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PROGRESS REPORT N°19

PROJECT: AGRICULTURAL TECHNOLOGY DEVELOPMENT IN PANAMA

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

PERIOD: JANUARY 1 TO MARCH 31, 1987

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 January 1 to March 31, 1987, 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:

	AREA	SPECIALIST
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)

ATD - PANAMA PROJECT

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

REPORT N°19

CONTENTS

		PAGE
I.	Tropical Pastures Dr. Pedro Argel	
	- Background	1
	- Germoplasm	2
	- Seed Multiplication	8
	- Future Plans	8
II.	General Agronomy Dr. Mark Gaskell	
	- Background	11
	- Activities During the Reporting Period	11
III.	Soil Fertility and Management Dr. Alvaro Cordero	
	1. Introduction	15
	2. Capacitation and Technical Assistance	15
	3. Meetings, Conferences, Seminars, Technical Field Trips	18
	4. Research Activities	20
	5. Other Activities	21
IV.	Livestock Research and Production Dr. José Zorrilla-Ríos	
	I. Research	23

CONTENTS

PAGE

II. Publications..... 29

III. Institutional Support and Other Activities..... 29

V. Administration and Management of Agricultural Research
Dr. Carlos A. Neyra

A. GOAL: "To assist IDIAP with the formulation and implementation of institutional objectives, strategies, priorities and evaluation of agricultural research"..... 41

A.1. Project Evaluation: Problems Areas..... 41

A.2. ATD Project: Extension/Amendment..... 43

B. GOAL: "To act as Chief-of-Party and in-country coordinator of the Technical assistance provided by Rutgers University to the ATD project in Panama"..... 45

APPENDIX..... 50

I. TROPICAL PASTURES

PEDRO ARGEL, Ph.D.

RE. QUARTERLY REPORT N°19

1

PROGRESS REPORT

Time period: January 1-March 31, 1987
Prepared by: Pedro J. Argel
Pasture Specialist

BACKGROUND

In general a pasture research program based on germoplasm begins with a high number of accessions that progressively are reduced in quantity as environmental pression and research intenseness select those with higher production potential. Are the plants themself the best indicators of environmental variations, particularly the effect of soil, rainfall and pests and diseases. During the last years a considerable number of forage species have been evaluated in their persistance on several sites of Panama, searching mainly for adaptation to acid infertile soils, drought, pest and diseases. The genera Centrosema, Braquiaria and Stylosanthes hase shown enough species variability as to offer ecotypes with production potential such as C. macrocarpum, C. acutifolium, S. guianensis, B. humidicola and B. dictyoneura. However, once the species have been identified, the evaluation process should continue to determine in an objetive way production parameters either in agronomic cutting experiments or under grazing. Advances in this regard observed during the time period of this report, are given as follows.

GERMOPLASM

The evaluation of selected promising species continues to concentrate on agronomic and seasonal productivity aspects, either as single crops or associations. Response to low fertility levels, particularly to elements as phosphorus (P), potassium (K) and sulphur (S) has been the priority in productivity agronomic studies under cutting. This exercise gives ideas of species productive potential and is useful to plan the following steps within the evaluation process.

a) A. gayanus 621 and C. macrocarpum 5062

Previous evaluations have shown good adaptation of these species to acid infertile soils of Panamá, moreover of their compatibility owed to the trailing and climbing growth habit of the legume and erect growth of the grass. An experiment partially reported in previos progress reports, carried out to evaluate plant response to low levels of S, P, and K during the establishment of the two species in association, was harvested in Finca Chiriquí, distintive for acid soils (pH 4.5) and high soil aluminum saturation (70%) of ultisol type. The experiment was harvested 96 days following planting. Table 1 illustrates part of the results obtained, where can be observed the significant effect of sulphur (S) on yield increase of both species; with only 40 kg of S grass production outyielded significatively ($P \leq 0.05$) those obtained with 60 and 100 kg/ha of K and P respectively, whereas the same level of S in presence of P and K was necessary for significant ($P \leq 0.05$) yield increases in the legume. Obviously

Table 1. Effect of sulphur (S), phosphorus (P) and Potassium (K) on dry matter (DM) yields of the association *C. macrocarpum* CIAT 5062 and *A. gayanus* CIAT 621 in a Chiriquí ultisol (Panamá). (Harvested 96 days after planting.

Elements (kg/ha)			DM yield (kg/ha)				Total	
S	P	K	*A. gayanus* 621		*C. macrocarpum* 5062			
0	0	0	1882	c	253	e*	2135	c
0	0	60	2660	bc	332	cd	2992	bc
0	100	0	1958	c	435	cd	2393	c
0	100	60	2489	bc	283	de	2772	bc
40	0	0	3835	a	462	bc	4297	a
40	0	60	4023	a	620	a	4643	a
40	100	0	3403	ab	506	abc	3909	ab
40	100	60	3840	a	681	a	4521	a

Basal application/ha: 20 kg Mg, 2 kg Zn, 1 kg B and 0.1 kg Mo. The legume was inoculated with appropriate rhizobium strain

*Figures followed by the same letter are not significantly different ($P \geq 0.05$)

that the interaction of the three elements was iqually benefitial for both components of the association.

b) Leucaena

L. leucocephala is recognized for high forage quality and tolerance to drought once established. Its main limitation is the low initial growth following planting and low tolerance to acid soils with high aluminum content. In Divisa, in collaboration with the National Institute of Agriculture (INA) it was terminated an experiment of two years duration with 16 different ecotypes of Leucaena, established in a moderately acid soil (pH 5.5) with low aluminum saturation. Six ecotypes outyielded the mean yields of the commercial variety Cunningham (CIAT 17502), particularly L. leucocephala CIAT 17467 for the good performance during the dry and rainy season as well (Table 2). This accession had the taller regrowth (52 cm) following dry season cuttings and one of the greater (90 cm) during the wet season. Mimosine content remained around normal for this species, namely an average of 4.0%, whereas protein content was 23% approximately. Other outstanding accessions were the hybrids L. pulverulenta CIAT 17490 and L. sp CIAT 17478, particularly the latter for its low mimosine content (3%). The five best accessions were selected for seed multiplication and establishment evaluations, contemplating the use of pre and postemergent herbicides to observe selectivity and weed control.

Table 2. Dry matter yields of Leucaena ecotypes established in Divisa during dry and wet season - Panamá 1987.

Species	Nº CIAT	Yields kg DM/ha*		
		Dry Season	Wet Season	Mean
L. leucocephala	17467	1252.8 a	6123.9 a	3577.0 a
L. pulverulenta (Hib)	17490	1046.1 ab	4904.4 a	2859.1 ab
L. sp (Hib)	17478	975.6 ab	4836.7 a	2757.6 ab
L. leucocephala (K 32)	17488	740.6 bc	4313.9 a	2464.5 ab
L. pulverulenta (Hib)	17489	760.0 bc	4226.7 a	2405.5 bc
L. diversifolia	17503	458.9 c	4487.5 a	2397.4 bc
L. leucocephala (Cunn)	17502	698.9 bc	3906.1 a	2219.7 bc
L. shannoni	17487	772.2 bc	3731.1 a	2153.9 bc
L. diversifolia	17461	670.6 bc	3938.9 a	2050.0 bc
L. leucocephala (K 29)	17498	571.7 bc	3825.0 a	2028.8 bc
L. leucocephala (Hib)	17475	743.3 bc	3472.8 a	2007.0 bc
L. leucocephala (Hib)	17477	767.2 bc	3358.9 a	1975.5 bc
L. leucocephala	17495	620.6 bc	3453.3 a	1895.5 bc
L. diversifolia	17388	643.3 bc	3333.3 a	1813.9 bc
L. leucocephala	17491	478.9 c	3455.0 a	1759.4 bc
L. diversifolia	17485	427.8 c	2970.0 a	1516.1 bc

* Mean of 6 cuttings every six weeks in each season. Means followed by the same letter are not statistically significant ($P \geq 0.05$). Duncan's multiple Range Test.

c) Brachiarias

Different Brachiaria ecotypes are beeing evaluated in several localities of this country where those established in Finca Chiriquí and Gualaca are the more advanced with regard to field information. One of the objetives of the experiments was species tolerance observations to spittlebug (Aenolamia sp); this insect periodically attacks commercially selected grasses causing considerable yield loss and even plant death. Table 3 illustrates insect degree of preference for different Brachiaria accessions, where can be noticed that the species B. humidicola - with the exception of the ecotype CIAT 6709 - and B. dictyoneura 6133 are highly prefered by nymphs of the insect; however degree of damage as indicated for accession loss of yield is the opposite to nymph population (see previous progress report). In other words species such as B. brizantha, B. decumbens, B. eminii and B. ruziziensis showed severe growth loss because of spittlebug effect even with low nymph populations. This indicates that insect plant tolerance mechanisms are independent of insect population and are associated with non determined factors yet. Based on observations of these experiments and bearing in mind seasonally dry matter yields, the ecotypes B. humidicola CIAT 6369 and 6707, and B. dictyoneura CIAT 6133 were selected for additional agronomic evaluations; the species are presently established in Hornito, Gualaca and Finca Chiriquí, contemplating large plots for seed multiplication.

Table 3. Mean population spittlebug nymphs (*Aenolamia sp*) in Brachiaria ecotypes established in Finca Chiriquí (Panamá).

Species	CIAT No.	Nymphs number/m^2	
B. humidicola	6705	99.2	a
B. humidicola	679	92.3	ab
B. humidicola	675	92.3	ab£
B. dictyoneura	6133	86.5	ab
B. humidicola	682	85.5	ab
B. humidicola	6707	81.0	ab
B. humidicola	6369	67.0	ab
B. ruziziensis	6419	58.2	ab
B. eminii	6241	51.0	ab
B. decumbens	6132	37.2	ab
B. ruziziensis	654	35.3	ab
B. brizantha	664	34.7	ab
B. humidicola	6709	32.0	ab
B. brizantha	6009	31.9	ab
B. ruziziensis	6291	31.1	ab
B. decumbens	606	24.0	ab
B. decumbens	6131	17.1	b
B. ruziziensis	6134	16.2	b
B. ruziziensis	6130	14.5	b

Means followed by the same letter are not statistically different ($P \geq 0.05$).

SEED MULTIPLICATION

Basic seed multiplication of promising species continues to have priority within the pasture evaluation process in Panamá. Obviously that limited research resources available within IDIAP reduces the opportunity to produce greater seed volumes; however, the effort carried out in several country localities, as illustrates in Table 4, allows to have enough seed for species research and promotion. A. gayanus continues to be the more importante species in terms of volume of seed produced, this indicates the commercial importance of the species particularly in the Central Provinces. Another species coming out in importance because good adaptation and potential production is C. macrocarpum; presently significant volume of seeds are availabe and will be used to study the species as protein bank in Gualaca and on a farm trial in Ocú. This species has been selected from germoplasm evaluated within the IDIAP/U. RUTGERS/CIAT project.

FUTURE PLANS

Seed multiplication, pasture weed control and selected species dry matter yield studies, are inmediate priorities to contemplate in future plans to develop within IDIAP. Discussions in this regard have been kept with IDIAP collaborators during previous months and new plans have been elaborated as follows:

A. East Región (Chepo):

- Response o B. brizantha 6780 to low levels of P, N and S.

Table 4. Basic seed production of forage species in during 1987 in Panamá.

Species		Yield kg/ha	Total Harvest (kg)	Site
A. gayanus	621	168	235	Los Santos
A. gayanus	621	240	240	Chepo
A. gayanus	621	169	424	Soná
C. macrocarpum	5062	-	15.5	Gualaca
C. macrocarpum	5062	-	1.3	Chepo y Tortí
C. maceocarpum	5434	-	7.2	Gualaca
Kudzú		-	11.5	Gualaca y Chepc
S. guianensis	184	-	1.6	Chepo

- Effect of S and P on seed yield of B. dictyoneura 6133
- Effect of commencement and frequency of cutting on S. guianensis 184 persistance.
- Establishment of large plots for seed multiplication of B. dictyoneura 6133, B. humidicola 6369 and C. macrocarpum 5062

B. Central Región (Calabacito, Soná, Los Santos)

- Weed control during forage legume establishment
- Effect of P, Ca and S on dry matter yield of the association B. dictyoneura 6133 and A. pitoi 17434
- Efecct of N and P on seed yield of A. gayanus 621, B. decumbens, B. dictyoneura 6133 and B. humidicola in Calabacito

C. West Region

- Chemical shrub control
- Weed control during establishment of C. macrocarpum
- Selection of stoloniferous ecotypes of C. macrocarpum
- Effect of S and N on seed yield of B. humidicola 6369

As can be seen these are new progammed trials additional to those underway in each region.

Contacts have been made with CIAT for collaboration and support for the realization of two different worshops during 1987. One on biometrics and economy for August-September and other on pasture seed multiplication technology for 6-18 December. Organization and participation on both events are inmediate activities.

II. GENERAL AGRONOMY

MARK GASKELL, Ph.D.

RE. QUARTERLY REPORT N°19

PROGRESS REPORT

for the period

January 1, - March 31, 1987

Dr. Mark Gaskell, Agronomist

BACKGROUND

Work activities during the reporting period were concentrated in the vegetable research program in the Boquete area. The vegetable research program is a relatively new program, initiated by IDIAP in1986 in collaboration with two producers cooperatives in the highland vegetable production region. This new cooperative program is a result of more than three years of onion research on producer's farms and formally ties IDIAP researchers to a producer supported on-farm research program in Boquete.

ACTIVITIES DURING THE REPORTING PERIOD

Vegetable Production Research Harvest of the varietal trials with broccoli and cauliflower continued during January and February. Results for broccoli from trials on the Deladier Gonzalez farm and the Rodrigo Marciacq farm in the Quiel area of Boquete are shown in Table 1 and for cauliflower on the Gonzalez farm in Table 2.

Table 1. Results of dry season broccoli variety trials. Quiel, Boquete - 1987.

CULTIVAR	-Gonzalez Farm- January1987		-Marciacq Farm- February 1987	
	HEAD WEIGHT (gm.)	YIELD (kg./ ha.)	HEAD WEIGHT (gm.)	YIELD (kg./ ha.)
Green Valiant	419 a *	6875 a	340	6877
Emperor	406 a	7250 a	241	4376
Green Duke	359 a	6325 a	274	6565
Packman	299 b	5450 ab	211	3908
Paragon	286 b	6125 ab	281	5314
Green Comet	281 b	4675 bc	253	3908
Premium Crop	276 b	4238 c	297	6533
Waltham	198 c	3300 c	307	6205

* Mean values followed by the same letter not different with 95% confidence

Green Valiant and Green Duke have thus far, consistently proven to be the best adapted broccoli varieties in the area - at least under the relatively dry conditions of the summer months. A new broccoli variety - "Emperor" appeared quite good in these trials in addition to Green Duke and Green Valiant. Emperor is one of the most widely planted of varieties in U.S. broccoli production areas. Another broccoli and cauliflower trial set for harvest during the period was not harvestable because of poor maintenance by the grower/collaborator. Steps have been taken to add additional field labor to the research program to assist in caring for the experiments on producer's farms when the growers are unable.

Table 2. Results of cauliflower variety trials harvested January, 1987 - Deladier Gonzalez Alto Quiel, Boquete.

CULTIVAR	MEAN HEAD WEIGHT (gm./head)	QUALITY (1)
White Sails	860 a*	very good
Polar Express	693 a	very good
Andes	677 a	very good
Snowball 741	532 b	poor
Snowball 76	525 b	
Selfblanche	523 b	good
Snowball D	518 b	poor
Snowball Y Improved	509 b	poor
Snowball Y	423 b	poor
Snowcrown	367 b	average

(1)General observations of color, shape and flower size
* Mean values followed by the same letter not different with 95% confidence

Three new cauliflower varieties; White Sails, Polar Express, and Andes, appear very promising from these and other early trials. These varieties are superior to the commonly grown varieties of the "Snowball" class because they have more robust foliage growth and cover the head to whiten better. The marketplace is demanding higher quality and the signals arriving to producers through the research program from the HORTICOLA marketing coop is that white heads are important and the yellow/ brown heads traditionally sold will no longer be accepted. These new cauliflower varieties will be important to area producers in the months and years to come.

A nitrogen and phosphorus fertilization experiment with dry season onions was harvested from the Cheva farm in El Salto in March and those results are presented in Figure 1.

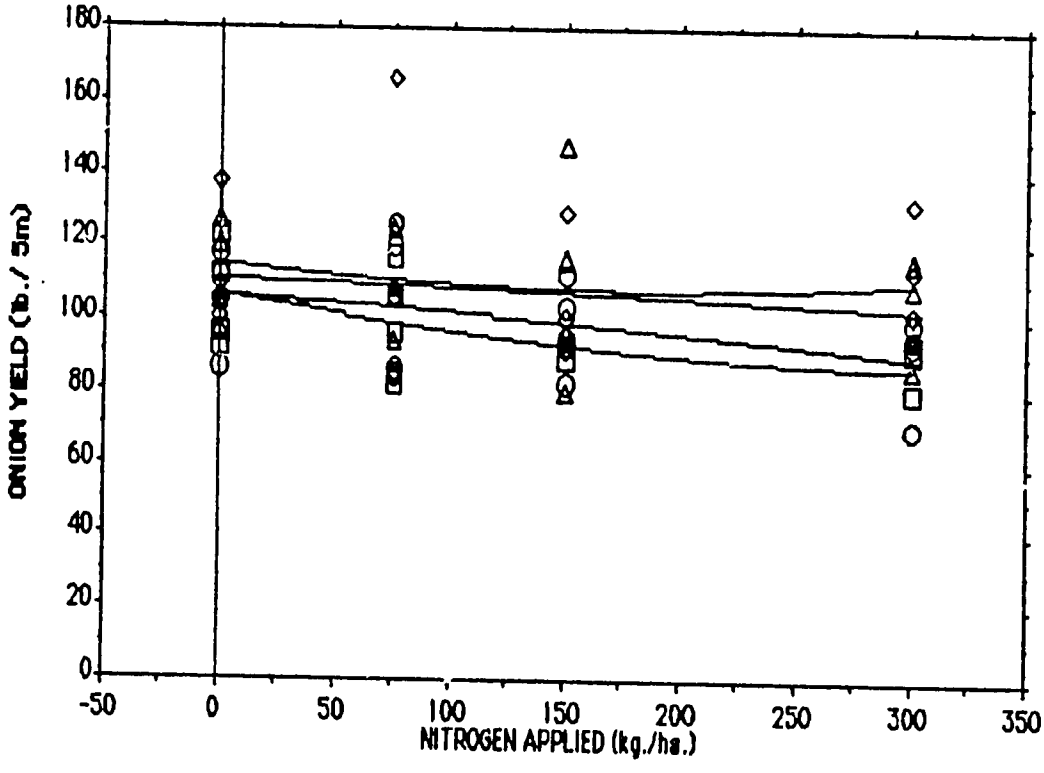

Figure 1. Yield response of dry season onions to fertilization with nitrogen at four levels of phosphorus application. (O = 0 P_2O_5; □ = 25 kg. P_2O_5/ha.; Δ = 50 kg. P_2O_5/ ha.; and ◊ = 100 kg. P_2O_5 / ha. applied in the furrow at transplanting.)

These results show no response to nitrogen or phosphorus fertilization. The yields with no fertilizer treatment were quite high - 1600 qq. / ha. - and it is assumed from these results that fertilizer was not limiting. Foliar fertilizer was applied on five different occasions as is commercial practice and fertility had been very high on the farm previously. Phosphorus soil test levels are high. It appears from these results that fertility level are quite high on this farm and perhaps other farms in the area and growers can afford to be much more conservative in the use of fertilizer materials.

Fertility experiments are continuing but these results indicate that growers can safely reduce fertilization levels without sacrificing yield, if past fertility has been high. Unfortunately it dos not indicate to what extent foliar fertilization - a relatively expensive source of nutrients -

satisfied nutrient needs. Foliar fertilization is widespread in the area and it is unclear at this time what is the relative value of this practice compared to a sound traditional soil applied fertility program. Nevertheless, it is assumed that as long as onion prices are high, growers will keep fertilizing at high rates as insurance.

Boquete Agricultural Fair An effort was initiated in late February to develop a collaborative demonstration for the Boquete agricultural fair in the pavillion facilities of the AGRICOLA and HORTICOLA coops at the fair. The purpose of the demonstration was to describe the cooperative research program to fair visitors. A new parcel of land behind the pavillion was rennovated with considerable effort and this served as the live planting demonstration area. It will also be used throughout the year for producing transplants for the on-farm research program. Additional displays were planned and setup within the pavillion to illustrate with photographs and graphs the different components of the on-going research program.

The new parcel of land will be quite useful in future years to plan even more elaborate demonstrations that would be possible with a longer anticipation time. Even though the rennovation of the land involved considerable effort and was concluded with only two weeks remaining to the fair start, the display resulted quite satisfactory. All of the effort and planning paid off finally, as the coop pavilion was awarded first prize for best pavillion by fair organizers.

Guatemalan Applied Research and Vegetable Exports Tour In mid-February Dr. Gaskell accompanied USAID/ Panama project officers Donald Drga and Tomas Ugarte and Coop Marketing Project Marketing Specialist Eduardo Matheu on an information gathering tour of Guatemalan production areas. The trip included visits to individual farms, horticultural inputs and marketing coops, private production and processing facilities and ICTA research experiment stations. Visits were also made to facilities and support organizations dedicated to export crops. The tour covered the principal domestic and export oriented production areas in Guatemala and in many cases circumstances very similar to those in Panama.

The most important visits included those to farms and coops with condions very similar to those of the AGRICOLA and HORTICOLA coops in Boquete. Vegetable crop production is more diverse and intensive in Guatemala but it is easy to imagine great gains for Panamanian growers in the next five years.

III. SOIL FERTILITY AND MANAGEMENT

ALVARO CORDERO, Ph.D.

RE. QUARTERLY REPORT N°19

PROGRESS REPORT N°7
DR. ALVARO CORDERO
SOILS SPECIALIST

PROJECT: AGRICULTURAL TECHNOLOGY DEVELOPMENT IN PANAMA-IDIAP-UNIVERSITY OF RUTGERS-USAID

PERIOD: JANUARY, 1 TO MARCH, 31, 1987

1. INTRODUCTION

During this quarter, January-March of 1987, the Soils Specialist gave technical assistance to IDIAP, as part of his activities on the Agricultural Technology Development in Panama, framed mainly in three components, as follows:

a) Capacitation and Technical Assistance

b) Meetings, Conferences, Seminars, Technical Field Trips.

c) Support to Research

2. CAPACITATION AND TECHNICAL ASSISTANCE

2.1. Annual Operative Plan, 1987.

We collaborated with IDIAP'S technical staff on different regions (Central, Oriental and Occidental) on the elaboration of the Annual Operative Plan (POA, 1987) on the following commodities: corn, sorghum, vegetables, pineapple forestry tress, beans, rice, roots and tubers. On this activity we set to define at commodity level the projects of research, including targets, hypothesis and the experiments to be conducted. The Soils Specialist participated and adviced on the aspects of soils management. This task was performed on every reunion maintained on the three different areas of influence of IDIAP. This activity we can consider as the most remarkably executed, since its effect is at the national level, multiplying and a direct assistantship to the technical personnel.

2.2 Working On Technical Documents

This technical assistance to IDIAP was performed by the Soils Specialist, through the preparation of different documents on the following:

2.2.1. Diagnostic of Soils Laboratory of IDIAP.

On this document (a letter was sent to Eng. Rolando Sanchez Diez-Director of the Central Region) we diagnosed the state of the Soils Laboratory in relation to the three principals resources: human, physical and economical.

This document perhaps polemical, shed light over the authorities of IDIAP on the present state of the Soils Laboratory; its organization and management. Also we made suggestions about how to solve some of the problems identified.

2.2.2. Research Project on Phosphorous Management on Maize

This document was prepared by the Soils Specialist as an activity of research planed for San Andres-Chiriquí, a part of the POA-87, on trials carried out by Eng. Ruben Degracia.

The general purpose on this study was to determine the best management of the phosphoric fertilization on corn and its residual effect, on a soils of volcanic origin with a high phosphorous fixation. IDIAP is developing technology on two areas about the management of phosphorous: the sites selected were the Ultisols of Calabacito and the Andepts of volcanic origin, on San Andres-Chiriquí.

2.2.3. Analytical Abstract on Studies and Projects on Research About Copper and Lead Contamination on Soils of Costa Rica.

IDIAP includes on its lines of action the environmental contamination and within this, soils contamination with agrochemicals products.

Because of the experience of the Soils Specialist on copper and lead contamination and because of the request made by Dr. Jaime Espinosa we prepared another critical abstract and sent a copy of the studies and research project with copper and lead on Soils of Costa Rica. That experience may be useful for experimental studies in lead in soils of Panama.

2.2.4. Formulary - Inquiry on Potential Yield of Cassava in Panama.

We advised Eng. José A. Aguilar, who is directing the trials on roots and tubers on the Region of Ocu-Herrera, how to reply the formulary sent by Dr. S. Sarma from the International Food Policy Research Institute-Washington, D.C. referring to the potential yield of cassava in Panama.

2.2.5. Effect of the Phosphoric Fertilization on Two Promissory Varieties of Rice on Soils with a High Phosphorous Fixation.

Upon request made by Eng. Eric Batista and Eng. Ezequiel Espinosa (University of Panama), prepared a document including a summary and a large draft to be presented at the XXIII Annual Meeting of the PCCMCA held on the first week of April in Guatemala City.

2.3. Review of Documents

Another form of technical assistance was provided by means of revision of documents such as the "Guide to the Agronomic Diagnostic of Problems on Corn" sent by Dr. F. Kocher of CIMMYT. Theses document was elaborated by a Working Group at International Level (Central America, Panama and the Caribbean Region) on the Workshop on Agronomic Diagnostic of the Corn Cultivation held on La Villa de Los Santos on November, 1986, sponsored by IDIAP/CIMMYT.

We revised the thesis at level at Magister performed by Eng. Araiz Cajar at CATIE-Costa Rica.

At the request of Eng. Rolando Sanchez Diez-Director of Central Region were reviewed two outlines research submited untimely by Eng. Cajar.

2.4. Technical Assistantship to the Soils Laboratory

We attended specially the Soils Laboratory through meetings held with the staff. We can stand out that the new facilities of the Soils Laboratory were visited by all members of the staff and When we were on this facilities discussed about the possible, future distributions of the analytical activities and the distribution of the working rooms. Eng. Name was present on this working day.

We colaborated with Eng. Benjamín Name on the searching of documents and orders of equipment, reagents and glassware requested by the staff of the Soils Laboratory last year . Together with Eng. Name we drafted to Eng. Rolando Sanchez Diez a list of urgent amendments that they ought to do on the new building of the Soils Laboratory. We personally discussed with IDIAP'S architect-Mrs. Chen.

Also, the Soils Advisor was present when the Technical of the A & L Company, who represents the Atomic Absorption Equipment visited the Soils Laboratory on Divisa with the target to repair the mentioned equipment. Regretably, the technician could not fix the equipment due to the serious damages and some pieces that needed to be changed. The problem was more acute because in Panama they aren't on the stock and it is necessary that we order from the exterior.

Despite of our efforts, and time spent by the Soils Advisor, the equipment A-A could not be repaired, causing serious obstacles on the rutine services usually offered by the Soils Laboratory.

2.5. Statistical Analysis of Experiments

With the arrival of the new computer system to the Central Region and associated with the colaboration of Eng. Miguel Sarmiento we performed statistical analysis of a quantity of experiments part of research on: a) acid soils b) roots and tubers c) experiments of fertilization on three zones: Alanje-Chiriqui, El Coco-Coclé and Chiriquí Chiriquí on the cultivation of rice.

We also assistedother technicians who work outside IDIAP like the case of Lourdes Cordoba from the Sugarmill La Victoria. The Soils Specialist processed the computer and discussed the results with the mentioned technician.

3. MEETINGS, CONFERENCES, SEMINARS, TECHNICAL FIELD TRIPS

3.1. Working Meetings

Important working meetings were carried out several times during this quarter:

As part of the meetings of the POA in Chepo to discuss the experiments of pinapple and forestry trees we took advantage to request Dr. Gaspar Silvera, National Agricultural Director and to Dr. Jorge Jonas the respective transaction to acquire the equipment for the Soils Laboratory, requested by Eng. Benjamín Name in 1986. We itemized priorities to purchase equipment based on inmediate and future needs of the laboratory. Also, on the quarter there were five working meetings in the Soils Laboratory with the purpose to colaborate on the organization of the new Soils Laboratory.

We agreed that before we pass to the new building it should be necessary analize all the soils samples for studies of soils taxonomy taken by Eng. Santander Jaramillo which could not be analized by multiples circumstances.

During this quarter we talked twice with Eng. David Polo about the Project Technology Transfer of MIDA in Parita. The aim of the meetings was to plan a course in Soils to be conducted in Parita in the month of May. We indicated the need to establish contact with Eng. Alfonso Martinez, IDIAP Program Officer of Information and Technical Capacitation with the finality to make the necessary arrangements

With Dr. Jaime Espinosa, we discussed in Panama, the initial results of the samples of fertilizers, collected and sent to the Soils Laboratory, for analysis. The samples of fertilizers proceded of different commercial establishments and agricultural zones. There were surprising analytical results since the concentration grade of the element (s) on the formula don't have coincidence with a great part of the analytical results. We can stand out and congratulate Dr. Espinosa by his effort on the proposal of the quality control measurements of the agrochemicals that most of the producers are using. The Minister of MIDA, Eng. Hirisnel Sucre, declared in presence of Dr. Jorge Jonas, Eng. Benjamin Name in an informal conversation during a field day at Rio Hato, that the government policy is focused to protect the producers and that IDIAP with his Laboratories would collaborate with the producers on this activity.

With the arrival to the Central Region of the micro-computer IBM we hold meetings with the professional staff of the Biometry Department from IDIAP (in central offices) or when they visited the region. The Soils Specialist collaborated jointly with Eng. Miguel Sarmiento on that activity.

During the quarter the Team of Rutgers held two meetings one was at La Villa de Los Santos and the second in Santiago city. On the mentioned meetings we discussed affairs related with the Project of Development of Technology in Panama On the meeting at Santiago were present Dr. Donald DRGA and Dr. David Schaer from the Agricultural Department of USAID/Panama.

3.2. Technical Tours

Like in previous quarters, there were several technical trips.

- Accompanied with Eng. Lineth Carranza and Eng. Araiz Cajar, we visited the validation trials on La Villa de los Santos. We visited the experimental field of the Nestle Company and we evaluated with Eng. Cajar an experiment of fertilization on tomato. We then visited a melon producer field where they were evaluating the effect of sulphur fertilization with other nutrients.

- In relation with the Fair of San Sebastian in Ocú, we accompanied Eng. Rolando Sanchez Dies-Director-Central Region in the Inauguration of the Fair. In the pavilion of IDIAP we received Dr. Roderick Esquivek, Vice-president of the Republic when we demonstrated the hightlights of technology development produced by IDIAP.

3.3. Field Days

We participated on a field day at Rio Hato where IDIAP showed to a number of producers the yield trials of soybean seed of the Baru variety. It was very interesting the demonstration of the excelent toleration of this variety in this type of soil and the eco-system, since the same variety on acidic and infertiles soils do not demonstrate a good adaptation.

3.4. Conferences/Seminars

We offered a seminar about "Recommendations of Fertilization on Crops" by means of the soils analysis. The attendants were technicals of MIDA working on the Project of South of Sona, directed by Eng. Rafael Ortiz, Agricultural Specialist of that Institution.

4. RESEARCH ACTIVITIES

On the quarter we collaborated with Eng. B. Name and his assistant on the harvest of some experiments of the Project on Acids Soils. The essays harvested were the following:

a) Evaluation of soybean lines

b) Study of varieties of cajanus cajan

c) Evaluation of varieties of sorghum

d) Evaluation of varieties of cowpea and kidney beans

e) Liming and fertilization of sugar cane.

We continued the experiments of adjusting the fertilization of Andropogon gayanus associated with Centrosema macrocarpum on acid soils of Chiriquí and Calabacito and with the help of Eng. Miguel Sarmiento, we did a great deal of statistical analysis for the experiments performed on 1986 on Acid Soil Program. We used the new computer with different statistical packages like the SAE, MSTAT, STATGRAFIC, LOTUS, etc.

An important activity for the development of technology on the fertilization of cultivation was the preparation of Fertility Guides for crops based on soil analysis information (See Figure 1). Tables and guide leaflets were prepared together with our IDIAP counterpart, Ing. B. Name.

5. OTHER ACTIVITIES

Preparation of the Quarterly Report, October-December, 1986 and we initiated the elaboration of the Technical Report of the Soils Specialist (1985-1987).

We reviewed the agricultural literature, and we delivered photographic material to Eng. Alfonso Martinez of the Cassava-Maize Experiment to be shown on the Fair at Ocú.

INSTITUTO DE INVESTIGACION AGROPECUARIA DE PANAMA
DIRECCION DE INVESTIGACION AGRICOLA
Laboratorio de Suelos--Region Central

CULTIVO: YUCA

FOSFORO	POTASIO (meq/100 ml)		
Valor segun Analisis de Suelos es:	0.0-0.15	0.16-0.30	>0.30
(ug/ml)	120-120-120	120-120-60	120-120-30
0.0-5.0	A) 6 QQ 10-20-20 B) 1.3 QQ DE UREA	A) 5 QQ 12-24-12 B) 1.3 QQ DE UREA	A) 4 QQ 15-30-8 B) 1.3 QQ DE UREA
	120-60-120	120-60-60	120-60-30
5.1-10.0	A) 6 QQ 10-10-20 B) 1.3 DE UREA	A) 4 QQ 15-15-15 B) 1.3 QQ DE UREA	A) 3 QQ 20-20-10 B) 1.3 QQ DE UREA
	120-0-120	120-0-60	120-0-30
>10.0	A) 6 QQ 10-0-20 B) 1.3 QQ DE UREA	A) 3 QQ 20-3-20 B) 1.3 QQ DE UREA	A) 3 QQ 20-0-10 B) 1.3 QQ DE UREA

SUGERENCIAS EN QQ/HA DE FERTILIZANTES PARA UN CULTIVO DE 10,000 PLANTA/HA, PARA OBTENER UN RENDIMIENTO SUPERIOR DE 20 T/HA DE YUCA FRESCA.

A) DE 0 A 30 DIAS DESPUES DE LA SIEMBRA.-
B) 70 DIAS DESPUES DE LA SIEMBRA

Figura 3. Tabla de recomendaciones de abonamiento para el cultivo de la yuca, haciendo uso del análisis de suelos. Producto del desarrollo de tecnología agrícola en Panamá, realizado por el IDIAP.

IV. LIVESTOCK RESEARCH AND PRODUCTION

JOSE ZORRILLA-RIOS, Ph.D.

RE. QUARTERLY REPORT N°19

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 OF PANAMA. PERIOD JANUARY - MARCH 1987.

This first Quartely Report of 1987 describes activities conducted on the areas of:

I. RESEARCH.
II. PUBLICATIONS.
III. INSTITUTIONAL SUPPORT AND OTHER ACTIVITIES.

I. RESEARCH.

Outlines of seven research activities are included. Three conducted at an Experiment Research Station, three at "on - Farms" level an one, as Regional survey - extension.

Title.- EVALUATION OF RESTRICTED GRAZING OF THE LEGUME KUDZU (*Pueraria phaseoloides*), IN COMPARISON TO AN ENERGY-PROTEIN SUPPLEMENTATION TO DUAL PURPOSE COWS.

Continue.- See Quartely Report Oct-Dec/'86.

Co-authors.- E. Arosemena, IDIAP.

Present progress.- Data is pending statistical analysis.

Title.- EVALUATION OF A PROTEIN BANK (KUDZU, *Pueraria phaseoloides*) IN THE REARING OF CALVES IN A DUAL PURPOSE SYSTEM. II. DRY SEASON. (December-February/'87).

Continue.- I. Wet season, see Quartely Report Oct-Dec/'86.

Co-author.- Ing. E. Arosemena; Dr. J. Alba-IDIAP

Present progress.- A summary of results for both, wet and dry season is presented in Table 1. The grazing of Kudzu had to be discontinue at the begining of March/'87, bringing to an end the dry season observation period. This trial should be continued as soon as the rainy season starts and the Kudzu recovers.

Title.- EFFECT OF FISH MEAL SUPPLEMENTATION ON PERFORMANCE OF DUAL PURPOSE COWS. II. DRY SEASON (February-March/'87).

Continue.- I. Wet Season, see Quartely Report Oct-Dec/'86.

Co-author.- Dr. J. Alba-IDIAP; Ing. S. Mirones-MIDA.

Present progress.- Results on marketable milk and supplement intake for the dry season are presented in Tables 2 and 3 respectively. A summary of results on marketable milk for both wet and dry season is presented in Table 4, and in Table 5, the reproductive performance data.

Daily cost of fish meal supplement was in average 10 cents/head. A minimum milk production response required to pay for the supplement would be in the order of approximately one pound of milk, at 26 cents per liter . Therefore, any production difference above 1 pound, would be a net profit, . the case of this study, for cows with 3-6 - months of lactation, either during the wet or the dry season.

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

Continue.- See Quartely Report Oct-Dec/'86.

Co-author.- Dr. Pedro Argel-IDIAP/U. of R.

Present progress.- A satisfactory establishment is taking place, with approximately 60% of the area covered with Centrosema. A new re-seeding will be necesary to speed-up land coverage. It will take place at the begining of the rainy season (appx. May/87). Light grazing by suckling calves was conducted already for a period of 8 days, at the middle of February.

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

Continue.- See Quartely Report Oct-Dec/'86.

Co-author.- Dr. M. Jaén-IDIAP.

Present progress.- A draft manuscript has been distributed for interval revision.

Title.- MINERAL SUPPLEMENTATION OF CATTLE IN THE TROPICS.

Continue.- See Quartely Report Sept-Dec/'86.

Co-author.- Dr. M. Jaén-IDIAP.

Collaborator.- Dr. L.R. McDowell University of Florida.

Present Progress.- Analytical determinations performed on four commercial available mineral supplements, each sampled twice with a four months interval, have been used to formulate preliminary recomendations. Table 3 shows the unitary cost of elements from the different commer-

cial sources and Table 7 compares

Tag-declared composition and analytical results. Out of five macrominerals and seven microminerals considered in total, FOSFOVAC mineral mixture was the chipest source in all five macrominerals and in three of the microminerals, and second close in another three microminerals. If corresponding manufacturers recomendations for mixing the various mineral supplements are followed and a theoretical daily intake of 60g by cattle is accepted, the daily cost per head of mineral supplementation and an estimated percentage fulfillment of recommended requirements, are shown in Table 8.

Title.- NON-CONVENTIONAL ALTERNATIVES TO IMPROVE THE NUTRITIVE VALUE OF LOW QUALITY FORAGES AND/OR CONSERVATION OF FEEDSTUFFS.

Continue.- See Quartely Report Oct-Dec/'86.

Co-author.- Dr. M. Jaen - IDIAP.

Present progress.-

I. Improving the nutritive value of low quality forages.

I.1. An on-farm trial was conducted to study the need to cover a stack of bails of hay with a sheet of plastic, when treated with a solution of urea. Fourty bails of Pangola hay (*Digitaria decumbens*) where treated with a solution of urea (5% fresh basis). Therty of these bails were then covered with plastic. The other ten were stored under a shade, uncovered. Samples of these two kind of treated bails (covered and uncovered) will be talken at the end of April, and analyzed for nitrogen content. A "cafeteria" type of test will be

also conducted, comparing untreated (control) hay vs urea treated (covered) hay, with lactating cows.

I.2. A conventional (cover under plastic) urea-treatment trial was conducted with bails of Brachiaria humidicola hay (one year old) to study the effect on nitrogen content. When material was uncovered five days latter, all organoleptic characteristics of an adquate ammonia treatment effect were percived. Nitrogen determinations of samples take before and after treatment will be reported in the near future. Excellent voluntary intake by lactating dual-purpose cattle was observed of treated material, without the need of an adaptation period.

II. Conservation of feed stuff.

Co-authors.- Ing. L. Tason; Ing. E. Arosemena - IDIAP.

II.1. Whole Cassava plant (Manniott): roots, stems and leaves was manually chopped, sprayed with acqua-urea solution (5 or 10% fresh basis) and covered with a sheet of plastic, under airtight conditions. A control treatment of chopped whole cassava plant without added urea was included. After eight days, both stack were opened. The untreated cassava had rotten to the extent that no sample were taken for any further analysis. Both levels of urea-treated cassava (5 and 10%) conserved the original appearance of the fresh chopped material, with a strong smell of ammonia. Partial results on chemical composition are presented in Table 9. Voluntary intake by lactating dual-purpose cows of the urea-treated -

cassava was excellent, without any signs of a need for an adaptation/tolerance period. No fresh untreated cassava was available at the time to conduct a preference test.

II.2. An exploratory trail was conducted to study the feasibility to ensile fresh forage (whole chopped sugar cone) by placing the chopped material at ground level, cover it with a sheet of plastic and applying vaccum by means of a Hy pro-liquid spraying pump. Other treatments also included were spraying the chopped sugar cane with acqua-urea solution before covering it with the plastic, and a conventional procedure of compresing the material to expell the air, before covering it with plastic. All - stacks will be opened at the middle of April. The vaccum pump performed as expected and expelled air from inside the stack, as judge by the visual compression of the plastic against the chopped material.

Title.- EVALUATION OF NON-CONVENTIONAL FEEDSTUFFS. I. PUMPKIN (*Cucurbita* sp.) FOR DAIRY CATTLE.

Final Report.- See Quartely Report.

Co-authors.- D. Herrera; E. Vargas and H. Ruiloba - IDIAP.

Collaborators.- Ing. Luis De León ; Dr. J Wolht, U. of R.

Summary.- A Switch-Back experimental design was used to conducted a trial with twelve Holstein cows, milked twice a day, to study the effect of three levels of fresh pumpkin intake (0,5 and 10 lb/head/day), on milk production and composition, and forage intake.

Results are shown in Table 10. Under the circumnstances in which the present experiment was conducted fresh pumpkin daily intake of up to 10 lb/head had no statistical detrimental effect on milk production, nor composition. There was a tendency to reduce voluntary hay intake as level of pumpkin in the diet increased. These observations could be used as bases to performe further studies with higher levels of pumpkins in the diet.

II. PUBLICATIONS.

Two publications appeared in press. One, a Note of Research in Progress, title: "IMPROVEING THE NUTRITIVE VALUE OF FORAGES. I. CHEMICAL COMPOSITION AND INTAKE".

The second one was a Miscellaneous Publication, title: "DESIGN OF A MINERAL BOX FOR GRAZING CATTLE".

Copies of each publication are attached as annex.

III. INSTITUTIONAL SUPPORT AND OTHER ACTIVITIES.

III.1. Seminars organization/participation.

- A seminar was organized with the participation of Dr. Lee R. McDowell, from the University of Florida. The topic of the seminar was Mineral Nutrition of Cattle in the Tropics.
- A talk was presented at above mentioned seminar about out-lines and progress of ATD Project activities concern with mineral supplementation.
- A talk was offered to milk producers, on the alternative strategies to feed dairy cows with local feed-

stuffs for livestock.

III.2. International activities.

- Invited by the Pasture Program at CIAT, Colombia, a visit to the Program took place for six days. A trip report was submitted at due time, and is included at the annex.
- Attendance to an International Symposiom on Milk Production on the Tropics, at San José, Costa Rica. This was followed by a two days visit to the Animal Production Department of CATIE. For more information see trip report included at the annex.

III.3. Technical support.

- As a request from the Livestock National Director of IDIAP, an original manuscript was elaborated in regards to posible actions IDIAP could have within the Estate Dairy Farms.
- Review and suggestions to IDIAP Complementary Proposal for Technical Assistance Support to the International Development Bank.
- A manuscript on future strategies of milk production from dual purpose herds in Panamá, as a result of a discussion on the topic, that took place at the Symposium at Costa Rica (Spanish version only).

TABLE 1. AVERAGE DAILY GAIN OF SUCKLING CALVES GRAZING A PROTEIN BANK (KUDZU, *Pueraria phaseoloides*) VS GRAMINEA (PANGOLA, *Digitaria decumbens*) DURING THE WET AND DRY SEASON (N=8; GRAMS/DAY; $\bar{x} \pm$ SD).

SEASON	KUDZU	PANGOLA
WET (Nov.-Dic./'86)	451 ± 180	393 ± 120
DRY (Dic. '86/Feb. '87)	417 ± 150	288 ± 122
AVERAGE	437 ± 149	333 ± 117

TABLE 2. EFFECT OF FISH MEAL SUPPLEMENTATION ON MARKETABLE MILK OF DUAL PURPOSE COWS, DURING THE DRY SEASON (February-March/'87) (lb/cow/day; Mean ± Standard deviation).

MONTHS AFTER PARTURITION: 1/

	SIX OR LESS TREATMENTS 2/				EIGHT OR MORE TREATMENTS			
Week 3/	Nº Obs.	MU	Nº Obs.	MU+FM	Nº Obs.	MU	Nº Obs.	MU+FM
1	5	4.5± .64	6	6.8±1.92	2	4.6± .88	4	4.0±1.02
2	5	4.7± .69	6	7.3±2.14	2	4.9± .88	4	4.3±1.02
3	5	4.4± .80	6	6.4±2.32	2	6.1±3.36	4	5.0± .74
4	5	4.8±1.15	6	6.6±1.87	2	5.4± .88	3	4.1± .63
5	5	3.6± .93	6	4.7±1.72	2	3.9± .18	2	3.5± .71
6	4	4.9± .77	6	6.2±2.38	2	5.0±1.41	1	5.3
MEAN		4.48±.47		6.33±.88		4.98±.74		4.36±.67
DIFFERENCE				+ 1.85				- 0.62

1/ At the time to start the dry season observations.

2/ MU = Molasses-Urea. MU+FM = Molasses-Urea + fish meal.

3/ Starting: February 16 and ending: March 31st.

TABLE 3. AVERAGE DAILY INTAKE OF SUPPLEMENTS BY DUAL PURPOSE COWS DURING THE DRY SEASON (February - March/'87).

SUPPLEMENT	TREATMENT 1/	
	MU	MU + FM
Molasses - Urea	1.95 lb.	2.06 lb.
Fish meal	--	217 g.

1/ MU = Molasses-Urea; MU + FM = Molasses -Urea + Fish meal.

TABLE 4. SUMMARY RESULTS ON MARKETABLE MILK (lb/cow/day; mean ± Standard deviation).

	MONTHS AFTER PARTURITION:			
	ONE OR LESS 1/		THREE TO FIVE 1/	
	TREATMENTS 2/		TREATMENTS	
SEASON 3/	MU	MU+FM	MU	MU+FM
WET	9.25±0.4	9.43±0.5	8.43±0.8	9.78±0.7
DIFFERENCE		+ 0.18		+ 1.35
	SIX OR LESS 4/		EIGHT OR MORE 4/	
	MU	MU+FM	MU	MU+FM
DRY	4.48±.47	6.33±.88	4.93±.74	4.36±.67
DIFFERENCE		+1.85		-0.57

1/ At the begining of the wet season observations.

2/ MU = Molasses-Urea; MU+FM = Molasses-Urea + Fish meal.

3/ WET = September to November/'86; DRY = February-March/'87.

4/ At the begining of the dry season observations.

TABLE 5. REPRODUCTIVE BEHAVIOUR OF DUAL PURPOSE COWS, SUPPLEMENTED WITH FISH MEAL.

Cow #	Months After Parturition	Reproductive Status Oct/'86	March/'87	
MOLASSES-UREA:				
12	≥ 1	-	Cycling	
8	✓	Estatic	Empty	
20	✓	-	Empty	
9	✓	L est/R cyc	3 mth	
5	✓	Cycling	3 mth	
4	✓	Cycling	2 mth	
1	✓	-	Empty	
Vidal	≥ 1	Preg ?	7 mth	4P/8 Tot
13	3-5	Cycling	2 mth	
18	✓	Cycling	3-4 mth	
Villa	✓	3 mth	7 mth	
Pelona	3-5	Cycling	2 mth	4P/ 4 Tot
MOLASSES-UREA + FISH MEAL:				
6	≥ 1	Cycling	3 mth	
2	✓	L /R cyc	Preg?	
7	✓	L est/R cyc	Empty	
24	✓	-	Preg?	
10	✓	L est/R hipo	Empty	
3	✓	Estatic	2-3 mth	
22	≥ 1	Preg ?	Cycling	4P?/7Tot
14	3-5	Cycling	Empty	
17	✓	L est/R cyc	4 mth	
11	✓	L est/R cyc	3 mth	
15	3-5	Preg ?	7 mth	3P/4 Tot

TABLE 6. UNITARY COST OF MINERALS FOR CATTLE SUPPLEMENTATION AT PANAMA.

	COMMERCIAL SUPPLEMENT			
MINERAL	FOSFOVAC 1/	PECUTRIN 2/	CONC. MINERAL 3/	BIOFOS 4/
Macrominerals (dlls/100 grams):				
Ca	.50*	.90	1.38	.51
P	.33*	1.11	301.94	.34
Na	.25*	7.85	621.14	84.51
K	62.03*	1706.30	282.34	117.65
Mg	11.68*	19.35	80.50	17.14
Microminerals (dlls/gram):				
Cu	.53	53.85	.42*	66.52
Fe	.03*	12.77	.04	.04
Mn	.19	18.15	.12*	1.55
Zn	.08*	7.69	1.09	4.46
Mo	27.40	611.40	442.30	26.46*
Co	47.60	574.00	4.18*	81.00
Se	45.32*	1754.00	26192.80	1304.35

1/ $ 4.5/25lb

2/ $ 47.00/25kg

3/ $ 2.00/920g

4/ $ 15.00/25 kg

* The most economic source of elements.

TABLE 7. DECLARED (D) VS. ANALYZED (A)($\bar{x} \pm SD$) COMPOSITION OF COMMERCIAL MINERAL SUPPLEMENTS.

MINERAL	COMMERCIAL SUPPLEMENTS							
	FOSFOVAC		PECUTRIN		"CONC. MINERAL"		BIOFOS	
	D	A	D	A	D	A	D	A
Macrominerals (%):								
Ca	7.7	7.9 ± 2.9	25.5	20.8 ± 6.0	22.0	15.7 ± 3.6	16.0	11.9 ± 1.2
P	10.0	12.2 ± 0.7	19.6	16.9 ± 2.8	N.D.	.07 ± .005	21.0	17.4 ± 2.6
Na	16.0	16.9 ± 2.6	2.4	2.4 ± 0.3	N.D.	.04 ± .011	.06	.07 ± .006
K	N.D.	.06 ± .03	N.D	.01 ± .007	N.D.	.08 ± .011	.08	.05 ± .007
Mg	N.D.	.34 ± .17	1.2	.97 ± .29	N.D.	.27 ± .07	.65	0.35 ± .16
Microminerals (ppm):								
Cu	2000	746 ± 26	500	349 ± 26	5800	5207 ± 352	N.D.	9.0 ± 1.2
Fe	5000	13921 ± 3753	1000	1470 ± 162	40000	51402 ± 2462	N.D.	13996 ± 983
Mn	2500	2087 ± 602	1000	1032 ± 42	18000	18080 ± 1183	N.D.	386 ± 50
Zn	10000	4904 ± 1404	2400	2442 ± 11	2000	1989 ± 229	N.D.	135 ± 57
Mo	N.D.	14.5 ± 7.5	10	31 ± 12	N.D.	4.9 ± 1.0	N.D.	22.7 ± 2.8
Co	20	8.3 ± 4.7	30	33 ± 1.1	700	521 ± 117	N.D.	7.4 ± 3.1
Se	20	8.8 ± 1.2	10	11 ± 0.6	N.D.	.08 ± .03	N.D.	.46 ± .09

N.D.= Not declared.

TABLE 8. ESTIMATED DAILY COST OF MINERAL SUPPLEMENTATION AND PERCENT COVERAGE OF REQUIREMENTS, FOR CATTLE IN PANAMA, BASED ON COMMERCIALLY AVAILABE MINERAL SOURCES 1/.

Mineral Mix 1/	Daily Cost, cents/head	Percent Mineral Requirement Covered: 2/										
		Ca	P	Na	K	Mg	Cu	Fe	Mn	Zn	Co	Se
Fosfovac	2.4	21	41	63	.05	1	45	186	35	82	50	53
Salt: Pecutrin(lb)												
70:30	3.8	16	17	76	.002	1	6	6	5	12	59	19
50:50	5.9	27	28	78	.004	2	11	10	9	20	98	32
Salt: Concentrado Mineral (Lb).												
101:2	0.8	-	-	-	-	-	6	13	6	1	61	-

1/ Assuming an average daily intake of 60g/head. Following manufacturer recomendations.

2/ Daily requirements for a lactating cow (6 lt/day) (NRC.1978).

TABLE 9. NITROGEN CONTENT OF WHOLE CASSAVA PLANT (*Manihot*) TREATED WITH TWO ACQUA-UREA SOLUTIONS (N=6; mean ± Standard deviation).

Urea (% fresh basis)	Percent Nitrogen (dry matter basis): Ammonia-N	Total N	NH_3/TN
5	0.19±.07	1.05±.13	0.18±.05
10	0.50±.05	1.64±.13	0.31±.02
Control whole Cassava	0.11±0.0	0.54±.08	0.21±.04

TABLE 10. FRESH PUMPKIN (*Cucurbita* sp.) AS FEEDSTUFF FOR DAIRY CATTLE.

	TREATMENTS: Pumpkin intake, lb/head/day			
Measurements	0	5	10	SEM
Milk production, lb/day	11.5	12.7	11.9	.44
Milk composition, percent fat	3.34	3.29	3.33	.11
Total solids	11.38	11.09	11.36	.09
Forage intake, lb/head/day				
Corn silage	30.3	27.1	34.7	1.02
Graminea hay	9.4	8.7	6.3	.77

V. ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL RESEARCH

CARLOS A. NEYRA, Ph.D

RE.: QUARTERLY REPORT N°19

ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL RESEARCH

Carlos A. Neyra, Ph.D

PERIOD: January 1° to March 31, 1987

The ATD project and Rutgers University are providing since February 1985, the services of an Agricultural Research Administration Mgt. 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. GOAL: "To assist IDIAP in the formulation and implementation of institutional objectives, strategies, priorities, and evaluation of agricultural research".

B. GOAL: "To act as a Chief-of-Party and in-country coordinator of the technical assistance provided by Rutgers University to the ATD project in Panama".

ACTIVITIES

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

A.1. Project Evaluation: Problems Areas

Following project evaluation an Implementation Letter containing recomended actions was addressed by USAID/Panama to the Minister of MIDA. It indicated that the lack of financial Support to the project by the Government of Panama was very critical. The evaluation team identified three essential problem areas requiring inmediate solution in order to justify continued project implementation. These recomendations and corresponding

benchmark dates were discussed and agreed to, in principle, by USAID and IDIAP personnel on October 29, 1986.

The Ag. Research Adm. Mgt. specialist collaborated actively with IDIAP to prepare answer to those questions and solutions there after.

1. PROBLEM: Inadequate Level of Counterpart Funds.

Recomended Action: IDIAPS budget include an acceptable level of funds for operating expenses.

Benchmark date: Level will be expressed in a mutually approved implementation and budget plan by January 31, 1987.

Response: IDIAP met satisfactorily the request on time.

2. PROBLEM: Timely Counterpart Funding.

Recomended Action: The G O P must establish a mechanism to ensure timely counterpart funding for 1986 and 1987.

Benchmark date: Evidence, by January 31, 1987 that the G O P did provide full and timely counterpart funding for the last three months of 1986.

Benchmark date: Evidence, by February 28, 1987, that the G O P has established a mechanism through which the G O P will guarantee the timely availability of funds during 1987.

Benchmark date: By march 31, 1987 operational counterpart fund for 1987 will be available to the project.

Response: IDIAP met satisfactorily all three benchmark dates.

3. PROBLEM: Linkage of ATT and ATD

Recomended Action: A mechanism will be established whereby IDIAP researchers and ATT extensionists will (a) identify specific farmer problems, needs and market conditions as a basis for development, prioritizing, designing and implementing on-farm adaptive research programs and, (b) participate in the determination of technologies to be transferred to farmers.

Benchmark date: A Memorandum of Understanding, in form and substance acceptable to USAID/Panama describing the linkage between ATT and ATD, completed and signed by February 28, 1987.

Response: The Regional Directors of MIDA in project areas have established agreements with representative administrators of IDIAP to conduct joint work in Chiriquí, Parita and Tres Quebradas.

A.2. ATD Project: Extension/Amendment

At the beginning of the quarter, contract negotiations towards an extension of the ATD project through December, 1988 were proceeding normally and possibilities for this were good. Among the major actions taken place were:

1. IDIAP requested to MIPPE (Ministerio de Política y Planificación Economica) an extension of the ATD project through December 1988.

2. MIPPE officially requested in the name of the G O P, to USAID/Panama an extension of the ATD project.

3. The Agricultural Office (USAID/Panama) had taken the necessary steps towards extension and amendment of the project (through December, 1988) to include seven (7) specialists for The Rutgers Technical Assistance, including a Chief-of-Party. It also contained 12 months of short-term technical assistance.

4. During all of this process the Ag. Research Adm. Mgt. Specialist maintained continued communications with both USAID/Panama and IDIAP and discussions were mostly centered as to ways to improve project impact and research methodologies.

5. At the end of January 1987, we were only waiting for the approval from USAID/Washington.

By the middle of February, We learned that USAID/Washington was not going to sign the request for extension/amendment made by USAID/Panama and that additional information was needed. Finally, the ATD project extension beyond its PACD date on December 31, 1987 was disallowed but authorization was given to extend the Rutgers TA through August 31, 1987. I should say that events taking place at USAID were hectic and critical. At a certain point, on February 13 I received a suggestion from the Regional Contracting Officer that we should start plans for demobilization in march before budget runs out. Later the same day we hold a meeting at the Agricultural Office/USAID/Panama and the news were given that no inmediate demobilization was needed but the TA was going to be extended for another six months. Those were good news in part.

By march, 1987 a new Request for Proposal covering the costs for the extension was send to Reed Hertford at New Brunswick with the instruction that all five TA faculty in Panama could be extended to August 31, 1987.

On Feb. 27, Reed Hertford and Carlos Neyra met with Ray F. Rifenbourg, acting Director of USAID/Panama. Other USAID staff members present were: Denton Larsen, Dong Chiriboga, Michael Kenyon, Donald DRGA and David Schaers.

- We were informed officially that in the short run we will be extended to September 1, 1987 and that the mission had decided not to extend the ATD project with IDIAP beyond its PACD date on December, 1987. At this time of the meeting we realized that USAID/Panama had already made a final decission on this and that new strategies for funding to guarantee Rutgers continuity in Panama had to be found.

After the meeting RH and CN visited with Ray Rifenbourg and the possibility for USAID/Panama opening with IDB for our project was discussed. RR offered to make the necessary contacts and meet with the IDB representative in Panama, Dr. Carlos Villar. The Acting Director of USAID/Panama, Ray Rifenbourg told me about having held conversations with IDB about the possibilities for funding for the ATD project with IDIAP and the Technical Assistance provided by Rutgers. As a follow up there was an initial meeting in David Schaers office at USAID with the participation of Arnoldo Beltrán of IDB/Panama and CN for Rutgers.

Among the issues discussed in that meeting were:

1. The ATD project had provided to IDIAP with infrastructure (construction of Sub-centers and laboratories) and long term training for 31 researchers of IDIAP which constitutes a resource to be capitalized into any IDB project initiative in support of IDIAP.

2. It was clear that the Technical Assistance provided by Rutgers University had been effective and should be supported to assist IDIAP/MIDA in research and institutional development.

3. The meeting adjourned with the idea that Arnoldo Beltrán was to follow up discussions with IDB while Carlos Neyra, Rutgers Chief-of-Party, was to follow up with IDIAP, MIDA and MIPPE.

4. CN prepared a working document outlining the strategies for financial support of IDIAP and ATD project including the Technical Assistance. The approach was discussed with IDIAPS top Administration and the Planning Unit headed by Vernon Wynter was charged with the preparation of proposals. The Ag. Research Adm. Mgt. specialist was acting as an advisor to this group. The draft document should be ready no latter than April 7, to give sufficient time for review and adjustments before the Analysis Mission of IDB arrives into Panama in late April.

5. CN and IDIAP administrators followed up actions with MIPPE and MIDA. A meeting was arranged with Lic. Nuvia de Harpa, Director of Economic and Social Planning (MIPPE) to discuss issuess related to the termination of USAID support for the ATD project

and the emerging possibility of funding from IDB. Similarly, meetings were held with Dr. Agapito Peralta (Livestock Project Coordinator) and Lic. G. Gonzáles (Director of Technical (Cooperation) of MIDA. Thus far, the possibility for obtaining funding support from IDB looked promising by the end of this quarter.

B. GOAL: "To act as a Chief-of-Party and in-country coordinator 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 described as follows:

1. Keeping records of activities and reports for each member of 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°18 for the period covered from October 1° to December 31, 1986.

3. Participate and Assist with the coordination to visits to Panama by Rutgers Faculty as part of the backstopping efforts to the ATD project and related activities.

   - Coordination of visit for research purposes by Dr. Mark Singley, Professor, Department of Biological and Agricultural Engineering. Dr. Singley came to Panama accompanied by Mr. Robert Flory and K. C. Ting to conduct collaborative work with the Vegetables-Onions program assisted by Dr. Mark Gaskell, Agronomy Specialist of the Rutgers TA team in Panama. Their visit was highlighted in a local publication of an important Producers Cooperative - Cooperativa Horticola de Mercadeo, Boquete, Febrero 1987, Bulletin 2/87.

   - Coordination of a visit by Dr. W. Wolfe, Cook College Faculty of the Entomology and Economic Zoology Department. His tour was in relation to a collaborative Rutgers-IDIAP-PSTC project in Panama.

   - Coordination of a visit by Dr. T. Airola, Cook College Faculty of the Environmental Resources Department. His

tour was related to a Fullbright Scholarship to conduct collaborative research with the University of Panama on "Remote Sensing".

- Coordination of visit by Reed Hertoford on February 26 through 28 related to matters dealing with ATD Project Amendment.

ChOP briefed Reed Hertford on:

- ATD project outlook in Panama
- Discussions held with IDIAP Top Administration on Project Extension and the consequences for IDIAP if ATD project is terminated on December 31, 1987.

- R. H. and the ChOP met with AID acting Director Ray Rifenbourg and several AID staff members on February 27.

4. RUTGERS ATD TEAM MEETINGS

During this quarter we held two Project related meetings with ATD Faculty:

- Meeting on January 27 at IDIAP, Sub-Centro de Azuero, Los Santos with the following agenda:

I. Report from the Chief-of-Party
II. Quarterly and Annual Reports
III. Communications Channels.
   - In Country
   - With Campus
IV. Work Plans/TA
V. Research Planning/IDIAP/POA 1987
VI. Other Bussiness

Called of order was given at 9:00 AM and the meeting was initiated with all five members of the Rutgers TA team: P. Argel; A. Cordero; M. Gaskell; C. Neyra and J. Zorrilla. The minutes were prepared by the ChOP (Carlos Neyra) and properly distributed to each TA member with a copy to Reed Hertford (IAFP/Cook College).

- Meeting on March 24, 1987 at Hotel Gran David, Santiago, Veraguas with the following Agenda.

I. Chief-of-Party Report
II. Technical Assistance Reports
   a. Annual/1986 due by April, 1987
   b. Quarterly Reports/1987.

- January to March, 1987 - Report N°19
- April to May, 1987 - Report N°20
- June to August, 1987 - Report N°21

c. Workshops and Seminars to report on the ATD work should be scheduled between April and July, 1987.

III. ATD/AID: Report by David Schaers and Donald DRGA of USAID/Panama.

The meeting was called to order at 11:00 AM by the Rutgers Chief-of-Party and initiated with the attendance of all five TA Rutgers Team members and two visitors from the Ag. Division/USAID-Panama, Donald DRGA and David Schaers. The Chief-of-Party was in charge of preparing the Minutes and to distribute them to ATD faculty and the IAFP/Cook College.

5. Development of InterInstitutional Cooperation Programs: University of Panama.

The Chief-of-Party (Rutgers) met with Rector Abdiel Adames and Professor Evidelio Adames in the Rectors Office to discuss the implementation of a collaborative project between the Dept. of Entomology and Economic Zoology at Cook College and the University of Panama. Attached to this report there is a copy of the Memory AID prepared by the Rutgers Chief-of-Party.

MEMORY - AID

FROM: Carlos A. Neyra

DATE: 1-15-87 10 a.m.

RE.: VIRUS EEE/RECTOR ADAMES

We met with Rector Abdiel Adames and Prof. Evidelio Adames in the Rector's office to discuss the implementation of a collaborative project between the Dept. of Entomology at Cook College and the University of Panama. Several steps had been taken prior to this meeting:

1. Contact with Prof. Evidelio Adames
2. Personal delivery of a telex from I.A.F.P. on the Subject to Rector Adames
3. A letter from my office to Rector Adames and
4. A request for a meeting.

The following relevant information was obtained:

1. Dr. Abdiel Adames is very insterested in the Collaborative project and has instructed to Prof. Evidelio Adames to draft a letter of intent and response to the request from Cook College.

2. In relation to the Graduate Student (PHD) and the Post-Doc:

   a. Dr. Adames offered to sponsor the fellowship for Prof. Evidelio Adames to pursue graduate work towards a PHD degree using University of Panama funds.

   b. He also suggested that the Post-Doctor salary would be difficult to justify here and that could be rather a responsibility of Rutgers.

c. The U.P. would provide logistic support: Laboratory and Technicians for when the Post-Doc. is here.

All of the above would serve as a basis for the implementation of the collaborative agreement and future seeking of funds.

To further on this initiative several faculty from the U.P working in fields related to Entomology have visited our offices and discuss possibilities of developing collaborative research projects:

- Lic. Gloria Davila de De Obaldía, MSc. Entomology "Plants with Insecticide Properties" and "Virus EEE" (W. Crans) Cook Contact: Dr. Cecil Still, Biochem. and Microbiology, Faculty U.P./Microbiology Dept.

  Lic. Viodelda Lee de Chong
  "Agricultural Entomology: Integrated Pest Management" Fac. U.P./Biology Dept.

  Interested in attending Vegetable Course at Rutgers during Summer.

  Lic. Ginella Calvit de Martinez

  MSc Entomology (Agriculture)
  Assistant Faculty at U.P.
  Interest: "Integrated Pest Management"

  Also interested in attending Vegetables short course at Cook for Summer, 1987.

  Experience in Horticulture

  Argentina Yin de Turner

  MSc. Medical Entomology/Parasitology.
  - Interest Virus EEE
  - Contact: Dr. Wayne Craus, Randy Gaugler

  Silvio Vega, MD
  Faculty of Medicine School/UP/Microbiology

  - Interest: Pursue Graduate Work in Microbiology at Rutgers.

  Fellowship: U.P.

All of this indicate good possibilities for developing a broadly based collaborative agreement with the University of Panama. There is evidence of sufficient interest as expressed by the above and the earlier conversations on occasion of President Bloustein visit.

APPENDIX

RE.: Report N°19 José Zorrilla-Ríos

A. Algunas Consideraciones Acerca de lo Riesgoso que Sería Tratar de Estacionalizar la Producción Lechera en un Sistema de Producción Doble Propósito Latinoamericano en el Trópico Seco.

B. Propuesta a la Dirección Nacional Pecuaria del IDIAP Sobre Posibles Alternativas de Acción en las Fincas de Fomento Lechero del MIDA.

C. Diseño para la Construcción de un Salero para Ganado.

D. Mejoramiento del Valor Nutritivo de Forrajes: Pruebas químicas y de consumo. Notas de Investigación en Progreso. IDIAP. Año 2, N°7, Enero, 1987.

ALGUNAS CONSIDERACIONES ACERCA DE LO RIESGOZO QUE SERIA TRATAR DE ESTACIONALIZAR LA PRODUCCION LECHERA EN UN SISTEMA DE PRODUCCION DOBLE PROPOSITO LATINOAMERICANO EN EL TROPICO SECO.

Preparado por José Zorrilla-Ríos,
Asesor Pecuario
IDIAP/U. de Rutgers.

La reciente atención que las Instituciones Nacionales e Internacionales competentes han mostrado en el estudio del sistema de producción de leche y carne (doble propósito) en zonas tropicales secas de Latinoamérica, ha llevado a algunos de sus estudiosos a sugerir la conveniencia de estacionalizar la producción como una estrategia para hacer mas eficiente el sistema. Bajo este concepto, se pretende que a través de prácticas de manejo reproductivo, se haga coincidir la época de mayor disponibilidad del recurso forrajero con la de producción de leche. Esto consecuentemente ocasiona que las vacas entren a la época de verano, en el período seco de su ciclo de producción. Esta actitud obedece en parte a lo antieconómico que comúnmente resulta el establecer prácticas de suplementación/alimentación para producción durante este período de restricción alimenticia.

El déficit en la producción de leche ocasionado con esta medida se argumenta puede ser cubierto por un incremento en la producción en aquellas zonas mas favorecidas para esta actividad durante el verano.

A continuación se mencionarán algunos de los factores que el autor considera juegan un papel importante en esta alternativa y que a su juicio, indican que no seria la estrategia mas conveniente a seguir.

1. La estacionalidad en la producción de leche implica que se busque concentrar la parición de las vacas con el inicio de la época de lluvias, de tal forma que sus altas exigencias nutritivas en esta época, esten cubiertas por el forraje tierno, suculento y abundante, al menos durante los tres-cuatro primeros meses de su lactación.

   Con un período de lluvias de mediados de Mayo a finales de Noviembre, el tener vacas pariendo a principios de Mayo hasta Julio, implica que queden gestantes entre Agosto y Octubre. El fin de la lactación tendría lugar entre Noviembre y Enero, de tal forma que la gran mayoria de las vacas estuvieran secas entre los meses de Enero y Abril (período de verano). En mi opinion, bajo este manejo, se puede esperar que el comportamiento reproductivo subsecuente de los animales tome uno de las dos siguientes alternativas: que las vacas queden gestantes en la primera época de empadre subsecuente a su parto, entre Agosto y Octubre, o sea durante su cuarto y sexto mes de lactación, o bien que de no quedar gestantes, tendrán que esperar hasta el siguiente período de empadre el año siguiente. La primera alternativa implica un período entre partos de 365 días (12 meses, parto todos los años), mientras que la segunda alternativa obliga un pe-

ríodo entre partos de 24 meses (partos en años alternos).

Las preguntas que al respecto debemos hacernos serian:

¿Qué porcentaje de vacas podemos esperar cumplan con un período entre partos de 12 meses? La información disponible y en base a mi experiencia me hacen dudar que cualquier cosa por arriba del 20% seria difícil de obtener en forma consistente. Por otro lado, el grueso de la población consecuentemente pasaria a presentar en forma muy prominente un período entre partos de 24 meses. El resultado final de esto se vería reflejado forzosamente en una tasa de parición anuales imposible de ser mayor al 55%.

¿Cuándo se puede esperar una mayor fertilidad del ganado? Mi respuesta es durante los tres primeros meses de lluvias (Mayo-Julio), período durante el cual NO se tendría empadre, ya que este se programaría entre Agosto y Octubre, con el propósito de hacer coincidir los partos con el inicio de las lluvias del año siguiente. Esto ocasionaría muchas vacas en celo sin recibir servicio o sea, el grueso de vacas que optaron por el período entre partos de 24 meses. Además del desperdicio biológico esto implicaría problemas de manejo con el toro de la finca que se mencionará mas adelante.

¿Cómo afectaria en la productividad y eficiencia reproductiva de las vacas el hecho de que el último tercio de su gestación lo pasaran en plena época de verano? Como lo que buscaria este sistema de estacionalidad en la producción es obviar el uso de la suplementación alimenticia en la época de verano, muy probablemen-

te estas vacas sufririan negativamente, sobre todo en el aspecto reproductivo, lo que contribuiria al bajo porcentaje de vacas conciviendo durante el inicio de la lactancia.

2. El empadre estucional implica separar al toro un buen número de meses durante el año, de hecho practicamente se tendría que usar unicamente entre Agosto y Octubre. En fincas doble propósito típicas, con un tamaño de hasta 100 has. resultaría un verdadero problema mantener al toro lo suficientemente separado del hato de vacas, como para que no las cubriera, sobre todo si estas estan saliendo en celo. Un problema de considerable magnitud para el productor y un requisito muy importante para el éxito del programa.

3. La estacionalidad en la producción en la época de lluvias fomentaría un ajuste de cargas animales mas acordes con esta época, con el propósito de aprovechar al máximo la transformación del forraje producido en leche, con la subsecuente sobrecarga en la época de verano. No todos los productores tiene la posibilidad de descargar sus fincas de animales durante el verano, lo que los obliga a mantener una carga mayor de la adecuada en verano.

¿Cómo afecta en la productividad a largo plazo de las praderas el sobrepastoreo en verano? Yo creo que negativamente, aunque podría estar equivocado. Lo que si es que tendría efectos negativos en vacas en su último tercio de gestación como se mencionó anteriormente.

4. En el caso particular de las Provincias Centrales de Panamá, la Compañía Nestlé controla practicamente el comercio de la leche producida por fincas doble propósito. Esta compañía ha alcanzado su total capacidad de procesamiento de leche en la época de lluvias, por lo que en caso de presentarse una situación de sobreproducción en lluvias, pretende establecer un sistema de cuotas para productores con un carácter preferencial para aquellos que también produzcan en la época de secas. Si bien esta es una condición local, podría servir de ejemplo como una posible realidad en otras zonas, es decir, enfrentar el mismo problema. La estacionalidad de la producción conllevaría a un incremento en la producción de lluvias, agudizando así el problema de su comercialización.

5. Creo que la estacionalidad en la producción fomentaria un estancamiento en el desarrollo de la actividad, al ser mas difícil justificar centros de acopio y enfriamiento de leche, cuando estos serían utilizados sólo una parte del año. La misma argumentación se podría dar para el cierre temprano y/o la resistencia a establecer nuevas rutas de recolección de la leche. El impacto económico que esto tendría lo resentiría unicamente el pequeño productor y nadie mas.

6. La alternativa de satisfacer el posible déficit de leche que se creara en la época de secas con el establecimiento de la estacionalidad en la producción, fomentando su producción en zonas mas

apropiadas no es posible concebir bajo un concepto de fácil entrada y salida según lo requiera el mercado. La producción de leche en forma mas especializada es definitivamente una actividad que toma mucho tiempo establecer y que debe tener una planeación sostenida a largo plazo. En países del trópico Centroamericano, aproximadamente el 80% de la producción lechera proviene de fincas doble propósito, con una marcada fluctuación entre la época de lluvias y la de secas. Para las Provincias Centrales de Panamá, esta diferencia llega a ser de cinco veces. El esperar que este volumen de leche sea suministrado por hatos localizados en zonas mas favorables representaria que estos tuvieran que aumentar su producción en 2 a 3 veces durante el verano (3-4 meses), y bajar a sus niveles anteriores durante el invierno. Esto como ya se mencionó es inconcevible en actividades lecheras especializadas. De hecho, en caso de lograrse un aumento considerable en la producción de verano en fincas especializadas, se esperaría se mantuviera en época de lluvias, lo que si bien podría ser positivo para reducir el déficit nacional, creo que podría tener resultados adversos para la economía de los sistemas doble propósito. La alternativa de la importación es sí, una acción a corto tiempo que se maneja actualmente con este fin. No creo necesario entrar en detalle de sus ventajas y desventajas para los fines de este manuscrito.

7. La producción lechera estacional y su consecuencia en el procesamiento, almacenamiento y reconstitución del productor para dife-

rir el excedente a las épocas de sequía representa un costo que en alguna forma repercutirá en el productor o el consumidor. Su efecto se puede predecir negativo para la actividad.

8. La característica financiera del sistema doble propósito de convertirse en el sustento diario familiar y de operación de la finca ha sido reconocido como un factor clave en la existencia del mismo. La estacionalidad en la producción iria en contra de esta situación por lo que se podría considerar como antagonista a una necesidad económica de sus productores.

9. Lo expuesto con anterioridad me hace pensar que la evaluación económica que se realiza sobre la conveniencia de suplementar en cierto grado al ganado en época de verano, no contempla estas posibles consecuencias y que por lo tanto podría ser mas ventajosa que lo que muestran apreciaciones mas tradicionales. Probablemente, se debería estimar el efecto de la suplementación no sólo en base a respuestas inmediatas, sino también incluyendo aquellos factores colaterales y de mediano/largo plazo, lo que podría mostrar una imagen diferente en el beneficio económico que se puede esperar de programas de suplementación apropiados para la época de verano.

Marzo/'87.

PROPUESTA A LA DIRECCION NACIONAL PECUARIA DEL IDIAP, SOBRE POSIBLES ALTERNATIVAS DE ACCION EN LAS FINCAS DE FOMENTO LECHERO DEL MIDA.

Preparado por: Dr. Jose Zorrilla Rios
Asesor Pecuario IDIAP
U. de Rutgers.

RESUMEN

Se presentan sugerencias de programas pecuarios especificos para una posible intervencion del IDIAP en el aprovechamiento del recurso potencial existente en las Fincas de Fomento Lechero del MIDA, en particular en los siguientes rubros:

1o. Diversificacion de los objetivos de las Fincas, incluyendo ademas de los sistemas especializados de produccion lechera, el doble proposito y los sistemas intermedios. De esta forma, el productor puede sentirse mejor identificado con las Fincas y visualizar sus alternativas de mejora, en una forma real y concreta. Esta accion significa el establecimiento de Unidadades de Produccion Lechera con diferentes grados de adopcion tecnologico.

2o. Para el establecimiento de las Unidades Doble Proposito, se propone la formacion de un Hato Nacional geneticamente superior, en base al rescate del material genetico disponible con los productores con caracteristicas productivas sobresalientes. Estos animales constituirian un nucleo fundador a partir del cual se podria generar una poblacion ganadera doble proposito mejorada.

3o. Como una consecuencia al establecimiento de estos programas, se podra proporcionar a los productores, sementales probados geneticamente, tanto doble proposito como de razas puras de carne y de leche. Estas razas puras serian aquellas que se hubiesen escogi-

do para los programas de curzamiento seleccionados para los sistemas de produccion de leche intermedios entre el doble proposito tipico y el especializado de leche.

4o. Utilizacion de estas Unidades de Produccion como Centros de Capacitacion de Tecnicos Pecuarios y Productores, y ademas, como verdaderos puntos de reunion e identificacion entre investigadores, extensionistas y productores.

Marzo/1987.

I. ESTABLECIMIENTOS DE UNIDADES DE PRODUCCION DOBLE PROPOSITO Y ESPECIALIZADAS.

ANTECEDENTES

La importancia que tienen los sistemas de producción doble propósito como satisfactores de alimentos básicos ha sido plenamente identificada en la actualidad. En el caso de Panamá, se estima que los sistemas doble propósito contribuyen con el 85% de la producción de leche nacional y proporcionan aproximadamente el 25 % de los becerros destinados a la engorda.

La producción especializada de leche o carne juega también un papel muy importante, con un potencial de mejoramiento en su productividad muy amplio, a través de la adopción de tecnología apropiada.

El Instituto de Investigaciones Agropecuarias de Panamá(IDIAP) ha enfocado su actividad de investigación pecuaria primordialmente, a la identificación de ecotipos de pastos y forrajes mejor adaptados a las condiciones ecológicas de Panamá, y a la caracterización de los sistemas de producción doble propósito. La experiencia acumulada por su personal técnico en estas áreas ha sido aprovechada por los productores interesados y ha servido de antecedente a otras instituciones nacionales e internacionales con similar interés. La metodología de investigación pecuaria en su afan de mejorar la productividad, reconoce la necesidad de actuar tanto en fincas de productores, como en Estaciones Experimentales y unidades de producción, en donde es factible controlar un mayor número de factores y tomar mayores riesgos. Por lo tanto, se considera que la proyección a impacto que la labor del IDIAP ha logrado dentro de sus limitaciones acutales, podría incrementarse substancialmente al contar con Unidades de producción Doble Propósito y Especializadas, en las cuales imple-

mentar y validar diversos sistemas integrados de producción, acordes con las características productivas de la región.

Introducción:

Con el propósito de fortalecer el puente tan necesario entre las Estaciones Experimentales, los extensionistas del sector y los productores, se propone que IDIAP, en colaboración con otros organismos del sector involucrados en el proceso de validación y transferencia de tecnología pecuaria, tenga la oportunidad de implementar el cumulo de tecnología disponible a la fecha en unidades de producción. Estas unidades podrán ser diseñadas con diversos grados de desarrollo tecnológico, de tal manera que sirvan en forma efectiva de vitrinas demostrativas del progreso productivo al que los ganaderos pueden aspirar, con la adopción gradual y programada de tecnología innovativa, apropiada a sus condiciones.

Una vez consolidados las distintas unidades de producción, estas podrán servir de centros de adiestramiento de técnicos y productores, al convertirse en modelos de funcionamiento de la tecnología pecuaria apropiada a los diferentes sistemas de producción.

Objetivo General:

Servir de apoyo al incrementar la productividad pecuaria a través del fortalecimiento del proceso de generación de tecnología, su validación y su transferencia al productor.

Objetivo Especifico:

El establecimiento de unidades de producción doble propósito y especializadas de leche, que permitan la validación y transferencia de tecnología generada, apropiada a diferentes niveles de producción.

Metas a Corto Plazo (1-2 años):

1. Identificación de los diferentes sistemas de producción y sus grados de especialización.

2. Definición de programas integrales de manejo de los diferentes hatos.

3. Implementación de los programas integrales de manejo.

A Mediano Plazo (3-6 años):

1. Integración a las unidades de producción de un mínimo de 5 productores localizados en el área.

2. Ajuste de programas de manejo y estrategias, de acuerdo a resultados y retro-alimentación de técnicos y productores.

3. Identificación de limitantes productivas en los diferentes sistemas implementados, seguido de una priorización y diseño de actividades de investigación pecuaria, tendientes a darles respuesta.

Largo Plazo (7 años en adelante):

1. Influencia a nivel nacional
2. Consolidación de unidades de producción con distintos grados de especialización.

3. Funcionamiento de estas unidades de producción también como centros de adiestramiento para técnicos y productores.

Estrategias. A corto plazo:

1. En base a información disponible y experiencia acumulada entre los técnicos del sector y los productores, se definiran los diferentes sistemas de producción que se implementarán en las unidades de producción..

2. Diseño por parte de técnicos y productores de los programas de manejo a establecer de acuerdo a los sistemas de producción seleccionadas.

3. Caracterización de fincas de productores operando en forma tradicional potencialmente interesados en adoptar cambios tecnológicos de manejo.

A Mediano Plazo:

1. Implementación de los programas de manejo adoptados en las unidades de producción, en fincas de productores.

2. Evaluación en finca de productores, del efecto en la producción con la implementación de cambios tecnológicos en función en las unidades de producción.

3. Análisis de información y experiencias generadas tanto en las unidades de producción, como en las fincas particulares, con el propósito de priorizar actividades de investigación.

4. Implementación de cursos teorico-prácticos para técnicos y productores, tomando como base las experiencias generadas en las unidades de producción y las fincas privadas involucradas.

A largo Plazo:

1. Difusión de las experiencias obtenidas en las unidades de producción con el mayor número de productores posible, por medio de cursos prácticos para técnicos y productores, utilizando las facilidades de las mismas unidades y a través de la integración de fincas particulares al sistema de manejo y registro de las unidades.

2. Establecimiento de un flujo contínuo de información de los investigadores a los extensionistas y de estos a los productores y visceversa. Se tendrá como punto de reunión las unidades de producción y las fincas particulares.

II. FORMACION DE UN HATO SELECTO DOBLE PROPOSITO.

Antecedentes.

La selección genética en una población es una alternativa de mejoramiento genético encaminado a la fijación de características deseables pre-establecidas, presentes en mayor grado en una proporción relativamente pequeña de la población. Ejemplos del empleo exitoso de esta alternativa en la fijación de una característica lechera, son el ganado lechero Illawara Shorthorn Australiano, el Criollo Lechero Centroamericano y el ganado Lucerna de Colombia.

La magnitud, complejidad y duración de esta labor la hacen propia de una institución oficial. Su objetivo fundamental es la identificación y rescate de animales genéticamente superiores a uno o varias características deseables de producción, las cuales servirán de núcleo fundador de una futura población mejorada.

Introducción.

Dentro de toda población de ganado indígeno, se pueden identificar individuos superiores a la media o moda de la población. El ganado identificado como Doble propósito de Panamá, una mezcla racial en proporciones indefinidas de *Bos indicus* (Cebu) y *Bos taurus* (Criollo, Pardo Suizo y/o Holstein, fundamentalmente) cuenta también con animales sobresalientes en una u otra característica productiva, tal como partos frecuentes (inter-

valos entre partos menores a 16 meses); buena habilidad materna (destete de crias grandes y sanas), se mantiene en condición física superior al resto del hato, aún en épocas de escaces; temperamento lechero (fácil de ordeñar, buena productora). Los productores aún cuando no lleven registros, tienen identificados esos animales superiores de su hato. Sin embargo, en la mayoria de los casos, estos animales no ejercen mayor impacto que el que puedan tener en el núcleo productivo reducido al que pertenecen. Es decir, su calidad genética tiene poca trasendencia sobre una población regional o nacional. Estos animales han pasado por un proceso de selección natural de varias centenas de años bajo condiciones ambientales y de manejo muy características de las regiones ecológicas de las que provienen. Su valor genético radica precisamente en esa superioridad productiva desarrollada bajo condiciones típicas ecológicas y de manejo, caracterizadas por marcadas limitaciones y fluctuaciones nutricionales, exposición continua a endo y ectoparásitos, factores climáticos y un manejo de tipo extractivo fundamentalmente. Un programa pecuario nacional encaminado a incrementar la producción de leche y carne en base a una mayor eficiencia del sistema tradicional, producto este del medio ecológico imperante, armónico con el proceso económico y de mercadeo establecido y perfectamente identificado con el factor humano, podría contar con posibilidades de éxito mayor, que aquel programa basado en la introducción de una tecnología totalmente extraña al medio

ecológico, al sistema económico y al hombre al que va dirigido.

Objetivo General.

Incrementar la productividad pecuaria en base a la explotación de material genético indígeno de calidad superior, coherente con los factores típicos ambientales y de manejo que intervienen en el proceso productivo.

Objetivo Específico.

La fundación de una población de ganado doble propósito con características deseables de producción, superiores a la media de la población original basada en un núcleo selecto local. Este núcleo selecto local estaría representado por el rescate genético de animales sobresalientes en términos de paramétros productivos pre-establecidos.

Metas A Corto Plazo (Primeros 2-3 años).

1. Estructuración de un programa técnico/administrativo/operacional que especifique la filosofía del programa y el mecanismo para su implementación. Dentro del renglón técnico se contemplarán entre otros, aspectos tales como el de la identificación de características productivas deseables y definición de programas raciales de empadre y manejo general del hato superior. La definición de un procedimiento administrativo para la obtención de estos animales sobresalientes, actualmente en poder de los productores (canje,

reemplazo, pago en efectivo, etc.). En el plano operacional, la identificación y acopio en fincas del Estado, de animales supuestamente superiores.

2. Implementación de registros productivos y reproductivos para el núcleo selecto de animales.

3. Inicio de pruebas de comportamiento en toretes nacidos de vacas fundadoras, candidatos a ser futuros sementales doble propósito. El criterio de estas pruebas a estas alturas del programa, será en termino de ganancia de peso a diferentes edades, edad a la pubertad, madurez sexual, líbido y capacidad de monta.

A Mediano Plazo (4-8 años).

1. Evaluación estricta de animales conducente a una identificación absoluta de animales realmente superiores.
2. Implementación en núcleo selecto de plan de apareamiento previamente seleccionado.
3. Incremento numérico del hato superior.
4. Inicio de pruebas de progenie en vacas fundadoras.

A Largo Plazo (más de 8 años).

1. Pruebas de progenie de sementales y vacas doble propósito, para identificar animales genéticamente superiores y determinar su capacidad de transmisión de caracteres productivos deseables.

2. Formación de un núcleo de población bovina doble propósito con potencial real de mejorar la ganadería panameña destinada a la producción simultánea de leche y carne.
3. Ampliación de este núcleo en las fincas estatales, a través de la aplicación continuada de tecnología especializada: inseminación artificial, transplante de embriones y cruzamientos programados.
4. Constitución de una fuente de producción de toretes sementales y hembras doble propósito, superiores a la media de la población, con características genéticas de producción y reproducción previamente evaluadas. Estos animales de alta calidad genética y perfectamente acordes al sistema común de producción, estarían disponibles a los productores interesados en mejorar sus hatos, a precios accesibles.

Idiap
Instituto
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Agropecuaria
de Panamá

Diseño para la Construcción de un Salero para Ganado

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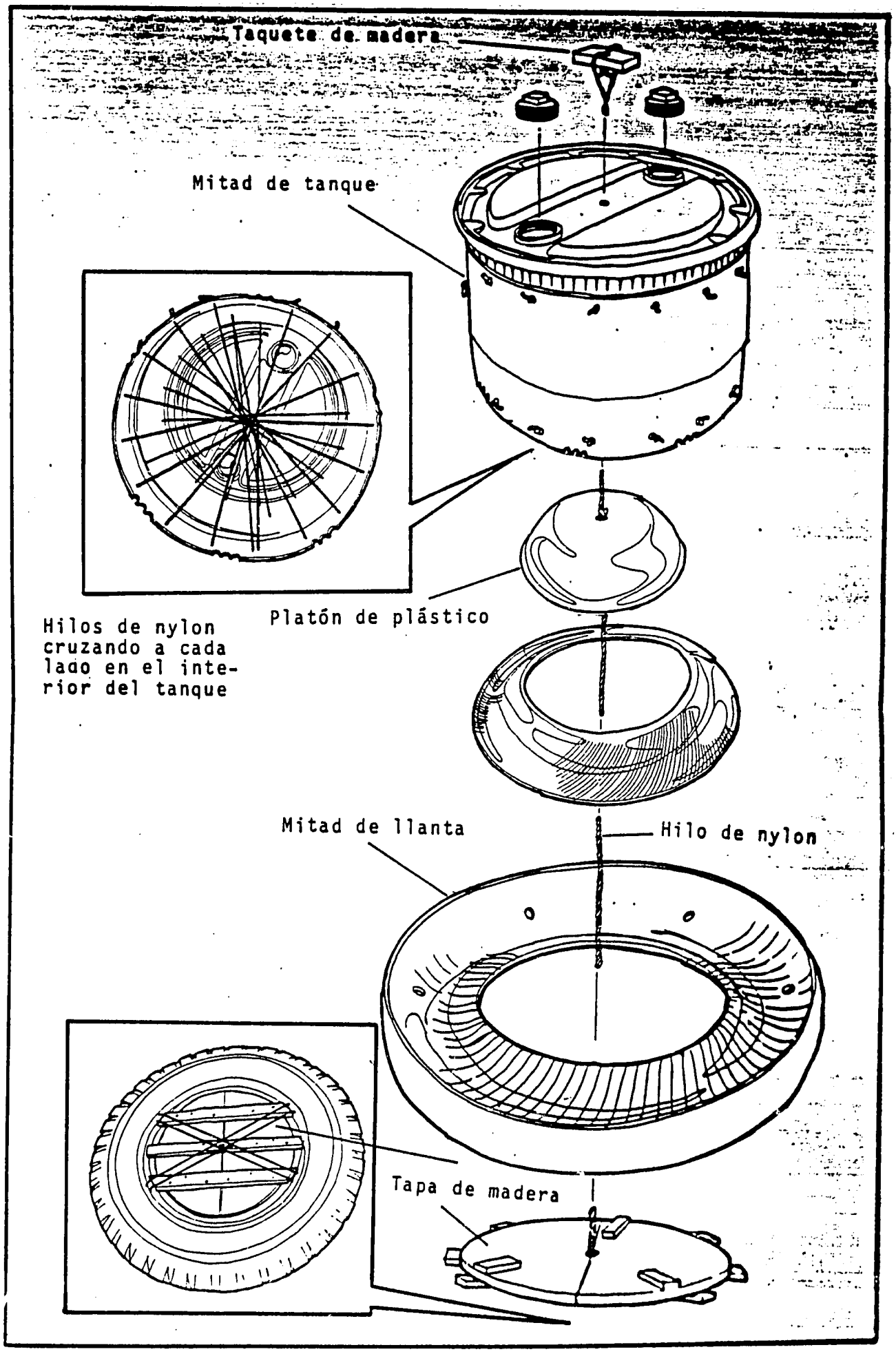
1987

69


Taquete de madera
Mitad de tanque
Platón de plástico
Hilos de nylon cruzando a cada lado en el interior del tanque
Mitad de llanta
Hilo de nylon
Tapa de madera

DISEÑO PARA LA CONSTRUCCION DE UN SALERO PARA GANADO

Los ganaderos panameños reconocen la importancia de suministrar sal mineralizada al ganado durante todo el año. Sin embargo, también es cierto que esta práctica no se realiza con la frecuencia y constancia que requieren los animales.

Dentro de los factores que limitan esta práctica se pueden mencionar:

1. La selección de una mezcla mineral a precio razonable, disponible en el mercado y que proporcione una combinación aceptable de minerales, especialmente fósforo y calcio.

2. La disponibilidad de saleros eficientes, durables, baratos, fáciles de construir por el ganadero y que eliminen o reduzcan la mayor parte de los problemas que se presentan con el suministro constante de sal al ganado y, finalmente,

3. La idea de que resulta costoso mantener esta práctica.

El aspecto económico es el factor que con mayor frecuencia determina la adopción de alternativas tecnológicas en el manejo del ganado por parte del ganadero. Por lo tanto, a continuación se comenta en primer lugar la suplementación mineral en términos económicos, seguido por algunas indicaciones sobre el tipo de mezcla mineral, además, se proporciona un diseño de salero mineral de fácil construcción, barato y funcional, reduciendo substancialmente muchos de los problemas que tiene el ganadero con el suministro constante de sal mineralizada al ganado en pastoreo.

Basado en los precios de las mezclas minerales, disponibles actualmente en el mercado (Enero/87), se puede calcular que el costo de una suplementación de sal mineralizada que cubra al menos la mitad de las necesidades diarias estimadas en el ganado de carne, en los trópicos, es de aproximadamente 3 centésimos de balboas por animal al día. Se acepta para

este cálculo que la composición declarada en las etiquetas de las mezclas disponibles, refleja adecuadamente el contenido del producto. El costo de un año de suplementación de sal mineralizada por animal sería entonces de 11 balboas, y en un hato de 100 animales de 1,100 balboas. Si se pretendiese cubrir íntegramente el costo anual de esta suplementación mineral con el incremento esperado en la cosecha de becerros destetados anualmente, se requeriría únicamente obtener de 6 a 7 becerros más. Experiencias en otros países del trópico latinoamericano y aquí en Panamá, han demostrado un incremento del 10 al 30% en el número de pariciones, dependiendo de la severidad de la deficiencia mineral. Si consideramos otros beneficios adicionales, tales como: un mejor peso, salud y aspecto general de los becerros al destete y el de sus madres, se puede esperar de la suplementación mineral del ganado, en Panamá, una de las prácticas ganaderas con mayor rentabilidad.

Es recomendable seleccionar las mezclas

13

minerales que reúnan lo siguiente: disponible en el mercado, proporcionar sal común, minerales mayores y menores (traza); a la alternativa común del ganadero de comprar por separado la sal, una fuente de fósforo y un concentrado mineral. Las ventajas que se pueden mencionar con la adquisición de un producto completo que contenga los tres ingredientes es que evita un mezclado incorrecto como sucede frecuentemente, ya que éste se realiza con palas en la finca. Además, ahorra tiempo y esfuerzo al ganadero evitándole acudir a dos o tres sitios diferentes para adquirir sus ingredientes por separado, y, por último, el posible ahorro que pudiera representarle el preparar su propia mezcla mineral, probablemente ni justifique los dos inconvenientes mencionados anteriormente. En todo esto, es muy posible que se incurra en el error de ahorrar en las riendas del caballo, a costa de sacrificar en la casta del animal.

El último aspecto del que hablaremos será el de los saleros para ganado en pastoreo.

El tipo de saleros que se observan en el campo varían de aquéllos altamente elaborados, de cemento y bloques, con techo, que si bien reúnen todas las características exigidas para un salero, son definitivamente costosos. Estos por su característica de ser fijos, obliga una inversión alta en la finca para cubrir las necesidades de saleros en todas las mangas. Los otros tipos de saleros más frecuentemente utilizados son demasiado rudimentarios, por lo que en realidad no cubren satisfactoriamente su objetivo de saleros, ni mucho menos ofrecen garantía alguna de proteger la mezcla mineral de los efectos de la lluvia y el viento, contribuyendo al desperdicio del suplemento. Para reducir las pérdidas bajo estas condiciones, el ganadero opta por ofrecer la sal periódicamente, lo que se traduce en una práctica tediosa, y a la vez coadyuva en que el ganado consuma menos sal mineralizada de lo que requiere. El personal técnico pecuario del Instituto de Investigación Agropecuaria de Panamá (IDIAP), Región Central, conscien

te de este problema y en su afán de asistir al productor en la búsqueda de soluciones a sus problemas, ha diseñado un nuevo tipo de salero que reduce considérablemente muchos de los problemas mencionados anteriormente; cuya construcción es sencilla, bajo costo y portátiles. Para mayor información e indicaciones de como usted, amigo ganadero, puede construir sus propios saleros, lo invitamos a que se dirija a las oficinas del IDIAP, en la Región Central, ubicadas en la Ciudad de Santiago y solicite información a los técnicos pecuarios quienes gustosamente le atenderán.

Recuerde amigo ganadero, el consejo que se le ha brindado:

1. Suplementar una mezcla de sal mineralizada completa a su ganado es una de las prácticas más rentables en ganadería.

2. Hay disponibilidad de mezclas de sales minerales completas en las casas

76

comerciales de la localidad, a precios razonables.

3. Por medio de este Boletín, se le está ofreciendo gratuitamente el diseño de un salero que lo liberará de los problemas que presenta el suministro de sal mineralizada al ganado en pastoreo.

Siga este consejo y al cabo de poco tiempo se convencerá de que tomó una decisión correcta.

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MEJORAMIENTO DEL VALOR NUTRITIVO DE FORRAJES
I. PRUEBAS QUIMICAS Y DE CONSUMO

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INTRODUCCION

Es característico de la estación seca la reducción en la disponibilidad y calidad del alimento en la pradera, lo que obliga al productor a enfrentarse a una de las siguientes alternativas:

1. Aceptar mermas significativas en la producción de carne y leche, y, en casos extremos, reducción de su hato.
2. Implementar medidas oportunas que disminuyan el efecto negativo de la sequía sobre la productividad de su finca.

Como alternativa de alimentación para el ganado durante esta época, el ganadero tendría la opción de mejorar el valor nutritivo de los forrajes pobres disponibles, tales como: residuos de cosechas agrícolas y heno de gramíneas en estado avanzado de maduración. Estos forrajes pobres se caracterizan por una baja digestibilidad

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y un contenido muy reducido de proteína, lo que redunda en un bajo consumo por los animales del hato, mermando la producción de la finca, ya sea de carne o leche.

Consecuentemente, es necesario adoptar alguna práctica, disponible y apropiada, para incrementar el consumo de estos productos y convertirlos así en una posibilidad real de alimentación del ganado durante la sequía.

El mejoramiento del valor nutritivo de forrajes por medio de tratamientos químicos es una práctica conocida (Jackson, 1978; Zorrilla, Owens, Horn y McNew, 1985). Dos compuestos químicos comúnmente utilizados con este fin son: el hidróxido de sodio y el hidróxido de amonio. Ambos aumentan la digestibilidad del forraje, sin embargo, el hidróxidode amonio tiene la característica de proporcionar nitrógeno, uno de los nutrientes más deficientes en los forrajes pobres. En Panamá, por no contarse con el equipo especializado, y el alto costo del hidróxido de sodio, se dificulta el uso de estos productos. Una alternativa factible para el productor es el tratamiento del forraje en base a una liberación enzimática de amonia, partiendo de una solución de urea. La efectividad de esta práctica ha sido reportada a nivel de laboratorio por Rodríguez, Zorrilla, Muñoz y Arellano (1985) y a nivel de campo por Cloete y Kritzinger (1984 b).

MATERIALES Y METODOS

Los resultados que se presentan provienen de ensayos realizados en las siguientes localidades: Soná, Calabacito, Los Santos y Divisa. Consistieron en el tratamiento del forraje original con urea en una proporción del 10% en base seca, 100 gramos de urea por cada kilo de forraje (materia seca). La urea se disolvió en un volumen de agua igual a la cantidad de forraje por tratar (1 l de agua por cada kg de forraje fresco). En caso de encontrarse el forraje en forma de pacas, éstas se colocaron en hileras dobles con un máximo de tres, una sobre otra. Cada hilera fue tratada con una solución de urea, proporcional al volumen de forraje por tratar. Una vez finalizada esta operación

la hacina de pacas se cubrió con una hoja de plástico negro, sellando herméticamente el material. Para garantizar el sellado y evitar que el aire levantara el plástico se regó suficiente tierra por encima del borde libre del plástico. En caso de que el material a tratar se encontrara suelto (no empacado), éste simplemente se amontonó y roció con la solución de urea. Los pasos siguientes de cubrimiento con el plástico y sellado fueron similares a los descritos anteriormente. Todo el material tratado permaneció cubierto herméticamente un mínimo de 15 días, tiempo suficiente para la reacción de la solución de urea y este material.

RESULTADOS Y DISCUSION

Para comprobar el efecto del tratamiento se efectuó exámenes visuales y se tomaron muestras del material tratado para su análisis en el laboratorio. Sin excepción, siempre que se abrieron las hacinas se detectó un fuerte olor a amoníaco, indicativo de la hidrólisis de la urea, así como un cambio en la coloración del material. Esta lució un tono más obscuro que el original (cocido), el cual se mantuvo aún después de oreado y secado. En ningún caso se observó indicio alguno de pudrición o enmohecimiento del forraje. Todas estas características descritas son deseables y representativas de un buen tratamiento.

El incremento en el valor nutritivo del material tratado se muestra en el Cuadro 1 en donde se compara el contenido de proteína cruda de los diferentes forrajes antes y después del tratamiento.

Como puede observarse, los niveles de proteína cruda se incrementaron de 2 a 7 veces con una proporción relativamente baja de nitrógeno amoniacal, como porcentaje del nitrógeno total (proteína cruda), en la mayoría de los casos. El resultado de un ensayo de preferencia animal realizado con el heno de gramínea Brachiaria humidicola, control y tratado se muestra en el Cuadro 2.

La prueba consistió en ofrecer a un animal los dos tipos de henos durante un tiempo específico (20 minutos), registrándose el tiempo que el animal permanecía consumiendo cada uno de los materiales disponibles.

CUADRO No. 1. EFECTOS DEL TRATAMIENTO CON SOLUCION DE UREA EN EL CONTENIDO DE PROTEINA CRUDA (% DE MATERIA SECA) DE HENOS Y SUBPRODUCTOS AGRICOLAS.

Material	Contenido de Proteína cruda		Tratado: NH3 N°Total
	Sin Tratar	Tratado	
Heno de:			
Pangola	4.1	15.1	.38
Humidícola	2.9	13.6	.14
Faragua	1.4	10.3	.24
Capullo de maíz	2.3	6.6	.17
Paja de arroz	4.8	10.2	.14
Cogollo de caña de azúcar	5.2	11.8	.20

CUADRO No. 2 PRUEBA DE PREFERENCIA DE CONSUMO, POR BOVINOS, DE HENO DE B. HUMIDICOLA TRATADA CON SOLUCION DE UREA

Observación	Heno, Brachiaria Humidícola	
	Sin Tratar (1)	Tratada (1)
1	-	15.0
2	.25	11.0
3	1.00	10.0
4	1.00	4.0

(1) Minutos de consumo en períodos de 20.

La prueba se repitió en cuatro oportunidades con cuatro animales diferentes. Como se puede observar, el tiempo que los animales transcurrieron consumiendo el material tratado fue mucho mayor que en el caso del forraje sin tratar. Esta situación indica claramente la preferencia que los animales tuvieron por el heno tratado con la solución de urea.

La información presentada demuestra la posibilidad de mejorar, a nivel de finca, el valor nutritivo de forrajes y subproductos agrícolas.

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