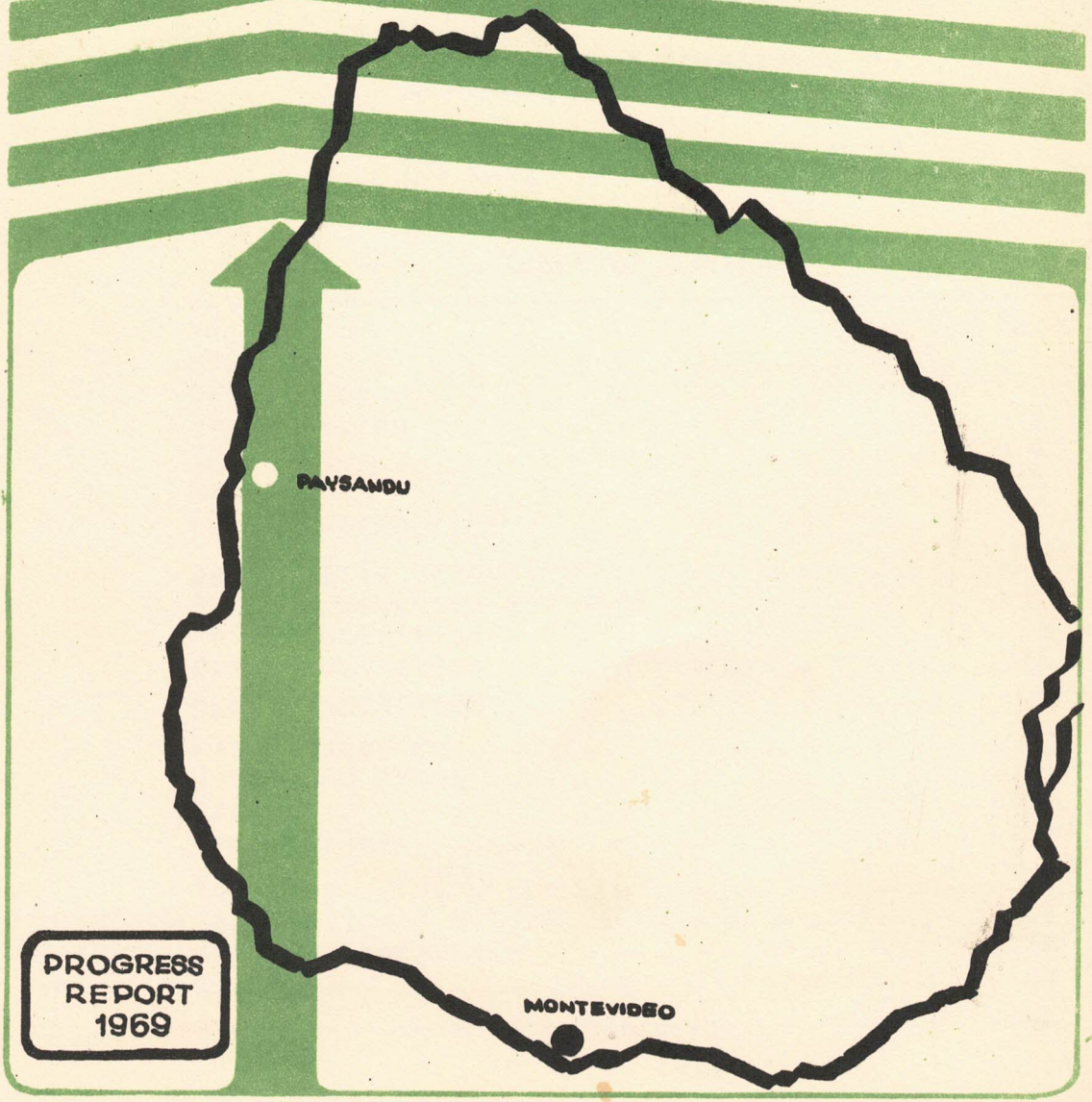
ESTACION EXPERIMENTAL

"DR. MARIO A. CASSINONI"

PAYSANDU • URUGUAY



PROGRESS REPORT 1969

universidad de la república

FACULTAD DE AGRONOMIA

ESTACION EXPERIMENTAL DE PAYSANDU

" DR. MARIO A. CASSINONI "

progress report

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May 1969

history

The Estación Experimental de Paysandú was created on July 18th 1963 according to a resolution of the Assembly of the College of Agriculture. This goal was achieved with the enthusiasm of young students and the support of the Rector of the University at that time, Dr. Mario A.Cassinoni and the Dean of the College, Ing.Agr. Carlos Fynn. The old Escuela de Práctica y Campo Experimental was thus transformed into an Agricultural Research Centre where the courses of the 4th year of the College are now being taught.

During the last five years the students have received *active* teaching. Research programs have been developed, new buildings and field facilities have been constructed and laboratories have been equiped.

objectives

To develop the career in Agriculture with scientific basis and support teaching with research.
To establish that research and teaching at high level must be accomplished together.
To provide opportunities for young people to join the staff as well as opportunities to receive post graduate training abroad, create an active type of teaching where the students participate on field - work as well as on research programs.
To emphasize on the need of creating groups of -- scientists from different fields working together in common tasks.
To define problems existing under field condition, thus obtaining a solid basis for the development - of research programs which will lead to solve them.

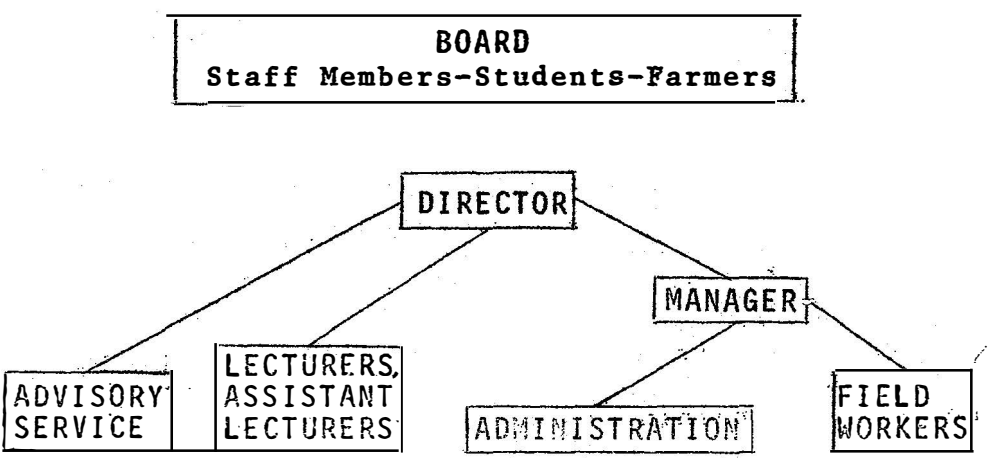
To develop Advisory work on the Station influence-area.

organization

The major tasks of the Experimental Station are:

teaching - research - advisory

In order to accomplish them the Experimental Sta-- tion is organized according to the following scheme



teaching

Currently the students take the courses in Agricul ture corresponding to the 4th year of the College.-

The following curses are offered:

wool
dairy
crops
forajes
beef production
sheep production

The students live at the Station from April to December and receive scientific as well as practical teaching pertaining to the aforesaid subjects

research

Research at the Station is organized about two main groups of work:

ANIMAL PRODUCTION

PLANT PRODUCTION

The Animal Productions people are working according to the following programs:

I-beef cattle production.

A) Reproduction and Management.

1) Nutrition levels and Reproductive Performance - of a beef herd.

2) Effects of age at first calving.

3) Studies on the time of mating.

4) Puberty in heifers.

B) Breeding.

1) Genetic improvement.

II-sheep production and wool.

A) Reproduction and Management.

1) Studies on the time of mating.

2) Mating of ewe lambs.

3) Early weanig of lambs.

III-animal nutrition.

A) Forage Evaluation.

1) Evaluation of sorghum silage.

2) Compatibility and forage yield of some species- for silage.

IV-dairy production.

1) Rearing of calves.

beef cattle production

The main program of research in this field is concerned with aspects of reproductive efficiency- on beef herds, connected with management practices On the average the calving porcentage of beef herds in Uruguay is about 58%.

The other line of research deals with genetic- improvement and the main objetive is to demonstrate that genetic improvement is a powerful tool for improving beef production efficiency. Show rings where individuals are evaluated mainly on "fancy points" without considering economically important traits, are still practically the only means of judging -- beef animals in this country.

A) Reproduction and Management.

1) *Nutritional levels and reproductive performance of a beef herd.*

(Started: Spring 1965)

a) *Objetives:* To estimate the effect of nutrition upon:

i) Growth rate of the cows.
ii) Length of the following intervals: calving, calving-first heat and- calving-conception.
iii) Birth and weaning weight of calves.
iv) Calving weight and weaning weight of cows.
v) Lifetime beef production of the- cow measured through the number- of calves produced and their wearing weights.

b) *Materials and Methods.* About 25 Herefords - ocows in each treatment. Two year old heifers were - mated for the first time on two consecutive years

c) *Primary Results.*

		Group 1 Improved Pastures	Gruop 2 Native Pastures
Calving (%)	1st	93.5	92.3
	2nd	85.7	37.5
	3rd	78.9	37.5
Calving-conception interval (days)	1st-2nd	85	127
	2nd-3rd	89	
Weight at 1st calving (kg.)		398	321
Calf weaning weight (kg.)		174	139

2) *Effect of age at first calving.*

(Started: Spring 1964)

a) *Objectives:* To estimate the same factors mentioned in 1.

b) *Materials and methods.* Treatments are: Calving for the first time at two and a three years of age. This implies that mating, in the first case, takes place at 15 months of age. Heifers were assigned to each treatment on two consecutive years. Each treatment includes about 25 Hereford cows.

c) *Primary results.*

		First calving at 2 years	First calving at 3 years
Calving (%)	1st	71.7	90.5
	2nd	90.9	85.7
	3rd	85.7	80.0
Weight at second calving (kg.)		452 (3 years)	431 (4 years)
Calf weaning weight (kg)		158	174
Number of calves produced at 4 years of age.		2.76 (3 calvings)	1.85 (2 calvings)
Kg. of calf produced at 4 years of age		436	321

3) *Studies on the time of mating.*

(Started: June 1968)

a) *Objectives:* To estimate:

i) The performance of beef cows - mated on two unusual periods - for this country (June-August- and September-November).

ii) The same features as in 1 and 2

b) *Materials and methods.* Fifteen two year old heifers mated in each breeding season.

4) *Puberty in heifers.*

(Started: May 1968)

a) *Objectives:* To estimate the effects of two- pre-weaning nutritional levels upon:

i) Age and weight at puberty.

ii) Establishment of regular oes-- trous cycles.

b) *Materials and methods.* The treatments are:- High(improved pastures) and Low (native pastures)- pre-weaning nutritional levels. First year of ob-- servations included 32 Hereford heifers.

c) *Primary results.*

	Pre-weaning nutritional level	
	High	Low
Age at puberty (days)	405	425
Weight at puberty (kg)	260	239
Showing heat before December 1st	78	47

B) Breeding.

1) *Genetic improvement:*

(Started 1963)

a) *Objectives:* To estimate genetic, environmental and phenotypic parameters for economically important traits in a beef herd, i.e. birth weight, weaning weight, post-weaning rate of gain, weight at 18 months of age and final weight.

b) *Materials and methods.* The cows herd comprises about 140 animals an is sired by 8-12 bulls each year. The sires belong to different stud. that cooperate with this program.

c) *Some results.* Preliminary results were published in the Technical Bulletin - Vol.4 Nº2 edited by this Experimental Station. Since the project started 46 different bulls have been used.

sheep production and wool

Research in this field is concerned mainly with reproduction and some aspects of flock management. There is a tremendous need of *increasing the Reproductive Rate of the national flock as well as changing its composition.* The following figures illustrate this situation:

Marking (or docking) percentage	60 - 70%
Breeding ewes	35%
Wethers	40%

Factors considered to be responsible for this low reproductive efficiency are:

i) Inadecuate time of mating.

ii) High peri-natal mortality.
iii) High proportion of ewes that mate -- for the first time as 4-tooths.

A series of experiments are being conducted in relation with these topics.

A) Reproduction and Management.

1) *Studies in the time of mating.*

(Started: November 1967).

a) *Objectives.* To estimate:

i) Seasonal variation in *Fertility and Fecundity.*

ii) *Survival rate* of lamb born - in different times of the -- year.

b) *Material and methods.* About 950 Corriedale, Merino and Polwarth ewes are being studies. Corriedales were randomly assigned to 4 mating groups (January, February, March and April). Due to their smaller number Polwarths and Merinos are being studied at only two mating seasons: Spring (Nov.-Dec.) and Fall (April).

c) *Primary results.* Data presented on the table on page 12 were obtained during 1968.

The same experiment is currently being repeated.

2) *Mating of ewe lambs.*

(Started: March 1968).

a) *Objectives.* To estimate:

i) Reproductive efficiency of Corriedale ewe lambs.

ii) Lifetime performance of ewes ma

Breeding	Time of mating	Barren ewes %	Lambs (1) born %	Lambs (2) macked%	Lambs (3) weaned%	Kg.of lamb (4)
POLWARTH	Nov-Dec.	30.1	77.4	68.8	68.8	10.2
	April	16.5	117.6	98.8	97.6	14.1
CORRIEDALE (4-6-8 tooth)	January	73.7	23.2	24.8	24.8	4.4
	February	41.0	68.7	52,8	49.3	7.5
	March	24.1	113.1	91.2	84.7	12.6
	April	14.1	107.7	89.7	86.5	14.1
CORRIEDALE (2 tooth)	March	40.4	70.8	47,7	44.6	----
	April	19.4	92.5	58.2	52.2	----
MERINO	Nov-Dec.	41.0	59.0	51.3	48.7	7.8
	April	9.1	103.0	72.7	72.7	10.5

(1),(2) As % of ewes joined to the rams.
(3) Weaned at 60 days of age.
(4) Kg. of lamb weaned per ewe mated.

ted for the first time as ewe --- lambs or as two tooths.

iii) Correlations between sexual activity as ewe lamb and subsequent - reproductive performance.

b) *Materials and methods*. Two hundred Corrieda le ewe lambs born in July-August 1967 were assigned to the following treatments:

Treatment A: Two thirds were mated for the -- first time as ewe lambs.

Treatment B: One third was mated for the first time as two tooths.

Sexual activity was studied in all ewe lambs on their first autumn of life with raddled vasectomised rams. Group A was mated when about half of the ewes were cycling (April 1968). Group B is currently being mated (April 1969).

c) *Primary results*. The following table shows the reproductive performance of ewes in treatment A (1968 Spring lambing).

Ewe lambs mated	Ewes (%) lambing	Mortality (%)	Marking percentage
136	56.6	42.9	32.3

3) *Early weaning of lambs*.

(Started - spring 1967)

a) *Objectives*. To measure the effect of early-weaning on:

i) Growth rate of lambs.
ii) Wool production of lambs.
iii) Wool production of ewes.

b) *Summary of results.*

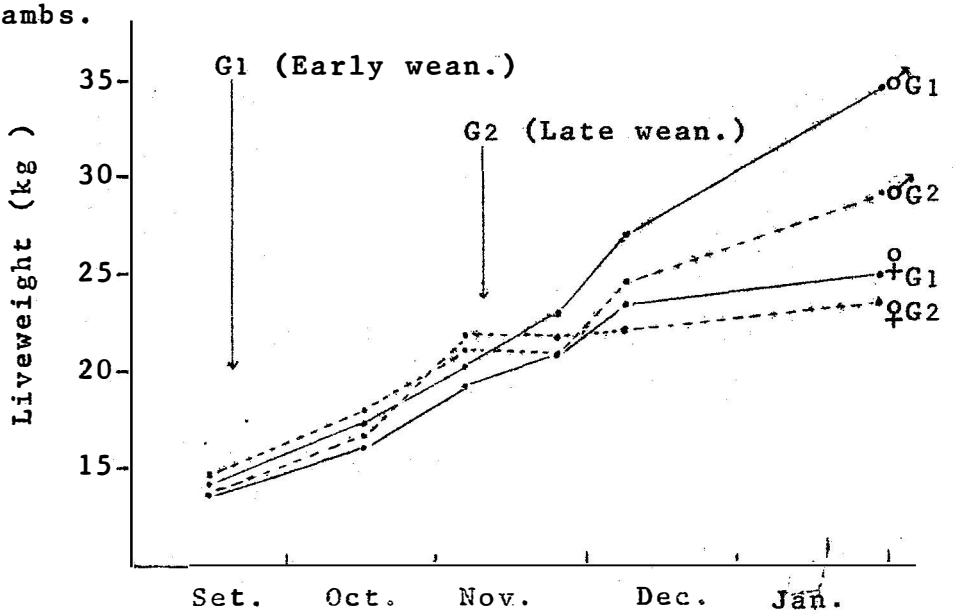
(E.E.M.A.C. Bulletin: Vol.5, Nº1, in press)

Fifty six Polwarth winter born single lambs from both sexes were split into two equilibrated groups by weight and sex and weaned over a sward of phalaris (*Phalaris tuberosa*) and white clover (*Trifolium repens*) when the average group weights and ages were 14 and 21 kg. and 48 and 100 days respectively.

Early weaned male lambs were significantly heavier ($P < 0.05$) than their late weaned counterparts at the end of a 136 day-period.

Non significant differences were detected between the weights of both female groups except for the weight recorded at weaning of the late group, when its weight was significantly heavier ($P < 0.01$) than that of the early group. Differences in daily gain among the early weaned lambs over the 136 day period are not attributable to differences in initial weight and age.

The following graph shows the growth rate of lambs.



c) *Further work*. Experiments are continued and wool production is being measured on the ewes by - the Dye Banding technique. The first results show- differences of about 10-15% in the wool production from those ewes whose lambs were early weaned.

animal nutrition

The seasonal pattern of pasture growth is characterized by periods of very low production. Under these conditions forage must be saved as hay or silage.

A - Forage evaluation.

Several project in Plant Production require the evaluation of species and varieties. The Nutrition Labotatory accomplishes this work. Determinations- are made on nutrients, digestibility *in vivo* and *in vitro*, energy, etc.

1) *Evaluation of sorghum silage.*

(Started:May 1968)

Sorghum is a good performer in this area and - it appears as a good choice for making silage. -- However, sorghum silage has shown to be of low nutritive value. A program based on the objective of improving its quality with additives (urea-molasses) has been started.

2) *Compatibility and forage yields of some species for silage.*

(Started: December 1968)

Legumes sown in association with sorghum could aid to improve the protein content of the silage.-

a) *Objective*. To study the compatibility and - forage yields of the species mentioned below.

b) *Materials and methods*. Species used were : Sorghum var. F.S.1 and var. F.S.22, Sorghum *spp*, - *Pennisetum typhoideum*, *Vigna marina* and *Phaseolus-lathyroides*.

The experiment was arranged in a randomized -- blocks design. Species were sown alone and in combination of one graminaae and one legume in a total of 14 treatments. *Pennisetum* failed to establish - due to low germination power.

Work is now being continued. Green weight, dry matter and protein content of herbage will be messured. Data on the compatibility of the different-species, botanical analysis of mixtures and forage grass yield will be performed to detect the effect of the legume on its associated grass.

c) *Primary results*. Preliminary results show - that F.S.22 ranks first in yield and that Phasey - bean increased the amount of the grass part of the mixture when sown together. *Phaseolus lathyroides* seems to be a very promising species.

dairy

Rearing dairy calves is an economically important subjet for the industry. It has been estimated that in our country's main dairy area 450 lt.(1.000 lbs.) of milk are used to rear a female calf from-birth to weaning. In our conditions a rearing system based on whole milk is expensive and it has -- shown to be inefficient since heifers are mated -- for the first time at 2 1/2 years of age.

Male calves on the other hand are eliminated at birth thus a tremendous potential for beef production is wasted.

Rearing of Holstein-Friesian calves.

(Started: June 1966).

a) *Objectives*: This experiment studies rearing

systems based on pasture and a lower intake of whole milk as well as its partial substitution by milk derivatives and concentrates.

b) *Materials and methods*. Three groups of Holstein-Friesian male calves were reared from birth to weaning according to the following treatments:

Treatment A: 280 lt.whole milk-pasture lucerne-hay

Treatment B: 150 lt. whole milk-329 lt. skimmilk--pasture lucerne-hay.

Treatment C: 213 lt.whole milk-469 lt.whey-pasture lucerne hay.

c) *Primary results*. Weaning weights the calves were as follows:

Treat. A: 82.2 kg.

Treat. B: 95.5 kg.

Treat. C: 82.8 kg.

plant production

Research on Plant Production as well as the -- whole research carried at the College of Agriculture is directed to solve the main problems existing under field conditions through a solid scientific-approach.

Plant Production work is focused considering - the soil-plant-climate relationships as a unit at basic as well as at applied levels. This type of - approach is relatively new at the College certain-areas being underdeveloped.

Currently the main proyects are classified into four groups:

I - Plant Breeding.

II - Soils and Crops.

III - Forages.

IV - Agroclimatology.

V - Microbiology.

The following is the general scheme for Plant-Production work. Projects marked (*) are being started this year.

I) *Plant Breeding.*

A) *Crops.* Variety and time of sowing trials on Wheat, Sugar Beets, Flax, Grain Sorghum and Sun---Flower.

B) *Forages.*

1) Nursery Introduction.

2) Evaluating pasture types of *Festuca arundinacea, Phalaris tuberosa* and *Paspalum notatum.* (*)

3) Introduction of subtropical pasture plants.

4) Comparisons of legume species and and cultivars for surface seeding in shallow basaltic soils.

II) *Soils and crops.*

A) *Plant nutrition.*

1) Use of soil testing to predict - fertilization responses.

a) Selection of soil testing methods to determine assimilable N, P and K.

b) Responses to N, P and K.fertilization on sugar beets.(*)

2) Timing of nitrogen fertilization- in weat and sugar beets.

3) Placement of phosphate fertilizers in sugar beets.(*)

4) Subterranean clover responsees to P and K.

5) Detection of mineral defficiencies in basaltic soils from Cretacico(*)

B) *Management.*

1) Cropping systems for wheat production.

2) Adaptation of the main summer crops (corn, grain sorghum and sun-flower) to different types of soil.

3) Tillage practices for wheat production. (*)

III) *Forages.*

A) *Management.*

General: 1) Time of apical differentiation and internode elongation in four grasses.

2) Ecological and agronomical behaviour of ultra-simple mixtures on - Fray Bentos soils. (*)

Special: 1) Deffinition of the Basaltic Area.

2) Effect of grazing on subterranean clover introduced with sod-seeder on a shallow basaltic soil. (*)

B) *Herbage seed production.*

1) Seed production of Phalaris, Festuca and White clover.

IV) *Agroclimatology.*

1) Studies on the frequency and distribution of rain in Salto, Paysandú and Rio Negro and its correlation with crop yields. (*)

2) Frequency and distribution of dry rains in the basaltic area. (*)

V) *Microbiology.*

1) Rhizobium studies on basaltic soils

2) Selection of strains. (*)

3) Nitrification capacity of soils and environmental factors affecting it. (*).

plant breeding

A) *Crops.*

Wheat.

Wheat comprises about 40% of the area of crops sown in Uruguay and is the most important cereal-crop. Yields obtained are low and the work at this Station aims at detecting the cause in order to improve productivity.

Work directed to improve wheat production is approached through different lines of research. Thus cropping systems described on page 35, tillage practices (to be started) and variety and time of sowing trial described in this section are the most important.

The work on wheat breeding has been carried for many years at the CIAAB (Estanzuela). This year the work has been coordinated between CIAAB and this Station.

Variety and time of sowing trials are conside-

red of importance for the following reasons:

i) Varieties have different productivity and the already existing should be compared with new ones obtained in -- Uruguay.

ii) The yield of a certain variety may decline abruptly from one year to the - next due to new fungus races.

iii) Varieties exhibit strong interactions with time of sowing.

This interaction is not constant depending on years as well as on occurrence of diseases.

1) *Variety trial.*

(Started: July 1968)

a) *Objective:* To study the behavior of different varieties of wheat.

b) *Materials and methods.* The following varieties were sown on July 3rd 1968:

Vilela Mar	(Paraná INTA)
Piamontes INTA	(Rafaela INTA)
Klein Rendidor	(Paraná INTA)
Tacuarí INTA	(Pergamino INTA)
Pinzón INTA	(" " " " ")
Klein Atlas	(Paraná INTA)
Bordenave Puan	(" " " ")
Magnif Guaraní	(" " " ")
Oncativo INTA	(Rafaela INTA)
Olaeta Artillero	(CALPROSE-Uruguay)
Estanzuela Sabiá	(" " " " ")
Multiplicación 14	(" " " " ")
Pergamino Gaboto	(" " " " ")
Buck Pampero	(variedad Argentina)
Klein Impacto	(CALPROSE-Uruguay)
Estanzuela Zorzal	(" " " " ")
INIA	(CIMMYT - Mexico)
CIANO	(" " " " ")

The design is a randomized blok design with 6 replications. Data were recorded on: Time from emergence date to maturity, height, loadging, disease-resistance, number of tillers per plant, grain per ear, weight of 1000 grains yield and test weight.

2) *Variety and time of sowing trial.*

(Started: May 1968)

a) *Objective:* To study the effect of time of sowing on the behaviour of different varieties.

b) *Materials and methods:* The following varieties considered to be the most important were included: Olaeta Artillero, Estanzuela Sabiá, Multiplicación 14, Pergamino Gaboto, Buck Pampero, Klein Impacto and Estanzuela Zorzal.

The different times of sowing were: May 15, -- July 1, and August 15. The design is a Split-Plot with 5 replications. Determinations. are the same as in trial 1.

3) *Diseases.* One of the most important aspects of plant breeding is the resistance to diseases. A survey of the main fungus races existing on the cereal areas of the country will be carried soon. A staff member specially trained at INIA (Castelar,- República Argentina) is in charge of this work. -- This is the first coordinated work with the Plant-Pathology people and is considered of importance to develop that section.

Sugar beets.

The study of new varieties adapted to our conditions as well as time of sowing and harvesting -- trials are important since de Station is located in one of the main sugar beets area. There are two factories in the country one being located near the Station. Seed is imported by these factories.

1) *Variety, time of sowing and harvesting trial.*

(Started: April 1968)

Objectives: To measure the sugar production (per Há.) of the main commercial varieties sown and harvested on different times. This work also aims to extend the harvesting periods trough the use of different varieties.

b) *Materials and methods*. The design is a Split Split-Plot design including:

Big-parcel: Four times of sowing.

Sub-Parcel: Eight varieties (most commonly used in Uruguay).

Sub-Sub-Parcel: Two harvesting times.

The soil is a brown prairie.

Measurements to be taken are:

Population, homogeneity, diseases, bolting, sugar yield/há., top and root yields

2) *Introduction of new varieties*

a) *Objectives*: Comparative behavior of introduced varieties and the most commonly used in Uruguay

b) *Materials and methods*. Twenty four varieties are used on a randomized blok design including Polybeta as a control. Measurements to be taken are similar to those in experiment 1.

Flax.

Flax is an important winter crop but yields are low. All the seed used is imported from Argentina and the adaptability of the varieties is not well-known. Knowledge on the effect of different times of sowing on the yield is also lacking.

1) *Variety and time of sowing trial.*

(Started: June 1968)

a) *Objectives*: To study the behaviour and yield of eight varieties sown is different times and in two regions.

b) *Materials and methods*: The following varieties are studied on a Split-Split-Plot design:

Paraná INTA, Pergamino Mocoretá, Pergamino Puelche, Rancagüa INTA Santa Catalina Nº6, Taragüí, Timbú, and Toba.

Time of sowing: June 1st, July 1st, August 1st and September 1st.

Regions: Salto and Paysandú. (Exp. Station).

Grain Sorghum

This crop is relatively new in Uruguay but its importance is increasing.

The available seed is imported from USA. The Station aims at creating a new variety in order to guarantee a permanent supply of seed as well as adaptability.

Several origins are currently being studied -- including a collection from FAO.

Due to physical limitations the trials carried up to date include only comparative studies of the main commercial hybrids.

1) *Behaviour of commercial hybrids.*

(Started: Nov. 1968)

a) *Objective*: To study the behaviour of the -- main commercial grain sorghum hybrids supplied by the seed producing Companies.

b) *Material and methods*. The design is a rando

mized block design including 12 hybrids adequately fertilized. Fertilization comprises 60 kg. of N, - 100 of P_2O_5 and 60 of K_2O per Há.

Measurements include: date of plant and ear emergence, tillering, grain production, forage production and occurrence of diseases.

Sun-flower.

Work on sun-flower started during the summer - 1968-69.

1) *Variety trial.*

a) *Objective:* To study the behaviour of local and foreign varieties on the area of Paysandú.

b) *Materials and methods.* The following varieties are being studied:

> Impirá INTA, Manfredi INTA, Cordobés INTA, Guayacán INTA, Klein Selección 6-B, Selección Puntano UNIIMK 1646 and Estanzuela 60.

Estanzuela 60 is the only local variety, the - rest are imported from Argentina. Varieties were - sown in November 28 1968.

The design ia a randomized block design with- 4 replications. The measurements taken were: date- of plant emergence, date of flowering, height of - plants, maturity, diameter of inflorescence, diseases, grain yield and loadging.

B) *Forages.*

Testing of new species and strains of pasture- plants is carried at the Testing New Pasture Plant Section, where work with grasses and legumes is - divided into two parts: 1) Primary testing of a -- large number of species (ecotypes and cultivars) - performed at the nursery and 2) Plot and yield testing of a small number of promising species and va-

rieties under environmental conditions where the - should be managed.

1) *Nursery introduction.*

(Started: 1963)

a) *Objectives:* The nursery is maintained with- the purpose of studying the behaviour of introdu-- ced species. Up to date about 600 differents ori-- gins have been under observation.

b) *Materials and methods.* Seed from various -- overseas organizations and native ones are sown in boxes and seedlings are singled and transplanted - to the field in arranged rows.

Ovservations include: growth habit, vigour, -- leafiness, regrowth date of ear emergence, onset of flowering, incidence of diseases, dry and frost re sistance and seed production.

c) *Results.* Species which have shown promise - for winter production include:

> *Festuca arundinacea, Phalaris- tuberosa, Dactylis glomerata,- Lolium multiflorum, Trifolium- Repens, T.pratense, T.subterra neum, Medicago confinis* and *M. tribuloides.*

Some subtropical grasses and legumes show in-- teresting prospects being good summer producers such as:

> *Desmodium intortuns, D.uncina- tum, Phaseolus,atropurpureum,- Glycine javanica, Medicago sa- tiva, Lotus corniculatus,Chlo- ris gayana, Cenchrus ciliaris, Setaria sphacellata* and *Pani-- cum maximun.*

A native species, *Paspalum no tatum* is being studied for summer forage productio Eighty ecotypes are under observation and determi-

nations on their citological, morphological and agronomic characteristics are in progress.

Ecotypes and cultivars of different species -- showing some outstanding characteristic graduate - to a sward trial. That is the case for some origins of *F.arundinacea, P.tuberosa,* and *Paspalum notatum.*

2) *Evaluating pasture types of Festuca arundinacea, Phalaris tuberosa and Paspalum notatum.* (*)

a) *Objectives*: Assessment of the agronomic behaviour and herbage production under sward conditions of 10 prominent varieties and ecotypes of -- tall fescue, 8 - 10 of phalaris and 3 ecotypes of *Paspalum notatum.*

b) *Materials and methods*. The trials with Tall-fescue and phalaris shall be started next fall. -- Each origin will be sown in mixture with white clover and comparisons made by cuts according to stage of development.

Three contrasting ecotypes of *Paspalum notatum* will be sown next spring in mixture with *Lotus -- corniculatus.*

Data on total dry weight, seasonal distribution of growth competition ability and eventually qualitative differences between them will be recorded.

3) *Introduction of subtropical pasture plants.*

(Started: Dec.1968)

On deep basaltic soils it seems to be a possibility of growing subtropical grasses and legumes to increase forage production thus contributing to --- avoid partially the effect of drought on the shallow soils which comprise about 70% of the basaltic area.

a) *Objective*. To search for species with good - forage yields during summer under the basaltic zone conditions.

Materials and methods. Plot trials have been layed out on two different localities, Carumbé, (Basaltic area) and Paysandú (Fray Bentos area). The latter presents similar problems to the first during dry periods.

Data is being recorded on the behaviour of the following species:

Cenchrus ciliaris	*Desmodium uncinatum*
Chloris gayana	*Glycine javanica*
Panicum maximum	*Lotus corniculatus*
Paspalum dilatatum	*Medicago sativa*
Setaria sphacellata	*Phaseolus atropurpureum*

Preliminary results show a very promising future for most of these species though heavy rains when sown and insect and rabbit attacks on legumes produced important failures in plant establishment. Properly chosen mixtures will be compound when a more complete knowledge of the different species is achieved.

4) *Comparisons of legume species and cultivars for surface seeding in shallow basaltic soils.*

(Started:1966)

Improvement of the native pasture on shallow basaltic soils should include species with the following characteristics: Persistency, grazing tolerance, competitive ability with the native grasses, low fertility adaptation and long growth season.

a) *Objective*. To study the performance of legumes introduced by surface seeding.

b) *Materials and methods*. Trials are layed out on two constrasting basaltic soil types (red and black soils) and located at seven different places scattered on Paysandú and Salto.

The following species and varieties are understudy:

Trifolium subterraneum vars. Dwalganup, Gerald

ton, Yarloop, Clare, Marrar, Baccus Marsh, Mount Barker and Tallarook.

Medicago tribuloides. vars. Commercial and 173.

Medicago confinis. Native population.

Lotus corniculatus, *Trifolium repens* and *Trifolium pratense* have been also included due to their good behaviour in other parts of the country.

Determinations are made on: establishment, vigour, developmental stages, growth cycles and diseases and pest appearence. Observations on early-autumn growth, flowering date and end of period receive special interest due to their importance on herbage productivity.

c) *Primary results*. Subterranean clover strains tested show that Yarloop, Baccus Marsh and Mount Barker strains are most promising.

Barrel clover adaptability is quite good but its forage yields seem to be lower that those of sub-clover

Polled clover, a sub espontaneous *Medicago* species, is very promising but its main herbage production is later than the other species.

Experiments to evaluate the forage yield of these well performed species will be started soon.

soils and crops

A) *Plant nutrition*.

The work in this field is directed to study the response of the main crops to fertilization. Crop response are studied in relation to soil characteristics (chemical and physical properties, soil ty

pe and parent material) and to the crop used.

The main problems faced at the moment are:

i) Responses to N,P and K in wheat and sugar beets.

ii) Responses to P and K in *Trifolium subterraneum*.

iii) Detection of some other mineral-defficiencies in different soil types.

Use of soil analysis to predict crop responses to fertilization.

Soil analysis is a useful tool to predict fertilizer requirements if:

i) The value obtained by analysis is related to the real amount of the elements available to the plants.

ii) The relationship between the actual level of a given nutrient in the soil and the response to fertization is known. Further, plant response has to be expresed in economically interpretable terms.

In order to acomplish these objectives two research projects were developed:

1) *Selection of the chemical method.* (*)

a) *Objective:* To find the chemical method of soil analysis which best expresses the level of N P and K available in the soil.

b) *Materials and Methods.* A pot experiment using the main soil types in the area will be conducted. Species to be used will be sudan grass hay

vested through several cuttings.

Treatments included are:

N : 000 ; 0PK; NPK
P : 000 ; NOK; NPK
K : 000 ; NP0; NPK

Methods of chemical analysis to be tested are:

N : Nitrification rate, amonification rate, amount of N soluble in hot-water, N extracted by H_2SO_4 or Na (OH), and total N.

P : Bray Nº, Olsen, organic and mineral acids.

K : Exchangeable K and K extracted by boiling water.

pH, cation exchange capacity, total cations, and texture will also be determined in each soil sample.

Measurements to be taken on the plants include: yield of dry matter, yield of nutrient and percentage of maximun yield.

The best chemical method will be that giving the largest correlation with the plant response data.

2) *Calibration of the chemical methods.*

(Started: May 1968)

a) *Objective:* To find a quantitative relationship between the data provided by the soil analysis and the response of plants to fertilization.

b) *Materials and methods.* Two of the main crops grown in this area were selected: wheat and sugar-beets. Soils used are those developed over the geological materials named Fray Bentos and Cretácico.

Five levels of N,P and K were included in 23 -

combinations determined by a central composite design. Each treatment was replicated two times in each site.

Levels of N P and K (Kg./Há.)

	Wheat	Sugar beets
N	0-30-60-90-120	0-40-80-120-160
P_2O_5	0-25-50-75-100	0-40-80-120-160
K_2O	0-25-50-75-100	0-45-90-135-180

The design allows to estimate the response as a continuous function of the independent variables.

Measurements taken in the field trials include:

i) *Soil.* Available N,P and K. Soil characterization: cation exchange capacity, total cations, organic matter, texture, water percentage at wilting point and field capacity and soil moisture (Sampling every 2 weeks).

ii) *Crop.* Wheat: Grain and straw yields, weight of 1000 grains. Tillering height and ears/m^2.
Sugar beets: Root, top, sugar yields and sugar percentage. N,P and K percentage in petioles in three different stages of development.

Timing of nitrogen fertilization in wheat and sugar beets.

(Started: May 1968)

1) *Sugar beets.*

High levels of nitrogen exert a depressive effect on sugar yield as well as an increase in harmful nitrogen and impurities during the process of extraction of sugar. These effects are more obvious the later the nitrogen fertilizer is applied. Besides, the response in root yield to high nitrogen -

levels is weak and in general does not increases the sugar yield per Há. Further, deletereous effects on germination and plant emergence have been observed with high nitrogen levels on sowing.

The problem seem to be stated in the following terms: the initial nitrogen level must induce an adequate photosynthetic surface remaining low at later stages of the cycle in order to allow sugar acumulation.

a) *Objectives*. To determine the latest possible date of nitrogen fertilization which does not depress sugar production, and to avoid harmful effects during germination and emergence.

b) *Materials and methods*. Two levels of nitrogen will be applied at three different stages of the cycle, the doses being divided in four different ways. Phosphorous and potassium will be included at high levels.

2) *Wheat*.

Wheat has been produced in Uruguay for many years through practices which generally not include fertilization. In those cases where fertilizers have been used the whole dose has been applied at sowing and occasionally at tillering. This practice increases the number of ears per m^2 but reduces ears weight. Practices including fertilization at internode elongation or ear emergence coul increase grain yields.

a) *Objective*: To study the effect of timing of nitrogen on wheat production.

b) *Materials and methods*. Two levels of nitrogen will be applied at sowing only or timed at three stages (sowing, tillering and ear emergence). Measurements will include weight of grain and straw, test weight, ears per m^2, weight of 1000 grains , number of grains per ear and nitrogen content of grain.

Responses to P and K on Trifolium subterraneum

(Started::1966)

1) *Fertilization on Trifolium subterraneum on shallow basaltic soils.*

a) *Objectives*: To determine the effects of P,K and their possible interactions on the productivity of sub-clover when sown on shallow basaltic soils.-

b) *Materials and methods*. The experiment was laid down on two different types of soil introducing the legume in the native pasture by means of a sod-seeder.

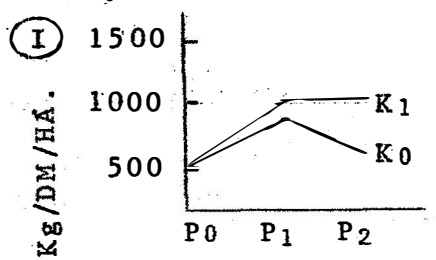
Levels of dressing: P_0 - No P.
P_1-100 units/P_2O_5/há. K_0 No K.
P_2-200 " " " " " " " K_1-80 units/K_2O/H_2

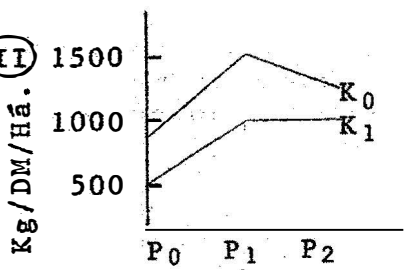
Treatments were:

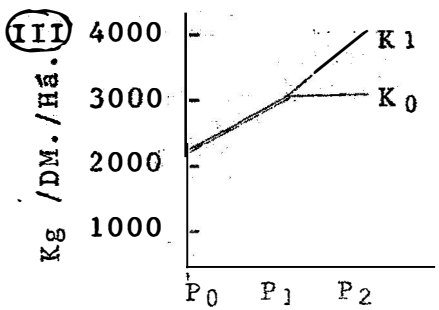
P_0K_0	P_0K_1
P_1K_0	P_1K_1
P_2K_0	P_2K_1

Trials have been sown every year since 1966 in six different places scattered in the basaltic area The number of experiments in progress is 16.

c) *Results*.







I and III.- Soils with low amount of exchange able K.

II.- Soil with high amount exchangeable K.

Responses to fertilization could be expresed - in short as follows: There was always a significant response to P when levels of 100 units were applied but occasionally when using 200 units.

There were significantsdifferences when K was- applied jointly with P this response being observed in soils with small amounts of exchangeable K (less than 0.4 me./100 g.).

2) *The effects of refertilization on Trifolium subterraneum.* (*)

a) *Objectives*: To determine the effect of P and K refertilization on 1,2 and 3 years old sown pastures.

b) *Materials and methods*: The preceeding experiment is being used for this purpose. Half of the plots have been treated with the different dressing treatment in April 1969.

B) *Management.*

Cropping systems for weat production.

(Started: June 1968)

Wheat is the most important among all crops in Uruguay and in the area of influence of the Station. Thus a study of the possibilities, pros and cons of differents cropping systems for wheat was undertaken on soils over Fray Bentos. A methodology somewhat different from traditional was chosen. It is- hopped that it will provide clearer and more easily interpretable results than those obtained through- the methods commonly used.

This projet comprises four sub-projets.

Sub-projets.

1) *Continuous wheat production with mineral - fertilization.*

a) *Objective*: To study the possibility of produ

cing wheat continuously with mineral fertilization only.

b) *Materials and methods*: The variables studied are different levels of N,P and K. The levels are:

N - 0-50-100-150-200 kg./há.
P_2O_5 - 0-30- 60- 90-120 kg./há'
K_2O_5 - 0-30- 60- 90-120 kg./há.

The combinations of N,P and K are those determined by the central composite design and the end pursued is to estimate a response surface for each -- year. There are 23 treatments (combinations of the three nutrients) grouped in 3 blocks.

The measurements to be taken each year are:

i) Chemical and biological characteristics of the soil in each parcel before sowing:

* N,P and K available.
** Organic matter and C/N relation.
*** pH.

ii) Physical characteristics of the soil in each parcel before sowing.

* Stability of structure.

iii) Water availability pattern of the soil during the growing season (Fortnightly Sampling of available water in the soil)

iv) Yield of grain and straw.

2) *Continuous wheat production with the intercalation of another crop during those periods when wheat is not growing.*

a) *Objective*: To study the posibility of growing wheat every year and further to grow another crop during the period when wheat is not growing. The intercalated crop may be harvested or used as green manure. Emphasis is placed on the N balance.

B) *Materials and methods*.The variables studied are the intercalated crop and N levels in wheat. -

The treatments are:

Intercalated crop for harvesting.--	i)Wheat----------Wheat ii)Wheat-Sun-flower-Wheat iii)Wheat-Sorghum---Wheat iv)Wheat-Soybean----Wheat
Intercalated crop for green manure	v)Wheat---Vicia----Wheat vi)Wheat--Melilotus-Wheat vii)Wheat---Soybean--Wheat

Nitrogen levels:0-50-100-and 150 kg./há.

The designis a Split-Plot.

Measurements to be taken each year are the same as in sub project 1 plus nitrification capacity - of the soil at tillering, internode elongation and ear emergence. Yields to be measured are grain and- straw for wheat and for the intercalated crop when harvested. When the intercalated crop is used as - green manure dry matter and C/N relation will be - measured.

3) *Lucerne wheat rotations*.

a) *Objective*: To study the effect of 1,2,3 and- 4 years of lucerne with different P levels on sub- sequent wheat production.

b) *Materials and methods*. The variables under - study are:

i) Age of the lucerne sward(1,2,3 and 4 - years)

ii) Level of P (0.30,60 and 90 kg/há.of P_2O_5 at sowing and 0,20,40 and 60kg/ha.on - subsequent years)

iii) Levels of N on wheat after lucerne or- wheat (0,30,60 and 90 kg/ha.).

The design is a split plot design. The treat-- ment are:

Big-Parcel. - 1,2,3 and 4 years of lucerne

Sub-Parcel. P level on lucerne and wheat.
Sub-Sub-Parcel. N level on wheat after alfalfa or wheat.

Measurements to be taken are same as in sub-project 1 plus number of lucerne plants per m^2 before ploughing and dry matter of lucerne, weeds and grasses.

4) *Pasture wheat rotations.*

a) *Objective:* To study the effect of different legumes (Lucerne, white clover and lotus) alone or in mixture with tall fescue on subsequent wheat -- production. Mixtures shall be evaluated after 1,2, 3 and 4 years. The variables under study are:

i) Age of sward.
ii) Kind of sward:
iii) Nitrogen level on wheat after the sward or on wheat alone (0,30,60, and 90 kg./há.

The design is a Split-split Plot and the treatments are:

Big-Parcel: years.
Sub-Parcel: Kind of sward and wheat.
Sub-Sub-Parcel: Nitrogen level on wheat after the sward or wheat (0,30,60 and 90 kg./há..

Measurements to be taken are the same as in -- sub-project 3.

Adaptation of the main summer crops (corn, grain sorghum and sun-flower) to different types of soil.

(Started: Oct.-Nov. 1968)

Corn, grain sorghum and sun-flower are the most important summer crops in Uruguay. Yields are considered to be low, or very low, and quite variable from year to year, depending uppon summer rainfalls. The greatest limitation is water, as our climate is quite variable with frequent summer droughts. Besides there is good evidence showing great differences in the capacity of soil types to store availa-

ble water.

This project aims at elucidating the potential of different soils to store and supply water to summer crops thus allowing to estimate the maximun - yield which can be obtained under the most adverse conditions. Further, the capacity of each species- to regulate its internal water balance and the critical periods during which water defficiencies cause the greatest effects may be estimated. On this- subject, more is known about corn and grain sorghum than about sun-flower. For this reason basis aspects of water balance and its effects shoul be studied on sun-flower.

a) *Objectives:* To compare corn, sorghum and sun flower behaviour in soils with contrasting physical and chemical properties.

Originally this project included two sub-projects:

1) Comparison of corn, grain sorghum and sun flower behaviour in four types of soil (Black prairie on basalt, Brown prairie on Fray Bentos. Brown sandy prairie on Cretacico and Sandy prairie on Tacuarenbó), under different fertility levels and with different betwenn and intra row distance and- distributions.

2) Basic studies on water balance on sun- - flower. Cuantitative relationships among water supply and demand and the effects of periods of water shortage on plant growth and grain production.

The first sub-project only has been started and limited to two soil types.

Sub project.

1) *Comparisons of sun-flower, corn and grain - sorghum behaviour on a brown paairie soil of Fray-Bentos and a Brown-sandy prairie soil of Cretacico.*

a) *Objective:* To compare the behaviour of sun-flower, corn and grain sorghum and to define the - limiting factors of grain production on two soils- which differ greatly on physical as well as chemical

characteristics.

b) *Materials and methods*. The variables understudy are:

i) Place (soil-Climate)
ii) Species (corn-grain sorghum-sun-flower
iii) Fertility (Natural-High)
iv) Between and intra row distances and - distributions.

The design is a randomized block design (4 replications). Treatments are all posible combina--- tions of species, fertility level and plant distances and distributions. The high fertility level -- comprises:

100 kg./há.of N, 120 kg./há of P_2O_5 and 90 kg./há. K_2O

Measurements to be taken are:

i) Description of the soil
ii) Chemical and biological characteristics:
*) Assimilable N,P and K.
**) Organic matter and C/N relation
***) pH.
iii) Water availability pattern during the growing season.
iv) Height of plants and length and width
v) of leaves.
v) Yield (grain and straw).

forages

A) *Management*.

General.

1) *Time of apical differentiation and internode elongation in four grasses*.

(Started: May 1968)

The time of the year when floral initiation and internode elongation occur is of basic importance- for herbage production (pasture, hay, silage) and -

seed crops management.

a) *Objective:* To determine the aforesaid events on three main grasses sown in uruguaian pastures:- (*Lolium multiflorum*, *Festuca arundinacea* and *Phalaris tuberosa*).

b) *Materials and methods.* The developmental -- stages mentioned have been related to time of the year and photoperiod. First year work just finished. One thousand observations were performed by dissecting shoot apices under stereoscopic microscope. -- Shoot apices were classified as vegetative, transicional and reproductive.

c) *Primary results.*

The following tables summarizes the observations on time of apical differentiation and internode -- elongation.

TIME OF APPICAL DIFFERENTIATION

	Nº-of days after the shortest day of the year (24th June)	Length of the photoperiod
Festuca arundinacea	32 (25th July)	10h.15'
Phalaris tuberosa (Commercial)	44 (8th August)	10h.33'
Phalaris tuberosa (Portugal)	59 (6th Septem.)	11h.02'
Lolium multiflorum	32 (25th July)	10h.15'

INTERNODE ELONGATION

Location y shoot apices (cm./height)

	Festuca	*Phalaris* (Com.)	*Phalaris* (Port.)	*Lolium*
29th May	0	0	1.57	--

Internode Elongation-Location y shoot apices (cm/height)

(Cont.)	*Festuca*	*Phalaris* (C)	*Phalaris* (P)	*Lolium*
10th June	0	0	1.32	---
20th June m	0	0	2.14	---
2nd July	0	0	1.86	----
16th July	0	0	1.70	----
27th July	0	0	1.32	2.60
7th August	1.14	1.37	1.64	6.10
14th August	1.55	1.44	2.81	7.90
22nd August	3.25	1,60	1.65	8.40
3rd Sept.	5.14	1. 68	2.45	14.1
13th Sept.	7.26	2.65	2.53	----
25th Sept.	0	5.71	6.77	-----

2) *Ecological and agronomical behaviour of ultrasimple mixtures on Fray Bentos soils.* (*)

a) *Objectives*: Ultrasimple mixtures of three grasses and three legumes shall be compared to study the ecological and agronomical behaviour of the different combinations for winter production.

b) *Materials and methods*. Ultrasimple mixtures:

Dactylis glomerata	*Festuca arundinacea*	*Phalaris tuberosa*
Trifolium pratense	*Trifolium repens*	*Trifolium subterraneum*

Two complex mixtures will be confronted with the ultrasimple ones.

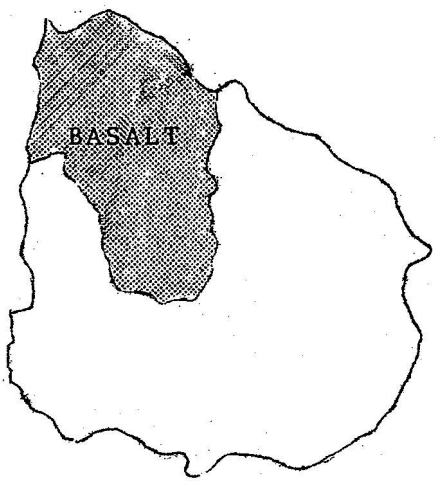
i) Shotgun mixture	ii) All year round mixture
F. arundinacea	*P. tuberosa*
P. tuberosa	*Paspalum notatum*
T. repens	*Lotus corniculatus*
T. subterraneum	*T. repens*

Determination will be performed on establishment, compatibility total forage yield, seasonal growth and digestibility of the different mixtures.

Special.

Deffinition of the Basaltic Area.

The Basaltic Area comprises about 1/5 of the country (3.5 million Hás.) and includes the departments of Artigas, Salto, big portion of Paysandú, and parts of Tacuarembó, Rio Negro and Durazno. Only 30% of the soils of this region are deep or medium, the rest are very shallow ones.



Main problems.

The potentiality of herbage production of the area is very low in winter. When summer arrives drought achieves fantastic importance and pastures on shallow soils normally fail to produce green forage. It has been estimated that during summer droughts soils do not have any moisture available during 3 to 4 months.

Shallow soils cannot be ploughed and reseeding with sod-seeder is the only possible way of introducing new species. Deep soils are difficult to cultivate due to their high clay percentage, therefore the possibility of cultivation to introduce new species is limited to short periods. The possi

bility of introducing sub-tropical species is being studied.

A program (Basalt Projet) directed to study the problems of the area was atarted in 1966 through a contract among the College of Agriculture, the Plan Agropecuario and the CIAAB(Estanzuela).

The objectives of the Project are to give answer tothe real problems of the area in a complete study which includes:

i) Geology and soil studies.
ii) Studies on water availability.
iii) Introduction of legumes on shallow soils.
iv) Potential of deep soils.
v) Management of the area as a whole.

Experiments.

The following experiments have already been started or are due to start soon:

1) Introduction of sub-tropical pasture plants (described on page 28).

2) Comparisons of legume species and cultivars for surface seeding on shallow basaltic soils. (described on page 28).

3) Subterranean clover responses to P and K.--
   a) Fertilization on *Trifolium subterraneum.* (described on page 34)
   b) The effects of refertilization on *Trifolium subterraneum.* (described on page 35)

4) Detection of mineral defficiencies in basaltic soils and sandy soils of Cretacico.(*)

5) Frequency and distribution of rains in the basaltic area, (*)

6) *Rhizobium* studies on basaltic soils (described on page 49).

7) *Effect of grazing on subterranean clover introduced with sod-seeder on shallow basaltic soil*

a) *Objectives*: To evaluate the effects of two contrasting pasture management and two different grazing pressures on the persistency of sub-clove on shallow basaltic soils.

b) *Materials and methods*. This study is now i its first steps. One year old sub-clover pasture is being used. Determinations should be performed mainly on the effects of grazing by sheep on the productivity of this sward, through studies on pl population changes, forage yield, seed productio capacity and persistency during the following ye

Subsidiary information should be recorded on body weight changes and fleece weight changes an fleece weight of sheep. Primary observations on oestrogenic activity of sub-clover will also be sayed with sheep.

B) *Herbage seed production.*

(Started: April 1968)

One of the limitations to increase the acrea of sown pastures in uruguaian agriculture is the lack of good herbage seeds. Normally low priced seed is imported without knowing its adaptability to our environmental conditions. Further, due to complicated import regulations seed is available t the farmer late in the season and it generally ha low germination power, or overseas seed producers are not able to provide the species we are intere ted in. The urgence to produce our own seed seems obvious.

1) *Effect of drill width and seed rates on se production of Festuca arundinacea and Phalaris tuberosa.*

a) *Objective*: To determine the effect of dril width and seed rates on seed yields.

B) *Materials and methods*. See below.

c) *Results:* Results to date, generally show a progressive increase in seed yields with increased drill spacing but there were not responses to the different rates of seed when Tall fescue was established at 0,5,10,15 and 20 kg./há. and *Phalaris* at 0,3,6,9, and 12 kg./há. The following table summarizes the results:

Phalaris tuberosa

Harvest year.	Drill spacings (mt.) Broadcast	0.30	0.60	0.90
2 nd	19.4*	15.0	29.0	43.7
3 rd	47.2	86.3	166,3	164.1

Festuca arundinacea

Harvest year	Drill spacings (mt.) Broadcast	0.30	0.45	0.60
2 nd	20.7	124.1	132.8	198.0
3 rd	225.3	399.0	439.4	450.3

*) kilos per hectare.

The data also show that in aged stands differences among drill spacing could become less important presumably due to changes in tiller population. Low seed yields in the second harvest year were obtained due to shattering.

2) *The effect of nitrogen and defoliation on seed production of Festuca arundinacea.*

a) *Objective:* To ascertain which tillers made the main contribution to seed yield and how nutrition and defoliation affect their behaviour.

b) *Materials and methods*: In pot experiment, - different treatments on rates and dates of nitrogen fertilization and dates of defoliation were applied. Time of origin of tillers was recorded from May to September. When head emergence started tillers were marked at weekly intervals during the ear emergence period. At harvest time inflorescences were cut singly when stems were a yellowish colour just below the panicle so avoiding losses by shattering When bagging fertile tillers, each pot was separated into their constituent group of tillers, according to the month of origin. in each sample, number of fertile tillers, seed yield and seed weight is recorded.

c) *Preliminary results*: Given in the following table:

	Seed yield per pot -- (mg.)	Nº of-- fertile tillers	Weight of 1000 seeds(mg)
A-No defoliation	3017	15	2.184
B-Autumn def.	2880	12	2.121
C-Def,before initiation	2736	14	2.169
N_0- No nitrogen	1516	7	2.013
N_1- 80 units/N/autumn	2174	11	2.027
N_2- 160 units/N/autumn	3780	17	2.138
N_3- 80 units/N/spring	3846	14	2.221
N_4- 80 units/N/spring	5886	18	2.390

3) *The effect of nitrogen and defoliation on - seed production of Phalaris tuberosa.*

a) *Objective*: Same as in experiment 2.

b) *Materials and methods*: Two different types- of *Phalaris* are used, Australian Commercial and -- one Portugal's ecotype. Methods and determinations are the same applied to Tall fescue in experiment 2.

c) *Primary results*: First year experiment shows that the Australian Commercial variety produces a- high number o fertile tillers but the length of -- the panicles was much lower than those coming from the field. Therefore it seems that investigations-

of this kind should be performed on single plants-grown under field conditions.

The ecotype from Portugal failed to produce inflorescenses and continued vegetative growth throughout spring and summer.

4) *The effect of cutting white clover grown -- for seed production.*

a) *Objective:* To detect the effect of different cutting treatments during spring on the seed yield components of white clover.

b) *Materials and methods.* Six plants chosen at random from sown pasture were clonally propagated-being each clon one different replicate. Five defoliation treatments were performed as follows:
i) No defoliation; ii) defoliation on sept.30; iii) Defoliation on Sept.30 and Nov.15; iv) Defoliation on Sept.30 and Nov.30; v) Defoliation on Sept.30,-Nov.15 and Dic.20.

c) *Primary results:* Most clones flowered profusely and flower heads which appeared at weekly intervals were marked during 12 weeks. The 12 populations recorded were subjected to determinations on number of flower heads, number of flowers per head and 1000 seed weight. Seed yield per pot was measured.

5) *The effect of nitrogen, phosphorous and potassium supply on white clover seed production.*

a) *Objectives:* To measure the effects of N,P - and K on seed yields of white clover.

b) *Materials and methods:* Four plants of white clover were divided vegetatively and individual - runners of each clone were transplanted into 8 pots and grown outside. Treatments were applied in a -- factorial design 2x3x3 as follows:

N_0-0 units N/há:	P_0-0 units P_2O_5/há.	K_0-0 units K_2O/há.
N_1-80 " " " " "	P_1-60 " " " " " "	K_1-60 " " " "
	P_2-120 " " " " "	K_2-120 " " "

c) *Primary results*: One clon flowered profusely while the rest failed to produce inflorescences and remained in the vegetative conditions.

Therefore data from the first year is incomplete.

microbiology

1) *Rhizobium studies on basaltic soils.*

(Started: 1967)

a) *Objectives*: The main objectives are to determine:

i) Seasonal variations on the number of *Rhizobium* per gram of dry soil.

ii) Possible relationship between *Rhizobium* numbers and temperature and moisture soil conditions

iii) Differences between two types of shallow basaltic soils (Black and red) on their ecological characteristics for survival of *Rhizobium*.

iv) The effectiveness of introduced *Rhizobium* - on the nodulation of new seedlings during - following years.

b) *Materials and methods*: In 1966 experiments- were established on two contrasting basaltic soils (black and red) and on another soil which did not- presented problems on legume nodulation. Sub-clover was introduced by a sod-seeder.

The experimental layout adopted was a completely randomized plots and the following treatments - were included:

i) Inoculation with 250 grams/m^2 of commercial inoculant for sub-clover.

ii) Control without inoculation.

In 1967 new experiments were laid down of the-same regions. Number of *Rhizobium* and their nodulation capacities were evaluated on seedlings at weekly intervals as well as temperature and moisture conditions of the soil.

c) *Results.*

Data has sown that:

i) Number of *Rhizobium* per gram of soil is higher in the inoculated plots than in the controls. This differences decreased in the second year (see the following figure).

FIGURA 1

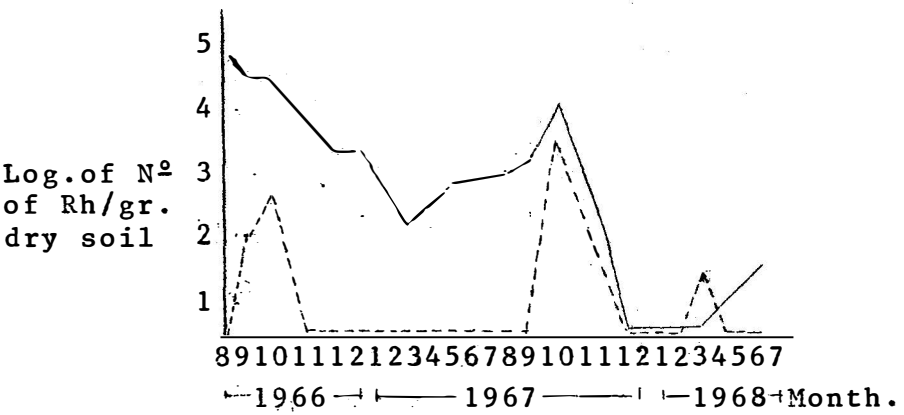


Fig.1- Paso Molle del Queguay.Black soil.
——— Inoculated ------ Control.

ii) There is a close relationship between the months which showed the highest temperatures (more than 45°C.) and the periods of moisture deficiency with the number of *Rhizobium* per gram. Under these condition *Rhizobium* were not recorded. When the adverse conditions disapperaed *Rhizobium* became available to the plants in the control soil (see next-figure).

FIGURA 2

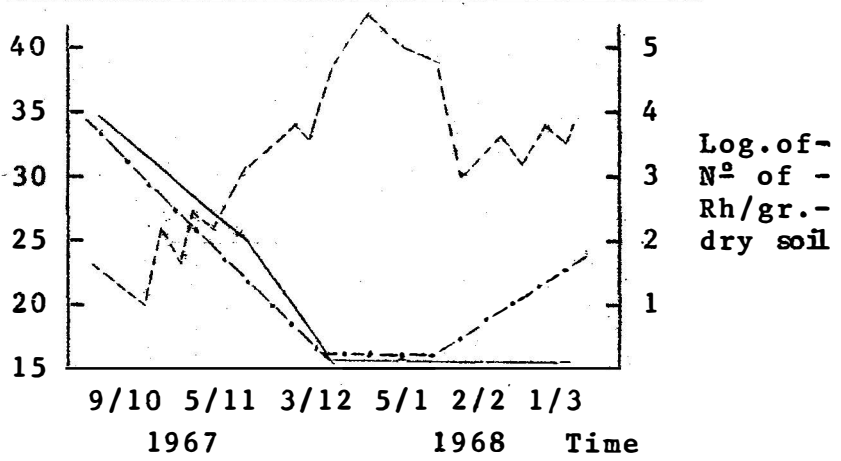


Fig.2 - Paso Molle del Queguay. Black soil.
----- weeks mean temp.
-.-.-. Nº of Riz. on control.
_____ Nº of Riz. on treated soil.

advisory

During 1968 the first steps to organize an Advisory Service were given. This Service is supposed to connect the Experimental Station with its area of influence. The Service will study the social and economic situation of the area surveying subjects such as markets, uses of the soil, cultural level of the farmers, attitude towards change, etc. Students will also be trained in this field.-

Publications.

A Technical Bulletin is published every six months. It contains original papers about the research being carried at the Station as wall as review on subjects on Animal and Plant Production. -

A Bulletin written speciàlly for the farmers - is published periodically.

Broadcastings and newspapers also diffuse advisory and technical articles.

international contracts

Finished:

Iowa State University (U.S.A.)

Projects:
Animal Production
Soils

Aid:
Equipment and Fellowships.

Standing:

French Government.
Through the Institute Nationale de la Recherche Agronomique. (I.N.R.A.)

Projects:
Sugar beets.

Aid:
Equipment, fellowships, technical assistance books, journal, etc.

British Government.

Aid:
Fellowships for post-graduate studies.

national contracts

Plan Agropecuario.

Projects:
Plan Basalto (Basalt Project)

Aid:
Equipment, vehicles, field assistants.

Coparroz.
(Cooperativa Arrocera de Tacuarembo).

Aid:

Fellowships for students.

staff

	1963	1969
Director	--	1
Jefe de Operaciones (Manager)	--	1
Profesores (Lecturers)	5	5
Asistentes (Assistant Lecturers)	--	6
Ayudantes (Assistant Lecturers)	4	20
Total	9	33

Post-graduate qualification.

The following table shows the numbers of Staff Members that have completed or are currently taking post-graduate training abroad:

Australia	2
France	1
Germany	1
G.Britain	6
Sweden	1
U.S.A.	7
Total	18

Present staff:

Director: Alvaro Díaz, Ing.Agr.
Manager : Ramón Gambetta, Ing.Agr.

Beef Production

Lecturer: Jaime Rovira, Ing.Agr.M.Sc.(Iowa State).
Fernando Madalena, Ing.Agr.(at Edinborough, G.Britain)
Assistant Lecturer: Danilo Cianzio, Ing.Agr.(at Iowa State, U.S.A.)

Fellow : Oscar Pittaluga,Br.

Dairy

Assistant Lecturer: Jorge del Puerto, Br.

Sheep Production

Lecturer : Luis Manta, Ing.Agr. (at Sidney,Australia).
Assistant Lecturer: Mario Azzarini, Ing.Agr.M.Sc.-- (Wyo. U.S.A.)
Assistant Lecturer:Raúl Ponzoni, Ing.Agr.

Wool

Lecturer : Santos Arbiza, Ing.Agr.
Assistant Lecturer: Beatriz S.de Pittaluga, Br.

Ruminant Pathology

Assistant Lecturer: Miguel Dubra,Med.Vet.(at Lyon, France)

Nutrition Laboratory

Assistant Lecturer: Dora F.de Rama, Qca.Ind.
Assistant Lecturer: Luis Bonnecarrère,Ing.Agr.

Forages

Lecturer : Milton Carámbula, Ing.Agr.M.Sc.(Aberystwith, G.Britain)
Lecturer : Oscar Castro,Ing.Agr.(at Iowa,U.S.A.)
Assistant Lecturer: Jorge Escuder,Ing.Agr.(at Wye-College,G.Britain)
Assistant Lecturer: Esteban Pizarro,Ing.Agr.(at-- Aberystwyth,G.Britain.)
Fellow : Julio Elizondo,Br.

Crops.

Assistant Lecturer: Evaristo Lazo,Ing.Agr.(at Iowa U.S.A.)
Assistant Lecturer: Ernesto Agazzi, Br.

Assistant Lecturer: Agustin Pernas, Br.
Assistant Lecturer: Héctor González,Br.

Soils,

Assistant Lecturer: Enrique Marchesi,Ing.Agr.M.Sc. (Iowa, U.S.A.)
Assistant Lecturer: Armando Rabuffetti,Ing.Agr.--- M.Sc.(Iowa, U.S.A.)
Assistant Lecturer: Roberto Saccone, Br.
Assistant Lecturer: Marlene Y.de Díaz, Br.
Assistant Lecturer: Norbert Claasen, Br.
Assistant Lecturer: Dagmar von Zakrzewski,Ing.Agr. (at Germany)
Assistant Lecturer: Ernesto Beltramini, Br.

Statisticians.

Assistant Lecturer: Alvaro Sanchez, Ing.Agr.(at Edinborough, G.Britain)
Assistant Lecturer: Carlos Gonzalez, Ing.Agr.M.Sc. (Aberdeen, G.Britain.)

Advisory Service

Assistant Lecturer: Gustavo Olveyra, Ing.Agr.
Assistant Lecturer: Guillermo de Torres, Ing.Agr.-
Fellow : Luis Acuña, Ing.Agr.

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