septemb	13	0	23.1	76.9
October	17	0	29.4	70.6
November	16	0	6.3	93.7
December	15	0	30	80
Jan-June	122	4.9	9.8	85.2
Jul-Dec	86	1.2	16.3	82.6

^{1/} Open-days after parturition = Calving interval minus 280 days gestation.

Table 11. EFFECT OF WEANING AND MONTH OF THE YEAR IT TAKES PLACE, ON CONCEPTION OF BREEDING COWS AT COCLE PROVINCE, PANAMA.

Month of calving	No. obs.	Calving interval (days)	Month of weaning	Month of conception ^{1/}	Interval weaning-conception (meses)
January	28	620	September	November	2
February	24	602	September	December	3
March	25	608	November	January	2
April	15	625	November	February	3
May	15	591	January	February	1
June	15	560	January	February	1
July	15	608	March	May	2
August	10	539	March	April	1
September	13	561	May	June	1
October	17	579	May	July	2
November	16	623	July	September	2
December	15	579	July	September	2

^{1/} Estimated from the following calving interval minus 280 days gestation.

V. AGRICULTURAL RESEARCH ADMINISTRATION
AND MANAGEMENT

CARLOS A. NEYRA, Ph. D

RE. QUARTERLY REPORT N° 18

ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL RESEARCH

Carlos A. Neyra, Ph. D.

PERIOD: OCTOBER 1 TO DECEMBER 31, 1986

The ATD project and Rutgers University are providing, since 1985, the services of an Agricultural Research Administration Management Specialist in Panama. This specialist provides technical assistance for the purpose of helping improve resource use and the overall management and administrative capacity of IDIAP. The specialist is also acting as a Chief-of-Party of a five persons research team placed in country by Rutgers University as part of the Technical Assistance component of the ATD project.

The activities report of the Ag. Research Adm. Mgt Specialist for this quarter, are organized according to the following specific goals:

- A. "To assist IDIAP in the formulation and implementation of institution objectives, strategies, priorities and evaluation of agricultural research".
- A major event during this quarter was offering in Panama City of a Workshop seminar entitled: "Ventajas Comparativas de la Agricultura Panameña", sponsored jointly by IDIAP, Rutgers University and ISNAR (International Service for National Agricultural Research).
- B. "To act as Chief-of-Party and in-country coordinator of the technical assistance provided by Rutgers University to the ATD project in Panama".
- A major event during this quarter was the visit to Panama by Dr. Edward J. Bloustein, President of Rutgers University.

ACTIVITIES

- A. GOAL: "To assist IDIAP in the formulation and implementation of institutional objectives, strategies, priorities and evaluation of agricultural research".

- A.1. Organization of a Workshop on ATMS

The Ag. Research Adm. Mgt. Specialist actively participated in the organization of a Workshop seminar offered in Panama City entitled "Comparative Advantages of Panamanian Agriculture", jointly sponsored by IDIAP, Rutgers University and ISNAR (International Service for National Agricultural Research) and coordinated in country by Miguel Cuellar,

National Director of Planning of IDIAP and Carlos A. Neyra, Rutgers Specialist. The event took place on October 13, 14 and 15 and was attended by representatives of various Panamanian Organizations related to the Agricultural Sector, including: MIDA (Ministerio de Desarrollo Agropecuario), MIPPE (Ministerio de Planificación y Política Económica), UP (Universidad de Panamá), BDA (Banco de Desarrollo Agropecuario), CNI (Consejo Nacional de Inversiones), IPCE (Instituto Panameño de Comercio Exterior), CNS (Comité Nacional de Semillas), IICA (Instituto Interamericano de Cooperación Agrícola) and the sponsoring institutions: Instituto de investigaciones Agropecuarias de Panamá (IDIAP), Rutgers University and ISNAR.

The two principal objectives of this workshop were:

1. To present to the different institutional components of the Agricultural sector the results of using a methodology for the analysis and identification of the most urgent needs by the agricultural research programs of Panama.
2. To promote a dialog on sector policy, expand the analysis of agricultural performance, and to develop a consensus about priorities for research, training needs, technology transfer, participation of the private sector and related policies.

A full report on the Workshop is being prepared and will be ready for distribution, shortly.

A.2. ATD PROJECT: Extension/Amendment

During this quarter the Ag. Research Adm. Mgt specialist was extensively involved in discussions dealing with conceptualization and procedures for the Extension of the ATD project and the Technical Assistance provided by Rutgers University to IDIAP. This discussions involved IDIAP, USAID/Panama and Rutgers University. Three major issues were extensively discussed:

- a) Rutgers insisted that the concept and spirit of the strategic Plan should be maintained and incorporated as part of the new contract/amendment and that the level of effort (TA) should be supported as indicated in the Strategic Plan.
- b) Rutgers also insisted that the ATD project and Technical Assistance be extended for at least two years (1987-1988).
- c) Donal DRGA was mainly concerned about Research Methodologies of the ATD project and would like to see more work using the Farming Systems Research approach. He indicated that this issue was not addressed within the Strategic Plan prepared by Rutgers.

During this time a new General Director of IDIAP was appointed, Ing. Tomás Noriega former Director of ENASEM (Empresa Nacional de Semillas). The Ag. Research Adm. Mgt. Specialist held meetings with the new Administration to define Technical Assistance needs for the Institute and the ATD project. Those meetings included the General Director, The National Director for Agronomical Research, Dr. Gaspar Silvera and the National Director for Livestock Research, Dr. Rafael Castellón. A request was made to strengthen the current composition of the Technical Assistance team by incorporating the following components:

- 1) Microeconomist, with particular skills to work on Research Evaluation and Priorities definition.
- 2) Horticulturalist, to work on lowland vegetables, roots and tuber crops.
- 3) Extensionist, to help develop effective links between Technology Generation and Transfer.
- 4) Phytopathologist, to work primarily on Vegetable crops.
- 5) Food Science Technologist, to help develop Agro-Industry research.
- 6) A Chief-of-Party, to be appointed to lead the Ten (10) persons Technical Assistance Team in Panama. The total level of effort would be eleven (11) long-term positions.

I was informed, on the other hand, that USAID/Panama will request to Washington an Amendment to the Project for two years, seven (7) TA specialists including a Chief-of-Party and twelve (12) months of short-term Technical Assistance.

The Ag. Research Adm. Mgt. Specialist also met on several occasions with Donald DRGA, USAID Project officer to discuss the issues concerned with Research methodologies and Project Purposes. DRGA wanted to convey the following points:

1. The project should emphasize on the small farmer production systems research methodologies with a focus on the development of technologies which are economically as well as technically feasible at the micro (On-farm) level. The Technical Assistance should help IDIAP with the implementation of the Farming Systems Research Methodology.

2. Planning for the research should start at the farm level and farmers are expected to participate actively in the research activities. This issue was also strongly addressed by the Evaluation Team appointed by USAID/Panama (See report N°17).

During the course of this discussions the Ag. Research Adm. Mgt. specialist also tried to convey the characteristics of the Rutgers TA:

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1. The most successful research effort undertaken by the Rutgers TA have been aimed at solving critical problems faced by farmers and Panamanian Agriculture.
 2. The Horticulture and Pasture Programs have been successful because they have recognized farmer needs. Working with selected farmers have also made use of the knowledge and expertise available in-country as well as from other countries, including the support from the International Research Centers (CIAT; CIMMYT; CATIE, etc).
 3. The Rutgers TA have made use of combined methodologies including on-farm applied research in conjunction with Experiment Station research and should continue to do so. The ATD Project Paper does not exclude work done in laboratories or Experiment Station. It is our belief that the Rutgers TA has, in principle, complied with the requirements of the Project Paper.
- B. GOAL: "To act as a Chief-of-Party and in-country coordination of the Technical Assistance provided by Rutgers University to the ATD project in Panama".

ACTIVITIES

The Ag. Research Adm. Mgt. specialist used about 50 percent of the effective time in activities related to its function as a Chief-of-Party and overall Project Coordination. These activities can be grouped as follows:

1. Keeping records of activities and reports for each member of the Rutgers Technical Assistance team.
2. Review and editing, in Spanish and English, of the quarterly reports and work plans prepared by the TA team.
 - Organization of Report N°17 for the period from July 1 to September 30, 1986.
3. Participate and assist with the coordination of visits to Panama by Rutgers faculty as part of the backstopping efforts to the ATD project and related activities:

RUTGERS FACULTY VISITING PANAMA

(OCTOBER-DECEMBER 1986)

Name	Expertise or Position	Month
Reed Hertford	Director, International Agric. and Food Programs (IAFP)	October



Judy Snow	Assistant Director, IAFP	October
John J. Kupcho	Extension Spec., Head	October
Nicholas Pintauro	Food Sciences, Head	October
Gonzalo Villalobos	Food Sciences, Researcher	October
*Edward J. Bloustein	President, Rutgers Univ.	November
Nathaniel Pallone	Vice-President, Rutgers Univ.	November
Sylvester Whittaker	Director, Rutgers International Programs Office	November
Reed Hertford	Director, IAFP	November

* This visit is covered more extensively below.

4. Visit by Rutgers President.

Dr. Edward J. Bloustein visited Panama from November 16 to 20, 1986, in response to formal invitations made by USAID/Panama, MIDA (Ministerio de Desarrollo Agropecuario) and the University of Panama. He was accompanied in his tour by Dr. Nathaniel J. Pallone, Vice President of Academic Affairs, Dr. Sylvester Whittaker, University Director of International Programs and Dr. Reed Hertford, Director of International Agriculture and Food Programs at Cook College, Rutgers University. In country coordination was made by the Rutgers Chief-of-Party and his Administrative Assistant Ms. J. Stone.

The activities of the Rutgers Party were initiated with a discussion of the agenda and informative briefing by C. Neyra. The agenda was prepared and carried out to help the Rutgers Visitors accomplish the main purpose of the trip: "To strengthen the links with Panama in the fields of Education, Research, Technology Transfer and the complementation with the Panamanian Private Sector dealing with Industry, Commerce and Export Markets development".

Thus, the Agenda was organized to cover meetings with:

- a. High Ranking U.S. Representatives
 - US Embassy in Panama
 - USAID/Panama
- b. Panamanian Public Institutions:
 - Universidad Nacional de Panama
 - IDIAP(Instituto de Investigaciones Agropecuarias de Panamá)
 - INRENARE(Instituto de Recursos Naturales Renovables)

c. Panamanian Private Sector:

- Commerce and Industry
- City Developers
- Agricultural Associations and Cooperatives
- Private Producers.

d. Rutgers Technical Assistance Team in Panama.

- Dr. Pedro Argel, Tropical Pastures
- Dr. Alvaro Cordero, Soil Fertility and Management
- Dr. Mark Gaskell, Vegetable Production
- Dr. José Zorrilla-Ríos, Animal Nutrition
- Dr. Carlos A. Neyra, Administration and Mgt. Agricultural Research

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