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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Results of Recent Experiments on Control of Mango Anthracnose

Robert A. Conover
Sub-Tropical Experiment Station
Homestead, Florida

Table 1. Control of anthracnose of Haden mango at time of harvest, 1964 test.

Fungicidal Treatment[1]		Disease free (%)	Mild Anthracnose (%)	Severe Anthracnose (%)
During Bloom	After fruit set			
Maneb alternated with zineb	Tribasic copper	76 a [2]	15 a [2]	9 a [2]
Dithane M-45	Dithane M-45	70 a	18 a	13 a
Dithane M-45	Tribasic copper	72 a	18 a	10 a
Check--no fungicide		21 b	42 b	37 b

[1] Rates were: maneb (80%), zineb (75%) and Dithane M-45, 1.5 lb/100 gal; Tribasic copper, 3 lb/100 gal. A surfactant, Triton B-1956, at 2 oz/100 gal, was added to all treatments.

[2] Differences between figures followed by the same letter are not statistically significant (5% level) according to Duncan's Multiple Range Test.

Table 2. Effect of fungicidal treatment on development of anthracnose on ripe Haden mango eight days after harvest.

Fungicidal Treatment	Percent of Fruit with		
	No Anthracnose	Mild [1] Decay	Severe [1] Decay
Maneb, zineb in bloom, copper post-bloom	45.4 a	46.1 a	8.5 a
Dithane M-45 throughout	28.4 a	64.1 a	7.6 a
Dithane M-45 in bloom, copper post-bloom	48.4 a	45.4 a	6.3 a
Check--no fungicide	5.3 b	37.2 b	56.3 b

[1] "Mild" means anthracnose spots less than 0.5 inch in diameter not extending through the peel or smaller superficial spots covering not more than 10% of fruit surface. "Severe" means spots larger than 0.5 inch in diameter extending into the flesh or smaller spots covering more than 10% of fruit surface.

Table 3. Yields per tree of Haden mango sprayed with certain fungicidal treatments.

Fungicidal Treatment	Marketable Fruit (No.)	Fruit Wt. (lbs)	Seedless Fruit (No.)
Maneb, zineb in bloom, copper post-bloom	98 1/	0.97 1/	130 a
Dithane M-45 throughout	89	1.01	148 a
Dithane M-45 in bloom copper post-bloom	95	1.03	171 a
Check--no fungicide	79	1.00	49 b

1/ Differences between treatments are not statistically significant.

Table 4. Control of anthracnose on Haden mango with certain fungicidal programs in 1965.

Fungicidal Program				
In-the-bloom sprays (weekly, @ 1.5 lb/100 gal)	After Fruit set (monthly, @ 3 lbs/100 gal)	% Disease free	% Mild Anthracnose	% Severe Anthracnose
Maneb, zineb alternated	Tribasic copper	74.2 a	23.1 a	2.7 a
Fermate	Tribasic copper	73.5 a	22.0 a	4.5 a
Fermate	Fermate	76.8 a	20.3 a	2.9 a
Daconil	Tribasic copper	69.7 a	27.5 a	2.8 a
Daconil	Daconil	53.7 b	43.5 b	2.8 a

Table 5. Yields of Haden mango trees sprayed with certain fungicides. Differences between treatments are not statistically significant.

In-the-bloom sprays	After fruit set	Avg. Yields per tree		Average Fruit size (lbs)
		No. of fruit	Lbs. of fruit	
Maneb, zineb alternated	Tribasic copper	47	43	0.92
Fermate	Tribasic copper	58	54	0.92
Fermate	Fermate	64	59	0.91
Daconil	Tribasic copper	53	50	0.93
Daconil	Daconil	59	55	0.89

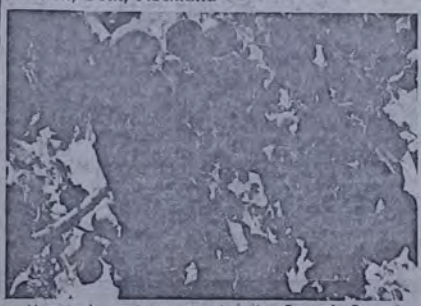
Table 6. Control of anthracnose as affected by row location.

Row position	Percent of fruit		
	Disease free	with severe Anthracnose	Marketable
North row	77.6	4.9	95.1
Center row	67.0	2.2	97.8
South row	42.1	14.7	85.3

STONE FRUIT VARIETIES FOR THE HOME GARDEN

Story: ALBERT FARMER, Plant Diseases Division, DSIR, Auckland

As only a relatively few stone fruit varieties do well in all districts, it pays to check before planting your favourite type.



Moorpark apricots growing in Central Otago. —Photo A. Farmer

Redhaven, one of the new peach varieties introduced by the DSIR. —Photo J. W. Endt

A number of good reliable stone fruit varieties are now available for home planting in New Zealand to give a succession of fresh fruit for several months of the year.

The home gardener, unlike the commercial grower, can allow fruits to ripen on the tree until they are at their best for eating or cooking. For these, and other reasons, a planting of stone fruit seems justified wherever there is room for it.

Peaches, nectarines and Japanese plums can be grown in most parts of New Zealand, but cherries and apricots crop satisfactorily only where winters provide a sufficient period of cold to meet their chilling requirements.

Of these fruits early varieties of apricots crop reasonably well in Thames and Hawke's Bay but mid-season and late varieties should not be planted except in South Island districts.

Sweet cherries should not be planted in the Auckland Province except possibly Waikato. This climatic factor, among others, must be taken into consideration when deciding which kind of stone fruit and indeed even which variety to plant.

Only a relatively few varieties do well in all districts.

In the modern small section there is room for only a few trees. Pip fruits, berry fruits and in the north, citrus and subtropicals may also be grown besides stone fruit. Selection will depend largely upon personal preference. One can and should aim at a supply of fresh fruit for as long a period as possible.

Left: New Yorker, a new nectarine from America. Photo A. Underhill

It is as well to remember also that a small planting which receives good care may yield more fruit than a larger planting which is neglected. There will be little return from stone fruit trees unless such matters as drainage, manuring, pruning and spraying are attended to.

A great number of fruit trees in home gardens never get sprayed. It is surprising the difference even a few well timed sprays will make in control of such devastating fungus diseases as brown rot, leaf curl and bladder plum.

One is usually well rewarded for the little extra effort required to carry out a minimum spray programme.

Dwarf trees growing six to eight feet tall offer definite advantages in the home garden. Unfortunately, there are no satisfactory dwarfing rootstocks generally available for stone fruit as there are for apples.

Work on dwarfing rootstocks for stone fruits now being undertaken may result in more compact and manageable trees in the future.

The very dwarf peach trees, which are now on the market and a similar nectarine soon to be offered, are more in the nature of garden novelties. They do not yield a significant amount of fruit.

Good flavour is high on the preference list with the home gardener. Because the fruit does not have to be packaged and transported a softer textured fruit may be grown than in commercial orchards.

Some people have a special preference for a particular variety or want to grow it simply for nostalgic reasons. The home gardener would be well advised, however, to plant well tested varieties known to be satisfactory in the locality.

New varieties are constantly being introduced, but it requires many years of observation to evaluate a variety properly. Many of the old varieties we knew as children have been discarded because either the tree or fruit, or both, failed in some essential character.

In many cases they have been superseded by improved types. New peach and nectarine varieties have resulted in a wider range of yellow-fleshed freestones over a longer season.

There has been considerable change, also, in popularity among plum varieties. Vigorously growing plum varieties which make large trees but crop poorly can now be avoided.

There has been relatively little change in varieties of apricots or cherries. The varieties now being grown are almost identical with those first introduced although in some instances the original names have been lost and they have been given local names.

Self-fertile varieties are more suitable for growing in the home garden than those varieties which will not set fruit with their own pollen. Pollination is not likely to be a problem with apricots, peaches or nectarines.

Practically all varieties of these fruits are self-fertile Most Japanese and European plum varieties crop better when more than one variety

is grown or when different plum varieties, flowering at the same time, are growing in a neighbouring garden.

Plums are not easy to get to crop, especially when there is space in a garden for only one or two trees. Too large plum trees with few fruits are common and can be very disappointing.

The provision of bees, bouquets of different plum flowers hung in the tree, sugar sprays often helps amount of fruit set; or part of a tree may be grafted over to a suitable pollinating variety.

All sweet cherry trees must be cross-pollinated and this factor, together with the necessity to protect them from bird damage, makes them somewhat unsuitable in a small garden. Suggested pollinators for the varieties which require them are given later.

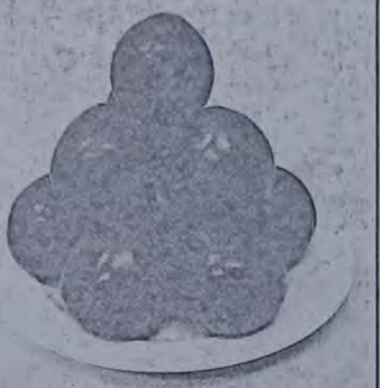
In southern districts of the country with moderately cold to cold winters, late spring frosts may injure or kill blossoms resulting in a loss of the crop.

It is in such frosty areas, however, that cherries, apricots and European plums do best. For this reason they are worth persevering with even if some method of frost protection must be provided.

A suggested home fruit planting for a family of five would read something like this: Two sweet cherries or apricots, one nectarine, three plums, four peaches.

The list could be started with an early plum, perhaps one of the myrobalan (cherry plum) types, then an early cherry, apricot or peach, depending on locality. This could be followed by a nectarine and other stone fruits ripening in midseason to provide a supply of fresh fruit and a surplus to give to friends or for bottling.

Finally, late maturing, preferably dual purpose plum and peach varieties could be planted to extend the season for fresh fruit and bottling. ■



George Wilson, the most important plum variety in New Zealand. —*Photo J. W. Endt*

A GROWERS' GUIDE TO STONE FRUIT

The stone fruit varieties listed here are considered the most reliable now available to the home gardener. Mr Farmer has considered the adaptability of the varieties to a wide range of conditions and the uses to which the fruit will be put in the home. The dates shown are approximate first picking dates and allowance has been made for Dominion coverage.

Apricots

Early varieties: Ripening, December 15-30.

Newcastle: Best known early variety and seems the most widely adaptable. Small to medium; orange yellow flesh. Reliable bearer.

Oullin's Early: Medium to large; yellow flesh. Has soft texture.

Mid-season varieties: Ripening January 1-20.

Dundonald: Medium; rich golden yellow flesh. More widely adaptable than Roxburgh Red.

Roxburgh Red: Large; golden flesh; red cheek. Variety closely associated with Central Otago. Inclined to shed its fruit right up to maturity.

Late varieties: Ripening January 22-February 1.

Moorpark: Best known New Zealand grown apricot. Good dual purpose fruit. Medium to large; yellow flesh. Usually dependable bearer.

Trevatt: Medium to large; yellow flesh. Dual purpose. Good bearer.

Cherries

Early varieties: Ripening November 12-29.

Early Rivers: Most popular early cherry. Medium; dark red. Fairly resistant to cracking. Pollinators: Florence. St Margaret.

Midseason varieties: Ripening December 1-12.

Bedford Prolific: Medium to large; dark red. Some resistance to brown rot. Pollinators: Florence, St Margaret.

Dawson (Noir de Guben): Type of cherry in most demand. Black; large to very large. Somewhat resistant to cracking. Pollinator: Early Rivers.

Late Varieties: Ripening December 14-January 1.

Florence: Medium large; white flesh. Pollinators: St Margaret, Early Rivers.

St Margaret (Black St Margaret): This strain has large black fruit. Rather susceptible to cracking. Pollinators: Early Rivers, Florence.

Necrarines

Early varieties: Ripening January 5-15.

Early Lowe: A comparatively new variety. White flesh; similar appearance to Goldmine. Becoming popular in Hawke's Bay.

Early Rivers: A widely adaptable variety. Medium; greenish creamy-white flesh.

Mid-season varieties: Ripening January 20-February 14.

Fillery: A new local variety. Medium to large; yellow flesh. Seems better adapted to districts with warm winters than most other nectarines.

New Yorker: A new nectarine from U.S.A. Similar type to Goldmine but ripens a few days earlier.

Goldmine: Best known and most popular nectarine. Flesh cream; tender; delicious flavour. Susceptible to brown rot in wet, humid weather.

Late varieties: Ripening February 15-March 5.

Murray: A comparatively new nectarine. Medium; deep yellow flesh. Useful variety to follow Goldmine in Hawke's Bay and southern districts.

Peaches

Early varieties: Ripening December 3-January 6.

Le Vainqueur: Small to medium; white flesh; semi-clingstone. Suitable for Hawke's Bay and more northern districts.

Mayflower: Medium; white flesh. Shy cropper in areas where winters mild.

Dixired: New American variety. Medium large; yellow flesh. Crops better in colder districts.

Swellengrebel: New South African peach. Medium; white fleshed; semi-clingstone. Suitable for districts with warm winters.

Mid-season varieties: Ripening January 8-February 18.

Redhaven: Most valuable new variety. Medium; yellow flesh; almost freestone. Sets heavy crops in most districts.

Wiggins: Well known. Medium large; white fleshed; semi-freestone. Widely adaptable.

Southland: New American peach. Large; yellow fleshed; fully freestone. Moderate crops in all districts.

Mary's Choice: Well known yellow fleshed bottling peach. Crops better in Hawke's Bay and districts south.

Paragon: Very popular in North Island. Medium large; yellow fleshed; clingstone; strong peach flavour; relatively large stone.

Stark: Medium; yellow fleshed; clingstone. Dessert and bottling. More favoured in Auckland than other districts.

Paragon II: Useful new home garden variety. Medium; yellow fleshed; clingstone. Sets heavy crops regularly.

Late varieties: Ripening February 20-March 30.

Black Boy: Peculiar red fleshed peach. Preferred by some for bottling or jam.

Golden Queen: Well known yellow fleshed canning clingstone. Excellent for bottling and dessert. Usually dependable bearer most districts.

European Plums

Early varieties: Ripening December 1-January 28.

Myrobalan (Cherry Plum): Really a separate species. Small bright red or yellow fruits; yellow flesh. Good for cooking and jam. Most strains self fertile.

Evans Early: Small to medium; greenish flesh. Self-fertile.

Angelina Burdett: Medium to large; greenish yellow flesh. Will crop in practically all districts. Pollinators. Grand Duke, Greengage, President.

Greengage: Medium; greenish yellow flesh; sweet rich flavour. Tree of slow growth. Pollinators: Coe's Golden Drop, Grand Duke, Angelina Burdett.

Mid-season varieties: Ripening January 30-February 12.

Monarch: Large, yellow flesh; freestone. Dual purpose. Good cropper. Self fertile.

Reine Claude de Bavay: Partially self fertile Greengage type but later ripening and larger fruited. Pollinators: Grand Duke, Greengage, President.

Coe's Golden Drop: Large; pale yellow flesh. Excellent flavour quality. Pollinators: Greengage, Monarch, President.

Grand Duke: Large; yellow flesh. Pollinators: Monarch, President.

Late varieties: Ripening February 12-22.

President: Large; yellow flesh. Suitable for dessert or cooking. Pollinators: Angelina Burdett, Grande Duke, Coe's Golden Drop.

Japanese Plums

Early varieties: Ripening December 5-January 5.

Wilson's Early: Most widely planted early variety. Medium; yellow flesh. Usually a dependable cropper. Pollinators: Billington, Doris.

Duff's Early Jewel: Medium; soft, yellow flesh. Moderate bearer, apparently self fertile.

Billington: Small to medium; red flesh. Dual purpose fruit. Pollinators: Wilson's Early, Cherry Plum, George Wilson.

Mid-season varieties: Ripening January 7-February 12.

Santa Rosa: Medium to large; flesh yellow, streaked with red. Partially self-fertile. Pollinators: Doris, Satsuma.

Sultan: Large, red flesh, dessert plum. One of most reliable croppers. Pollinators: Burbank, Doris, George Wilson.

Burbank: One of best-known Japanese plums. Variable size; flesh yellow. Usually a reliable cropper. Pollinator: Sultan.

Satsuma: Old favourite for jams and preserves. Medium large; dark red flesh. Pollinator: Santa Rosa.

Late varieties: Ripening February 14-April 5.

Doris: Small to medium; yellow flesh; agreeable brisk flavour. Fruit hangs well. Polinators: Sultan, Wilson's Early, Santa Rosa.

Late Burbank: Similar shape and colouring to Burbank but ripens three weeks to month later. Partially self-fertile. Pollinator: George Wilson.

George Wilson: Has become most important plum in New Zealand. Medium to large; dark red flesh. Fruit stores well. Rather susceptible to bacterial spot. Pollinators: Sultan, Victory. ■

ROOTING OF PEACH CUTTINGS UNDER MIST AS AFFECTED BY MEDIA AND POTASSIUM NUTRITION.

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Escuela Agricola Panamericana, Honduras.

Ralph H. Sharpe
Agricultural Experimental Station, Gainesville, Fla.

Some difficult rooting species have been successfully rooted with the important advancement of mist propagation techniques. Sharpe (4) reported successful results in rooting softwood cuttings of peach under mist, using as a media a mixture of peat and Perlite. The loss of potassium from the foliage of the peach cuttings rooting under mist brought out in this work, extends the observations of many workers (1, 2, 3) that nutrients may be lost from the foliage during rainfall or under mist propagation units. The potassium appeared to be most critical of the major elements (3). This paper reports further studies on potassium nutrition of peach cuttings under mist.

MATERIAL AND METHODS

Cuttings of peach were obtained when new shoots were long enough to make two 6 to 8 - inch cuttings. The terminal and subterminal portions were used equally in all lots. Cuttings were obtained in several tests to compare fertilized and check trees of Jewel, FV 234-1 and Okinawa peach, the latter two being of special interest as rootknot resistant stocks. Leaves were analyzed before and after mist to determine the percentage of potassium, using flame photometry. Dry weight determinations were made before and after rooting, for use in calculating losses of K from the foliage.

Intermittent mist was maintained during daylight hours with a cycle of 8 seconds on and 52 seconds off. It was turned completely off at night.

Flats with good drainage were filled with two grades of Perlite and mixtures of Perlite and peat at different percentages, (Table 2). The particle size within each grade of Perlite was designated as follows: Perlite # 8, 1/8 inch mesh or larger; Perlite # 30, 1/8 to 1/30 inch mesh.

Indolebutyric acid at a concentration of 1000 ppm. in 50% alcohol was applied to the base of the cuttings by the concentrated quick-dip method. The cuttings were prepared by removing the bark with a lengthwise cut of about one inch along one side at the base.

Tests involving lighting at night were made, using 75 watt bulbs set 24 inches apart and at a height of 12 inches above the cuttings. The lights were turned on from 6 P.M. to 7 A.M. each night.

Potassium sulfate was applied to stocks at rates of 150 and 300 pounds per acre on June 25 and again on July 24. Cuttings from those stocks were made on July 20 and August 21.

Rooting was determined after 25 days under mist, both as percentage rooted and by the following score for vigor of rooting:

5.- Very heavily rooted - 10 or more roots over 2 inches long.

4.- Good rooted - 6 or more roots over 1-1/2 inch long.

3.- Medium rooted - 6 or more roots 1/2 to 1-1/2 inch long.

2.- Poor rooted - 2 or more roots less than 1/2 inch long.

1.- Non-rooted - callus formation without roots.

All treatments and tests were replicated several times and data analyzed by analysis of variance methods.

RESULTS AND DISCUSSION

Position of cuttings - In each replication, rooting score was determined after 25 days under mist, as recorded in table 1. Subterminal cuttings showed more vigorous rooting and slightly better overall percentage of rooting with differences significant at the .01 level.

TABLE # 1. EFFECT OF POSITION OF CUTTING ON ROOTING

Date of Cutting	Plant Material	Terminal		Sub-terminal	
		Rooting Score	Percentage Rooted	Rooting Score	Percentage Rooted
7/20	Jewel, 234-1	3.26	97	4.07	97
8/21	Jewel	2.68	75	3.30	90
8/21	Okinawa	2.87	93	3.92	98

Effect of media - Of the media used, Perlite # 8 alone gave inferior results (Table 2). The other seven media showed no significant difference between them in rooting. It may be noted that the Perlite # 8 was the coarsest media and held less water than any of the other mixes.

TABLE # 2. EFFECT OF MEDIA ON ROOTING AND K CONTENT OF FOLIAGE.

MEDIA	Rooting Score	Percent Rooted	% K in Foliage	
			Original	After 25 days
Perlite # 8	2.96*	77*	2.10	1.24
Perlite # 8 (3/4-1/4	3.67	93	2.09	1.26
and (1/2-1/2	3.54	94	2.06	1.27
Peat Mix. (1/4-3/4	3.76	95	1.87	1.11
Perlite # 30	3.67	95	2.08	1.22
Perlite # 30 (3/4-1/4	3.70	95	2.06	1.23
and (1/2-1/2	3.27	96	1.84	1.15
Peat Mix. (1/4-3/4	3.44	95	1.87	1.15

* Difference is significant at 5% level.

Supplemental light - Night lighting as used in the experiment, did not improve rooting (Table 3). The light intensity was probably insufficient for effective photosynthesis, and apparently had no benefit of a photoperiodic nature. It had no appreciable effect on changes of dry weight or potassium level in foliage.

TABLE # 3. EFFECT OF LIGHT ON ROOTING AND K CONTENT OF FOLIAGE.

DATE OF CUTTINGS	24 Hours Light		Normal Light		% K in Foliage		
	Rooting Score	Rooted %	Rooting Score	Rooted %	Original	After 25 days: 24 hrs Light	After 25 days: Normal Light
6/22	3.90	98	3.77	100.	1.64	0.88	0.86
7/20	3.46	84	3.49	91.	2.41	1.41	1.47
8/21	3.55	91	2.91	85.	2.39	1.35	1.45
9/26	3.40	84	3.88	100.	---	---	---

Potassium fertilization of stocks - No significant difference in rooting of cuttings from the potassium fertilized stocks was found (Table 4). It should be noted that potassium levels were not very low in any of the material, however. There was some evidence (Table 3) that potassium level could be fairly low without affecting rooting. In the June lot of cuttings, the levels were 0.86% K after 25 days in mist, yet rooting was excellent.

TABLE # 4. EFFECT OF POTASSIUM LEVEL OF STOCK ON ROOTING.

DATE OF CUTTINGS	Stock Treatment	Rooting		% K in foliage	
		Score	%	Original	After 25 days
7/20	CK	3.65	92	2.33	1.45
	K1	3.67	91	2.25	1.40
	K2	3.67	96	2.43	1.46
8/21	CK	2.94	85	1.97	1.17
	K1	2.94	82	2.24	1.06
	K2	3.10	82	2.30	1.24

Seasonal comparisons - Perhaps the most interesting data of this experiment are the seasonal comparisons showing rooting, dry weight changes, and changes of potassium in the foliage (Table 5). Rooting percentage and quality were best in the first lot of cuttings taken in June and became progressively poorer in July and August. Even more striking are the figures showing change in dry weight of leaves, which ranged from an increase of 34% during 25 days under mist in the first lot to a decrease in the last lot. Using the dry weight changes to calculate the estimated losses of K from the foliage show that there is increasing loss of K as the season progresses.

TABLE # 5. ROOTING, DRY WEIGHT CHANGES, AND ESTIMATED LEACHING AND TRANSLOCATION LOSS OF K FOR THREE DATES.

DATE OF CUTTINGS	Rooting		% K in foliage		% dry weight chg. of foliage	Estimated % K loss
	Score	%	Orig.	After 25 days		
6/22	3.69	98	1.64	0.89	+ 34	0.33
7/20	3.66	95	2.27	1.43	+ 12	0.60
8/21	3.00	88	2.17	1.29	- 3	0.95

The reason for these striking changes during the season are probably not due to age of foliage at time of sampling. While no careful measurements were made, the shoots were growing rapidly during the season and it is believed that the cuttings were of comparable age material. It is suggested that the decreasing day lengths may be an important factor affecting these changes. That this would be an overall effect rather than a photoperiodic effect was indicated from the tests of lighting.

SUMMARY

The results of the studies on rooting cuttings of peach under mist showed that subterminal cuttings rooted slightly better than terminal cuttings. Of the media used only the coarse perlite alone was found to result in inferior rooting. Night lighting did not give markedly improved rooting for the season of June to September when cuttings were set. Potassium fertilization of stocks did not affect rooting.

It is suggested that the decreasing day lengths as the season progresses appeared to be directly correlated with the dry weight changes and loss of K from the foliage.

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3) Sharpe., R. H. (1955) Mist propagation studies with emphasis on mineral content of foliage. Proc. Fla. State. Hort. Soc. 68: 345-347.

4) Sharpe., R. H. (1956) Observations on rooting softwood cuttings of Peach. Proc. Amer. Soc. Hort. Sci. 67: 102-106.

1. ~~Project requires sound horticultural~~ or botanical background, ~~and possibly also a thorough understanding of genetics~~

2. "It should be possible to gain insight into ....." (?)

3. Which Costa Rican fruit trees are propagated by cutting?

4. ~~Why Costa Rica?~~

5. Should the possibility of grafting or budding by non-literate Indians be considered?

6. What methods will be used to determine if mutation is recent or old?

7. What standards will be used to measure "the characteristics and drives of the individual who made the initial observations and selection"?

8. (see question 5, page 3). A native wild plant in its natural environment must be well adapted to that location. It is difficult to conceive of a situation where the size of the fruit could be increased by changing the amount of sunlight or soil nutrients.

9. Has the ~~author~~ writer tried taking a picture of a tree in its native habitat?

10. are good living conditions a reason for conducting field research in a specific area?

OUCH!

RESEARCH CONTRACT PROPOSAL

BETWEEN THE

UNIVERSITY OF OREGON

EUGENE, OREGON

AND THE

NATIONAL SCIENCE FOUNDATION

Chief Investigator: Carl L. Johannessen, Assistant Professor of Geography

Title of Proposed Research: The Distribution of Varietal Differences in Fruit Trees of Costa Rica

Desired Starting Date: June 10, 1961.

ABSTRACT

I propose to study the distribution of varieties of one or two species of fruit trees in Costa Rica (and possible adjacent regions where necessary). At the same time these data are collected, information on the process of selection and dispersal of new varieties will be investigated in order to determine the effect of these two factors on the domestication of plants. Trees are suggested as a valuable type of plant for this study because they retain a more distinctive physical identity than do herbaceous, annual forms.

The results of this research will be submitted to the Annals of the Association of American Geographers or comparable journal for publication.

THE DISTRIBUTION OF VARIETAL DIFFERENCES IN FRUIT TREES OF COSTA RICA

Purpose:

The purpose of this study is to learn more about the varieties of fruit trees present in Central America, and with this information to examine the processes of selection and dispersal, as these affect the domestication of plants. It should be possible to gain insight into the way in which tree crops are presently being selected by the relatively uneducated peasants, by comparing the trees that are utilized in tropical gardens with the homologues of the fruit trees in the feral, volunteer and wild conditions.

Relatively little information is available on the diversity of many of the useful trees in Central America because of the lack of interest on the part of systematic botanists for the study of the domesticated and semi-domesticated plants and because of the problems involved in the preparation of herbarium plant specimen from trees. Several species will be investigated concurrently, until it can be decided, which will yield the most information under intensive study. Ideally one would like a species that has several, well defined, true-breeding varieties without diversity as a result of a hybrid swarm, for such a "swarm" would include components of at least two varieties. Whether or not such characteristics are present will be determined in the field. However, as will be discussed later, one of the methods to be used in the study will differentiate the hybrid swarm from the forms retaining their genetic identity. (In essence this will be done by close examination of the useful trees and the preparation of ideographs for the comparison of many morphological characteristics at one time.) Some relatively homogeneous races will be found because the trees are propagated from cuttings rather than from seeds fertilized from randomly distributed pollen.

The frequency with which these asexual techniques of propagation are used is an interesting problem and will be investigated as an integral

part of the study. Incident to this is the question of how genetic identity is maintained if some form of bud grafting is not used; yet the use of such grafts is rarely, if ever, documented in the historical accounts of the non-literate Indians. In the singularly fine research on the avocado in Guatemala, Wilson Popenoe[1] found no evidence of the use of grafting techniques.

Throughout the study a search will be conducted for fairly recently derived varieties or beneficial mutations, which have been selected as being distinctly different by the backwoods farmers; and so recent a product of selection that the variety can be traced back to a single region (possibly an individual tree whence it dispersed.) A multiple problem will appear at this time: (1) what are the characteristics and drives of the individual who made the initial observations and selection? (2) What are the characteristics of those who have an opportunity to obtain an innovation in their food products? It is acknowledged that I will be very lucky to find a person who has made the primary selection of a new form, but the potential value of such a find justifies the attempt. The second question, dealing with the manner in which the new form was dispersed and the extent and rate of the dispersal, is much more likely to be successfully answered and will provide a new insight into these two aspects of the domestication process as they have functioned in the recent past.

Additional questions have been raised as I have thought on this problem. Answers to the following questions need to be obtained through investigations in the field:

1. Why do some new varieties of fruits disperse with greater rapidity than others?
2. Is the new variety handed along at first only among close friends or relatives or is there indiscriminate dispersal?

1. Popenoe, Wilson, "The avocado in Guatemala" Departmental Bull. of U.S.D.A., No. 743:1-69, 1919.

3. Do some gardens have a concentration of the new varieties of several species, which would indicate a readiness to experiment on the part of the farmers?

4. Are the literate, young farmers or city folk more likely to accept a new variety than the illiterate, old farmers or country folk?

5. To what extent does the small size of the fruit in the wild forest varieties reflect a lack of sunlight or soil nutrients?

6. Do the farmers sell only the best fruit that they have at their disposal, and is this an effective long-range process of selection that can account for the improvement of the varieties?

7. To what degree is the selection of a new variety a conscious act of selection to give diversity to the daily fare?

8. To what extent do the farmers grub out the seedlings of varieties that are known to produce inferior fruit?

9. In what ways do the farmers care for their fruit trees? Do they cultivate the soil around the trees, do they prune and fertilize them, and do they take careful notice of the life cycle of the trees?

10. Another major field of interest and inquiry for library research by the historical geographer relates to the problem of the pre-Columbian distribution of several of these fruits. Were some of the species in both the New and Old World prior to 1492? How do the varieties in New and Old World differ at present in these pantropic species? Before the latter can be answered, of course, we need detailed studies in both regions and therefore this need provides direction for future activities and studies.

Theoretical considerations:

One of the assumptions underlying such a study, is that disturbance

of the habitat often allows new varietal forms of plants to germinate and develop where otherwise they would be at a disadvantage with respect to the long-established wild varieties. Since man is a great disturber of habitats, it follows that mutants and hybrids of plants growing wild, semi-domesticated or domesticated, may be able to develop because of this disturbance. When in addition man finds the variety or hybrid useful, these more aberrant forms of the species have an increased likelihood of survival in the next generation due to some form of planting by man. Since the peasant farmers of the tropics are well aware of the plant forms around them, they may be expected to be continually alert for new varieties. What is done with them once they are found is the subject of this research.

Presumably, domestication includes the idea that desired qualities of a plant can be maintained, through controlled reproduction, and implies the accumulation of both large and small beneficial mutations. Domestication also involves the dispersal of the selected traits throughout a large enough area that the plants will be maintained.

The process of domestication has been a difficult study because so many of the major domesticated plants were part of the agricultural heritage of man at the beginning of written history. An examination of multiple characteristics in the morphology of a plant sometimes reveals which of the wilder forms have contributed most to the more modified and useful varieties. Plant geneticists have used this technique to a considerable extent in the study of staple foods, and they have reconstructed the wild progenitors of these domesticates. However, the ethnographic information on the manner in which pre-literate peoples go about the selection of the varieties that they plant in their gardens has not been carried out to the extent that it could be.

Why should fruit trees be singled out for the study of selection

and dispersal of domesticates? For one reason the identity and origin or parentage of a tree is more likely to be firmly fixed in the minds of peasants (if they personally planted it) than the genetic identity of herbaceous plants in their gardens. Therefore, the fruit trees ought to provide the best subjects available about which to get information from the non-literate farmers and thereby lend a degree of needed simplification to the problem.

Method:

1. Varietal differences of the species may be found in several habitats. The following list of ecological niches will be investigated:

   a. Gardens or conucos (mixed, semipermanent, arborescent assemblages). Presumably the most domesticated types will be found here.

   b. Abandoned gardens. Some of the varieties, once started, will remain for a few years, but the length of time will depend on the characteristics of the particular form. Some species may even reproduce without the aid of man for a limited number of years.

   c. Secondary regrowth. Abandoned, cultivated land that has been used for herbaceous crops provides relatively open habitat for a couple of years after abandonment during which time the seedlings of fruit trees may get a start even though they are not consciously planted.

   d. Roadsides. Volunteer reproduction may well account for many of the fruit trees in the cleared areas along the road as a result of seed dropped beside the road by travelers. Presumably the more highly domesticated a plant becomes the less likely it is to grow under volunteer conditions. Therefore, we should obtain a separation of the several varieties on this basis.

   e. Pastures. The seeds of fruit are often deposited after passing

through the alimentary tract of livestock (rather than being discarded by humans, as is the case in the other ecological niches), hence an additional selective factor is operative here.

f. Mature forests that have grown on old archeological sites. Often useful trees have been concentrated at old archeological sites and still remain to give special character to the biotic community as a result of the altered habitat created by the transported organic and basic nutrients (e.g. garbage, sewage, limestone--$CaCO_3$ etc.) that have been added and concentrated at sites that have been long occupied by man. The rate of change of the varieties through time may be indicated by the degree of difference between the currently planted varieties and the two- to four-century old trees on certain of the archeological sites.

g. Mature forest without special concentrations of transported nutrients in the soil. Surely the ultimate in wild varieties will be found here, if the trees can be definitely identified as the progenitors of the domesticated trees. In some cases this has been possible in the past.

2. The primary technique to be used in this study will be the field examination of the fruit trees in their native habitat. Observations are to be made of many characteristics of the plants, including location of flowering parts in relation to new growth for the season, the length of internodes between flowers and between leaves, characteristics of leaves, flowers and fruit, etc. At least 10 and preferably 15 representative individuals of each variety will be collected.

3. These several characteristics are to be plotted on ideographs and pictorialized scatter diagrams in a similar manner to those used

successfully by Professors Edgar Anderson[1] and Jonathan Sauer[2] in the separations of varietal differences. This consists of plotting seven to ten variables as stylized pictures (or unit graphs) against two other variables. When these show a segregation into distinct groups, varieties are indicated. It is possible to identify hybrids between two parent forms in this way too. The value of this method of identifying varieties is that the stylized pictures allow one to compare a large number of variables at one time.

4. Each time a plant is collected, two pictures will be taken; one of the tree, the other of leaves, fruit or flowers on a grid background.

5. Information on the selection of plants for propagation, qualities desired in the fruits, and uses for the products of the tree will be obtained, as much as possible through indirect methods of questioning. For instance, photos of gardens and of the trees of interest will be shown to the farmers. With an absolute minimum of direct questions from me, the farmer can look at the picture and explain what has taken place in the landscape or garden without my biasing his comments by letting him think I wanted him to answer in a particular manner. The photos are to be taken with a Polaroid Land Camera for rapid development in the field.

6. Several species of fruit trees in tropical Central America lend themselves to this type of study. The following species will be investigated in the field as to their suitability for more intensive study; Ultimately one or two of them will be used.

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1. Anderson, Edgar, "Efficient and Inefficient Methods of Measuring Specific Differences." Chapter 6 of Statistics and Mathematics in Biology, Edited by Oscar Kempthorne, et. al. Ames, Iowa, Iowa State College Press, 1954, and other publications.
2. Sauer, Jonathan, "Recent Migration and Evolution of Dioecious Amaranths.", Evolution, XI (1), 11:31, 1957 and other publications.

a. Tree gourd - Crescentia alata and C. cujete.

b. Pejibaye or peach palm - Guilielma utilis or Bractris utilis

c. Hobo or hog plum - Spondias mombin or S. lutea

d. Ciruela - Spondias purpurea

e. Papaya - Carica papaya

f. Plantain - Musa sp?

g. Ceiba - Ceiba sp?

h. Zapote negro - Diospyros sp.

i. Zapote blanco - Casimiroa edulis Llave & Lex.

j. Anona or sweetsop - Annona squamosa or A. reticulata

k. Guayaba or guava - Psidum guayave

l. Jagua - Genipa caruto HBK

Many more species are available for a study of this kind, but each of these has a special attribute that makes it a likely candidate for research, either it is reproduced vegetatively, occurs in unique habitats, or may have been in both hemispheres in 1492.

Reasons for conducting the study in Costa Rica:

1. Costa Rica has a considerable altitudinal range within which to find varieties of fruit trees. It also has several types of precipitation regimes, among which is the savanna-deciduous woodland vegetation of the Pacific coastal plain, in which I have long been interested.

2. I have conducted field studies on the savanna lands of Honduras and wish to diversify my area of geographical interest in a country that is similar enough to make present knowledge useful, but different enough to widen my experience.

3. The Instituto Interamericano de Ciencias Agricolas at Turrialba is present as a source of stimulating scientific interchange of ideas. It has a library and herbarium available to scientists working on the problems of the area.

4. Living conditions are as satisfactory in San Jose as in any other location with similar vegetational characteristics in Central America.

Qualifications of the Researcher for such a study:

1. Three field trips, each of three months duration, to Central America and the Greater Antilles, have made me aware of the problems to be met in these tropical locations. My studies have dealt with vegetational problems and have resulted in a completed doctoral dissertation on The Geography of the Savannas of Honduras, an article on the role of man in the distribution of the Cohune Palms, (Orbignya sp.), and a preliminary report on the geography of the Olancho area, Honduras, to the Office of Naval Research, which supported the research.

2. My long interest in the domesticated plants and animals, the tropics, and plant geography was initiated by several courses and seminars under Professors Carl O. Sauer, James J. Parsons, and Herbert Mason.

3. A graduate seminar on Plant Geography has been conducted by me for two years at the University of Oregon, and I have taught cultural geography and various aspects of physical geography.

List of Publications:

Anti-Freezing Hoods for V-Notch Weirs, Journal of Forestry, Vol. 55 (8); August 1957.

Higher Phosphate Values in Soils under Trees than in Soils under Grass, Ecology, Vol. 39 (2):374, April 1958.

Man's Role in the Distribution of the Corozo Palm (Orbignya spp.), Yearbook of the Association of Pacific Coast Geographers, Vol. 19:29-33, 1957.

Introduction to Geography (Cultural Geography) Eugene, Oregon, Oregon State System of Higher Education, pp. 27, 1960. A general extension divison correspondence course.

List of Publications (Cont'd)

Sustained Swimming Speeds in Dolphins, Science, Vol. 132, November 1960. (in press).

PROPOSED BUDGET

Salaries:		
Carl L. Johannessen 2½ months Summer 1961	$1,667.00	
Wages:		
Field Assistant, hourly wages	350.00	
Cartographic Assistant, hourly wages	500.00	$2,517.00
Permanent Equipment:		
Polaroid land camera (for interrogation purposes)	200.00	
Dissecting microscope	400.00	600.00
Supplies and miscellaneous expenses:		
Collection of plant & specimens, and mailing charges	100.00	
Film and development, color & black & white	350.00	
Health insurance	75.00	
Transportation of equipment	200.00	
Miscellaneous expenditures	400.00	
Payroll assessment, Retirement Contribution, Civil Service, Social Security, State Industrial Accident, & Staff Liability Insurance, (5.46% Salaries and Wages)	137.00	1,262.00
Travel and Per Diem:		
Air Travel, round trip Eugene - San Jose, Costa Rica	410.00	
Living Expenses at $15.00 a day for 80 days in the field	1,200.00	
Local travel expenses, Costa Rica	500.00	2,110.00
Sub total		6,489.00
Overhead - 20% total costs		1,298.00
Total Proposed Budget		$7,787.00

The financial requirement for a second summer in the field in 1962 would be about $7,300.00.

Approved:

C. L. Johannessen, Assistant Professor of Geography
Principal Investigator

C. P. Patton
Acting Head, Department of Geography

W. C. Jones
Acting President, University of Oregon

Harry Alpert
Dean, Graduate School

J. O. Lindstrom
Business Manager

Fruit Growing in the Patzcuaro Area

Preliminary Report
L. H. MacDaniels, May 1963

This report is a preliminary appraisal of the problems, limitations and possibilities of growing fruit crops in the Patzcuaro area of Michoacan, Mexico. The experience gained during six weeks (Feb. 1st - March 15th, 1963) is perhaps sufficient to appreciate some of the problems encountered that need further study but certainly not adequate to arrive at any conclusions upon which to base useful recommendations for planting in the future.

The climate of the Patzcuaro basin presents a combination of factors that make fruit growing difficult. At a latitude of about 19 N. it is well within the tropics. However, its altitude, 2220 M, gives it a sub-tropical or temperate zone character complicated by frequent spring frosts through February and into March with temperatures going down to about -5° C. This is too cold for the strictly tropical fruits which cannot withstand frost. On the other hand the chilling is of short duration so that the temperate zone fruits, apples, peaches, pears, plums, apricots and quinces do not have enough hours chilling to break the rest period or dormancy and these have abnormal and unsatisfactory growth and yields. These and some other subtropical fruits are grown locally in a small way.

Another important factor is the distribution of rainfall, about 32 inches, confined to the months of May through October giving six or seven months of drouth conditions during which non-irrigated trees certainly suffer from lack of water except where there may be a high water table related to the level of Lake Patzcuaro. A possible factor affecting the growth of temperate zone fruits may be their response to day length in the same way as do herbaceous crops. Little is known about fruit plants in this regard.

Observations made at Patzcuaro (Feb. 1 - March 14, 1963) include the following. Frosts occurred almost every morning until Feb. 24th, then no more until a light frost March 13th. There may have been others later in March. On two mornings the temperature at 6:30 A.M. was about -5° C. but usually it was about -2°. These low temperatures were related to the rapid radiation to the clear sky and probably were of short duration. Days were always sunny with noon temperatures reaching about 18° C. During the night temperatures fell rapidly with corresponding rise in humidity reaching the dewpoint toward morning with heavy deposit of dew or frost on exposed surfaces. The effect of these frosts was to kill the embryos in blossoming and young fruits of apricots and peaches. Foliage damage in these fruits was slight or lacking but young shoots of mulberry were killed along with those of some other species. Leaves on cherimoya and some other subtropical fruits were damaged. Leaves of Calla lilies and Cannas were killed in exposed situations.

The effects of prolonged drouth were apparent in some leaves and flowers of peaches and in older persistent leaves of quinces. Applying water to selected trees on February 1st increased the turgor of leaves but did not noticeably change the rate of flowering or other growth as observed on March 14th. Fruit trees at the Van Arx garden in Patzcuaro village which had received water, were normally turgid but showed delayed bud breaks and irregular blossoming due to lack of chilling. Quince bushes near an irrigation ditch that had received water during the winter were in practically full leaf on March 15th while those without water had not started growth except for a few buds. It was obvious that trees of all temperate zone fruits were suffering from a water deficit. This may have begun in late November or December and is probably a major factor in the poor performance of the trees.

Without much doubt the most important factor in growing temperate zone fruits in the Patzcuaro area is the lack of chilling to break dormancy. These fruits showed

typical response to such conditions as studied and observed in other areas. With apricots, plums and peaches there was shedding of buds, irregular blossoming and setting of young fruits, accompanied by dieback of terminal shoots. Pears showed delayed, irregular bud break and growth from buds that had remained dormant for more than a year. The apples observed had not started growth by March 15th.

The effect of all these factors was apparent in the orchards of the Montana project. These had not been fertilized or watered during the growing season of 1962 and had previously not received good care in pruning and other orchard practices. The trees were of various ages mostly between 5-10 years. Many had died and others severely damaged beyond possible rejuvenation. Peaches, apricots and plums were in worse condition, quinces and pears were more nearly normal. Apple trees were too young to make comparable observation. It is a very difficult matter to separate the effects of drouth from those from lack of chilling.

The soils of the area appeared to be of two types, that formed in the lake bottom and that on the slopes above. The latter were deep, red soils of volcanic origin that had been heavily eroded. The level lands at the edges of the lake were variable but in the orchards observed, showed two to three feet of silty clay over white pumice deposits which formed a hardpan layer. The Ph of the soils was about neutral in the places examined. No comprehensive soil survey was made and it is highly probable that there is great variation in soils of the areas related to slope, rock outcrop, origin and other factors.

The growth of subtropical fruits in the Patzcuaro area was not observed critically but it was evident that the number of kinds grown might be extended by the introduction of other species and clones from other areas. Citrus in general did not appear to do well though just what the limiting factors may be was not studied. Figs are a promising possibility. Avocados of the Mexican race appear to do well but it is probable that better varieties can be secured from the highlands of Central America. Loquats appeared to be damaged by the spring frosts. The Annonas such as the cherimoya might be further developed. In fact the whole field of subtropical fruit needs further exploration particularly as this might be extended by irrigation.

One of the essential steps in evaluating the possibilities of extending fruit production in the Patzcuaro area is to secure more adequate information on the climate and particularly the micro-climates of the region. It is obvious that the occurrence of frost is related to air movement on the slopes and accumulation of cold air in the valleys. The orchards on the Montana project probably were subjected to more frost than occurs on the slopes above. In the foothills of California there are so called thermal belts on slopes which are relatively frost free. It may be that there are such areas on the slopes above Lake Patzcuaro. To explore this situation would be an essential first step. Of course, much can be learned by observing the behaviour of trees at various elevations and locations but in the long run accurate meteorological data are most helpful.

Such data are also essential in making rapid progress with the problem of chilling to break the dormancy of temperate zone fruits. The amount of chilling necessary to break dormancy differs with the different kinds of fruits and between different clones within a species. The effect of chilling is cumulative during the winter season and the cold requirement of any clone is related to a more or less definite number of hours of chilling below a given temperature. Having accurate data on this point is of great importance in determining what clones are promising for trial.

Without doubt one of the most serious handicaps to fruit growing in the Patzcuaro area is the long dry season. Temperate and subtropical zone fruits do have a more or less dormant period in their yearly cycle but during this period there is root activity and other life processes going on so that drouth, even while the trees are dormant can cause injury and abnormal development. No study was made of the moisture content of soils in the orchards at Patzcuaro but from the appearance of the trees it was evident that they were suffering from a water deficit. Normal growth is dependent on favorable conditions of temperature, moisture, dormancy and other factors. These are all interrelated and it is a difficult matter to determine which factor may be limiting. The poor condition of the trees on the Patzcuaro orchards appeared to be related to lack of chilling and water.

Although much is known about the climate and soil requirements of fruit trees our knowledge is not sufficient to be able to predict just how a species or clone will perform in a new situation. Thus it is known that some fruit varieties require less chilling than others and these should be selected for trial in the Patzcuaro region. However, the only way to be sure that these varieties will succeed is to grow them in the area under the best conditions of moisture, pruning and other care that it is possible to provide. To do this it is necessary to have test orchards with assured supervision and continuity such as may be found in an Experiment Station. Variety testing to be of any value is a long and expensive project which should not be attempted unless there is a good prospect of permanent financial support. With present day communications, plant material is available from all parts of the world but there is no use assembling it unless it is to receive adequate care. In any variety trials it must be recognized that commercial production for market is quite different from casual growing of fruit for home use. The home owner may enjoy what few fruits he gets without counting the costs or giving consideration to quality. To succeed commercially, however, the orchard must not only give a profit over costs but also over alternate use of the land for other crops. It may very well be that fruit is not a worthwhile crop in the Patzcuaro area as compared with alfalfa or corn.

In addition to the problem of securing basic information on climate and soil and introducing and testing of new species and clones, there is the possibility of the selection of the best local seedlings and breeding new varieties that are better adapted to a region. The native peaches showed differences in their chilling requirement. Modern techniques are such that, often, rapid progress can be made in an area using local material that already shows some adaptation. On the more technical side in a new situation, there are special problems that warrant study. For example at Patzcuaro the spring frosts are of short duration. A problem would be to determine what the actual temperature was within the fruit buds as compared with an exposed surface or within a weather station shelter. Another question, what is the interaction, if any, between water deficit and amount of chilling required? The possible effect of short day length on temperature zone fruits is another problem. These are only a few of the technical problems that the situation suggests.

The improvement of fruit growing in a region like Patzcuaro is a long-time program that requires continuity. Much can be learned, of course, by observing what is and what has been done and the success or failure of material already there. However, it is apparent that there is much valuable material that has not been tried and many modern cultural practices that have not been used. Insect and disease control presents a whole new field for exploration. It is obvious that to do these things, it is necessary to have institutions that have continuity and will devote themselves to the problems.

REPORT ON A VISIT TO THE INSTITUTO SUPERIOR DE AGRICULTURA AND THE SCIENTIFIC CENTER FOR AGRICULTURAL DEVELOPMENT, SANTIAGO, DOMINICAN REPUBLIC

Oct. 21 to Oct. 27, 1964

John Popenoe

A review of the research facilities and program at the SCAD has been made. The following suggestions are the result of this review.

If research is to be the principal job for the SCAD the projects should be more clearly defined. Only a few definite projects should be assigned to each research worker at the present so that effective work can be done. After the scientists have been on the job a year or two they will see other important problems that they will want to work on. My visit has not been long enough for me to know which problems are most important, however I am proposing the following projects and arragements as a basis for discussion. I believe that a definite understanding should exist with the workers regarding their responsibilities.

I suggest that the researchers time be alloted to various duties in approximately the following way: 50% research, 25% technical supervision and advising of the ISA farm and teaching programs, and 25% in observations for conditions of agriculture in the Dominican Republic, consulting farmers, attending meetings, and setting up and equipping the new laboratory for scientific research.

I suggest that Mr. Cheaney be assigned to work on irrigation and fertility studies with rice and corn and in bringing in some new varieties for trial in the Santiago area. He could also work in cooperation with Dr. Smith on problems with yuca. These would include fertilizer, irrigation, and herbicide studies.

I suggest that Dr. Smith work on testing various tomato varieties to determine which ones are best adapted to the Santiago area and to determine the best planting dates. As the program is in progress, disease and insect problems that arise can be studied. In addition Dr. Smith should work on disease and insect problems with yuca. Some work has already been done to clear land for a small fruit orchard. Dr. Smith should supervise this and see that virus free citrus is planted along with several varieties of avocado, mango, and guava. After planting the care of this orchard should be under the supervision of the teachers. The orchard should be planted as soon as possible because of the length of time necessary for these trees to mature and the desirability of having them available for the teaching program. Dr. Smith should not be expected to travel around the country collecting superior varieties of fruits. This is a difficult project and requires a thorough and intimate knowlege of the fruits.

The above projects were selected because of their importance to agriculture in the Dominican Republic; because the background of the workers suits them to these jobs; and because they will fit in well with the school farm program at ISA where these basic crops must be grown to feed the students.

Neither Dr. Smith nor Mr. Cheaney should be expected to do extension work on crops they are not actively working on. Time should be allowed for them to make a few consultations and offer advice where they can be of help but this should be greatly restricted or they will have no time for serious research.

Administrative responsibility should be more clearly defined. To avoid difficulties individual members of the Association and the Board of Directors should channel their ideas and requests through Luis Crouch who will present them to Dr. Watkins. This is a rather cumbersome administrative set up which will have to be changed eventually, preferably by having one administrative head over the school and research center who will be resident.

Certain areas of friction appear likely to arise in the future if the administrative problem is not solved. One of these concerns the assignment of land. No overall land usage plan has been worked out so far. This should be done as soon as possible with some areas set aside for future development. Land for research purposes should be in large enough parcels to make it easy to cultivate. If fertility studies are to be made on many different crops, a lot of land will be needed. Accumulation of phosphorus and potash in soils prevents their being used over again for other studies of the same type. This means that some fertility studies will probably have to be made cooperatively on private farms. Also some of the SCAD land may eventually have to be traded back for the ISA farm land and arrangement for this could be made in the original land usage plan.

Disputes over water and equipment are likely to arise. The research program seems to be dependent on the farm program for land clearing. The farm program is overwhelmed with work and has little time for this. These small areas of friction should all be brought into the open and freely discussed while Dr. Watkins is present.

As I understand it, Dr. Smith and Mr. Cheaney will be making progress reports to Texas A&M every three months. These reports will not be detailed, but they should be made available to the Association so that it will be aware of the progress that is being made.

After a year or so the reserch should provide results worthwhile for publication and will benefit the agriculture of the Cibao. If the research is of a technical nature the scientist should have the opportunity to choose where it is first published. He may wish to publish in a journal in which he will get international recognition. This will enhance the prestige of the research center and make it easier to get additional or future research workers. This material can then be elaborated on and published locally in Spanish for domestic use. The research worker may prefer to have some material published strictly for local use.

As the research workers find they have time and equipment to expand their research to additional crops and problems they should present proposals to Dr. Watkins who will approve them in consultation with members or representatives of the Association. The Association should help Dr.

Watkins decide which problems are the most important to Dominican agriculture and thus assign priorities to them for future investigation. The workers should be free to use their own methods and designs to solve problems.

Most of these suggestions have been discussed with Dr. Smith and Mr. Cheaney and they are in general agreement with the proposals.

PROPOSAL FOR THE FRUIT ORCHARD AT ISA-SCAD

The soil and climate seem to be very well suited to the growing of tropical fruits. Most fruit trees will need irrigation to grow well but some such as the Mango and Nispero will probably do well without irrigation once they become established. Special care must be taken when planting avocado trees that the soil underneath has perfect drainage. Some areas were seen on the heavier soils north east of Santiago where the avocados were apparently dying from root rot. In general the soils around the school seem well drained however, there is said to be a stratum of clay passing through the area somewhere. This should be avoided for avocados. To begin the orchard the following varieties have been suggested:

Virus free citrus: oranges - Hamlin, Pineapple, and Valencia
Grapefruit - Duncan and Marsh
Tahiti lime

Citrus hybrids such as Ortinique, Chironja, Ugli, Oceola and Minneola tangelos if they can be obtained as virus free budwood

Avocados - Ruehle, Simmonds, Catalina, Hall, Choquette, and Kampong.

Mangos - Irwin, Haden, Carrie, Palmer, Smith, Kent, and Keitt. In addition the local varieties of Banilejo and Mameyito should be obtained.

A few seedling trees of the Patillo guava should be grown.

The avocados and mangos can be planted at a spacing of 35 feet while the citrus and guavas can be planted at 20 feet apart.

AVOCADO CULTURE IN FLORIDA.

By

T. Ralph Robinson, Physiologist.

The avocado, often incorrectly called "alligator pear", is a favorite dooryard fruit tree throughout tropical America and interest in its commercial possibilities for Florida and California is rapidly increasing. It is the purpose of this circular to answer briefly some of the questions most frequently asked relative to its culture, varieties, and possibilities in Florida.

The tree is normally a large, rapid-growing evergreen of symmetrical shape and handsome appearance. The fruit varies greatly in size, shape and color, but frequently resembles a large green pear. It is eaten as a salad fruit and is greatly relished by all who are familiar with its qualities. The best varieties have a very high oil content and rank high in food value.

Until recently the Florida crop was gathered from a few scattered seedling trees and consumed locally, but the growing demand for the fruit in the Northern markets, and the increasing knowledge of proper methods of propagation and culture, have resulted, within the last fifteen years, in the planting of several thousand acres of budded avocado groves. A somewhat similar development has taken place in California. In both Florida and California the industry is so new that knowledge of the requirements and culture of this fruit is still far from complete.

VARIETIES.

Perhaps the most important question to be settled by the prospective grower is the selection of the few best varieties to plant from the hundred or more sorts now available. As many of these have been very recently introduced, and have borne but one or twice in Florida, it will not be possible for several years to make a definite list of recommended varieties. In any event, it should be well understood that no variety can be extensively planted with safety in any locality until it has been thoroughly tested for that locality over a period of years. A variety may prove quite unsatisfactory in one locality, although well adapted to other nearby sections. While extensive plantings should be restricted to well-tested varieties and localities, small experimental plantings consisting of two or three trees each of the varieties which seem most promising for each particular locality should be encouraged. After four or five years, when the trees have borne two or three crops, the varieties which prove undesirable can be readily top-worked to the sorts which have proven most successful.

There is also evidence that varieties should be chosen for interplanting that are adapted for "reciprocating", in the matter of pollination, most varieties being more or less self-sterile. This is because pollen is shed only on the second opening of the flower at which time the pistil is usually past the receptive stage. The fact that all flowers act in unison on a single tree or other trees of the same variety makes it desirable that pollen should be available from nearby trees of some other variety having a different period for shedding pollen. This will be referred to later.

Avocado varieties may be conveniently grouped in three races, namely:- West Indian, Guatemalan and Mexican.

WEST INDIAN RACE. All varieties of this race are comparatively tender to frost, withstanding even less cold than the common guava or Key lime. Their commercial culture, therefore, is restricted to the most tropical section of the State, such as the localities immediately adjacent to the coast south of Fort Pierce and Punta Gorda. Most of the land north of these points, and nearby all of the interior of the State, with the possible exception of a few unusually well-protected localities, is too subject to frost for the safe planting of the West Indian varieties on a large scale. Small home plantings may be made with reasonable safety in localities somewhat colder than those mentioned, but in most of the colder localities the hardier Guatemalan and Mexican sorts will doubtless prove more desirable.

Among the most promising West Indian varieties the following may be mentioned:-

Trapp. Until recently this has been the leading commercial variety constituting nearly fifty per cent of the Florida plantings. Its season is September to November, a few fruits hanging on until January. The tree is usually prolific, but is often lacking in vigor; the fruit is fair to good in quality. This variety is apparently self-fruitful to a large extent, - i.e. not dependent on cross-pollination. New varieties of more vigorous habits and holding fruit into the winter months are gradually superseding Trapp in popularity.

Waldin. The fruit somewhat resembles the Trapp but is later in season and higher in quality. It is more thrifty than Trapp especially on the rock-pine soils of the lower East Coast; not so well adapted to sandy soils.

Pollock. A summer and early fall fruit of large size and excellent quality. Usually not a heavy bearer but on account of the high prices which the fruit commands Pollock has generally proven a profitable commercial variety and is quite extensively planted.

Simmonds. A seedling of the Pollock, thrifty and usually productive; fruit excellent in quality, maturing in summer. Simmonds and Pollock furnish good examples of "reciprocating varieties", each serving when growing close together, to assist fruit setting in the other.

Other West Indian varieties worthy of mention are Barker, Butler and McCann, the last named being chiefly grown in the Ft. Myers section where it originated.

GUATEMALAN RACE. Varieties of this race have been recently introduced into Florida, where, on account of their late season and relative hardiness, they are now the center of interest among avocado growers. In contrast with the thin-skinned West Indian sorts the Guatemalan varieties have fruits with thick, rough, or shell-like skins. They vary greatly in quality, but the best varieties are considered equal in richness and flavor to the West Indian fruits.

In Florida the season of the Guatemalan varieties extends from October to May. They vary greatly in hardiness, but will withstand from three to five degrees more of frost than the West Indian sorts. They are in no sense "frost proof", and average only about as hardy as the lemon. Although some of the most recent introductions may prove considerably hardier than any yet tested, until further evidence is at hand commercial plantings of Guatemalan avocados should be restricted to sections as free from killing frosts as are the highlands of Polk and Pinellas Counties. For home use the hardier sorts appear promising for trial in the most protected sections of Orange and Lake Counties, and similar localities where lemons are grown in home gardens.

Among the fifty or more Guatemalan varieties now being tried out in Florida the following show considerable promise.

Taft. The season of Taft is February to April and the fruit is of good size and excellent quality.

Taylor. The season of Taylor is January to March and the quality of the fruit is fair to good. Several profitable crops have been harvested in Dade County from mature trees of the Taylor variety and its popularity is increasing despite the rather small size of the fruit.

Eagle Rock. A late winter maturing variety of large sized green fruits, nearly round, and of good quality.

Fuerte. Fuerte is a variety which possesses some characteristics of the Mexican as well as the Guatemalan race. Its season in Florida is December to March. The trees are exceptionally vigorous and much hardier than most of the Guatemalans. The fruit is excellent in dessert quality, but is often attacked by anthracnose. On this account the fruit has a tendency to drop before mature, and does not ripen evenly. Of doubtful value for extreme south Florida but may prove better adapted to central portions of the State.

Other Guatemalan varieties which have fruited in Florida and are considered worthy of further trial there are Wagner, McDonald, Schmidt, Linda, Atlixco, Queen, Verde, Nimlich, Panchoy, Itzamna, Benik and Lamat.

MEXICAN RACE. The leaves of all varieties of the Mexican race give off an anise scent when crushed in the hands. The Mexican varieties are also characterized by their relative hardiness. They average as hardy as the round orange and there are a few seedling trees which have fruited for years as far north as Gainesville. Many of the Mexican varieties bear fruits too small for shipping, although excellent in quality. They may be strongly recommended for trial as home garden fruits in the northern citrus sections of Florida where the West Indian and Guatemalan varieties are too tender. Furthermore, some of the new Mexican varieties now being tested bear much larger fruits than varieties of this race hitherto grown.

Among the most promising varieties are:-

Puebla. A vigorous grower. The fruit, while a trifle small, is excellent in quality and large enough for market purposes. The season is late summer.

San Sebastian. Another Mexican variety of very thrifty growth habit, but inclined to be shy in bearing; not fully tested.

Gottfried. A variety originated and disseminated by the United States Plant Introduction Gardens at Miami. The fruits ripen in September and are large and excellent in quality.

Harmon. A very early variety ripening in July. Although small in size the fruits are rich in flavor and excellent for home use.

Hybrid Varieties.

Hybrids between the West Indian and Guatemalan (or Mexican) races give promise of proving better adapted to Florida conditions than many of the introduced varieties already being tried out. A few such hybrids having distinct promise are already being propagated and grown.

Winslowson. (also known as Rolfs), A seedling of Winslow - a Guatemalan - West Indian hybrid, very thrifty grower, producing large, nearly round, fine flavored fruit maturing from November to January. Appears to be more self-fertile than most varieties.

Collinson. A seedling of Collins, a Guatemalan - West Indian hybrid of distinct promise, maturing its attractive dark green pear-shaped fruits through March and April. The tree and fruit is especially noteworthy for its resistance to scab. Since its flowers are unique in being devo . of pollen it should be interplanted with reciprocating varieties such as Winslowson or Trapp to facilitate fruit setting.

Lula. Believed to be a Guatemalan - Mexican hybrid, - a thrifty growing tree pro'ucing pear-shaped green fruits of good quality, medium to large in size, maturing in January and February.

Pinelli. Of uncertain origin, probably Guatemalan - West Indian hybrid, - producing a large pear-shaped fruit having much the character of the West Indian race but maturing in the winter months, - also scab resistant.

Interplanting.

The grouping of varieties has already been referred to as desirable to assist in flower pollination and fruit setting. All varieties thus far studied fall in two classes, which may be called "class A" and "Class B". - the former having flowers ready to be pollinated in the AM. but shedding pollen from a second set of flowers in the PM., the latter (Class B) having a reverse flower behavior. It will be readily seen that varieties representing these two classes if planted in adjoining rows, would be reciprocally benefited in the matter of pollination provided bees or other insects were active in carrying pollen from tree to tree. It would also be necessary that the trees should have approximately the same blooming period. There is still much to be learned about the best grouping of varieties to bring about satisfactory conditions for fruiting but a short list of Class A and Class B varieties will serve to guard against making solid plantings of varieties that have the same flower behavior and which are therefore not capable of benefiting each other through cross-pollination.

Class A.* Varieties.	Class B.# Varieties.
Alixco	Eagle Rock
Benik	Fuerte
Blakeman	Harmon
Collinson	Itzamna
Dickinson	Knight
Family	Lamat
Gottfried	Linda
Lula	McDonald
Perfecto	Meserve
Pinelli	Nimlioh
Puebla	Panchoy
Sharpless	Pollock
Simmonda	Queen
Sinaloa	Schmidt
Solano	San Sebastian
Spinks	Surprise
Taft	Trapp
Taylor	Verde
Wagner	Winslowson (or Rolfs).
Waldin	

* Class A, having only first-period flowers (receptive) in AM; second-period flowers shedding pollen in PM. #Class B, having only second-period flowers, shedding pollen in AM; first-period flowers (receptive) in PM. This classification may be altered or upset by sudden and violent weather changes but holds good for weather favorable to pollination and fruit setting.

Commercial plantings of recent years have been largely restricted to the following varieties, A or B following the name indicating its class as to pollination period. Pollock (B) Trapp (B) Waldin (A), Winslowson (or Rolfs) (B), Lula (A), Taft (A), Collinson (A), Taylor (A), Schmidt (B), Eagle Rock (B), Linda (B), and McDonald (B), listed about in the order of fruit maturity. Any new planting should include varieties selected from both of the above classes for interplanting. Where solid plantings of one variety (or varieties all of one class) have been made, it may be necessary to topwork a portion of the trees to one or more reciprocating varieties before fruiting will be satisfactory. West Indian seedlings growing nearby may serve to effect cross-pollination, in such plantings, since in any group of seedlings approximately fifty per cent are found to fall in each class, A and B.

If possible hives of bees should be placed in the groves at blooming time to increase the chances for cross-pollination.

PROPAGATION.

Seedling trees are seldom planted in Florida because of their uncertain yield and variable quality. Avocados are usually propagated by shield budding. The method is similar to that used with citrus trees, although considerably more difficult in execution, requiring much closer attention to details for successful results. Mature seeds are sown in boxes, pots or in the open ground with the pointed end uppermost and barely covered by the soil. Three or four months after planting, when 1/4" to 1/2" in diameter, the seedlings are ready for budding, providing they are making a vigorous growth and the bark slips easily. The budwood should be selected by taking wood which is of recent growth, but not so sappy that it will break when bent. The buds used should be plump, well developed, one to two inches in length. They should be cut smoothly with a very sharp, thin-edged knife. The usual T-shaped incision is made in the stock close to the ground and the bud gently inserted, taking great care not to injure the delicate inner bark tissues. After the bud is inserted it should be firmly and snugly wrapped with waxed tape or raffia, leaving the eye exposed. Three to five weeks later, when the bud has united with the stock, this wrap may be loosened, but it should not be entirely removed until the bud sprout is an inch or so long. At the time of budding the top of the stock should be lopped a foot or so above the bud. When the bud sprout is six inches or more in length the old stock should be cut off cleanly and as close to the bud as possible.

Avocados may also be propagated by whip, saddle or cleft grafting, and the latter method is now being used with considerable success on seedling sprouts while still quite tender and only of pencil size. Seeds can thus be germinated in a bed and bench grafted, then placed in boxes in which they are to be grown until set in permanent place. Covering the graft union with melted paraffin is an important aid in securing success with this method.

Old seedling trees bearing scanty or inferior crops can be top-worked to the best standard varieties. This is done by cutting half or more of the main limbs back to stubs late in the fall. The following spring vigorous sprouts appear from these stubs and when these sprouts are half an inch or so in diameter they are budded by the shield budding method described above. The following season the remainder of the tree may be rebudded by the same process.

SITES AND SOILS.

In choosing a site for the avocado select land with good air and water drainage. Low areas or pockets in which cold air might settle on frosty nights should be avoided. Land with poor water drain-

age, is very objectionable. Sites exposed to the wind should be protected by some sort of a windbreak, as tropical storms often do much damage. A number of avocado groves planted on low ocean keys have been severely injured by salt spray during strong winds, as well as by flooding of salt water during exceptionally high tides. Muck lands subject to flooding in periods of heavy rainfall are likewise to be avoided as grove sites.

The avocado can be successfully grown on a wide range of soils, but prefers a rich, sandy loam. The porous rock-pine soil of the lower East Coast where it contains sufficient humus and clay (as in the Redlands section) seems to be well suited to avocado growing. Hammock land soils, and the best grade of high-pine lands, are very satisfactory. Pine flatwoods lands are often good when well drained, but are frequently too wet and subject to overflow during the rainy season. Very light soils, such as the scrub pinelands of south Florida are undesirable for avocados unless the grower is prepared to heavily fertilize and water his trees.

PLANTING METHODS.

On light or rocky soils the trees should be planted about 20 by 20 feet apart. On richer soils a distance of 25 by 25 feet, or even more space, is preferable. Planting may be done at any time of the year when good trees can be secured, but tree mounds should be prepared several weeks (or months) in advance of planting by digging holes when the trees are to be placed and bedding in manure or other organic material in the prepared ground. Any hardpan should be thoroughly broken up. The roots should be kept moist at all times during planting. When plants are received in boxes (as usually shipped out from nurseries) the box should be removed with great care so as not to injure or disturb the roots. The ball of earth should not be broken. The trees should be planted with the bud union slightly above the surface of the ground, and the soil packed firmly down until it is in close contact with the roots.

The trees should be liberally watered at planting and re-watered at intervals until safely established. It is an excellent plan to mulch the ground about the newly set trees with hay, weeds, manure, or other material which will keep the soil cool and moist. A mulch of this sort is almost essential to protect the surface roots from the hot sun. It is well also to shade the trees during their first summer with a simple covering of lath and burlap. Thousands of valuable budded trees are lost each year in Florida because they are set out in the hot dry sand and left to shift for themselves. A little attention, after the trees are planted, to watering, mulching and shading, will be well worth while.

On occasional application of Bordeaux mixture is desirable as protection against the bark fungus often fatal to young trees.

During the first two winters the small trees are much more tender to cold than when older and larger. A rough shelter of some sort will often save young trees from severe frost injury. During the winter season the trees should be mounded above the bud union with soil which is free from weeds and grass, so that new shoots will grow from above the union in case severe cold kills the top.

CULTIVATION, MULCHING AND COVER CROPS.

Some method of caring for the soil should be planned which will conserve moisture and fertility and add humus. Clean cultivation the year round has been found unsatisfactory as it destroys too much of the humus. Clean cultivation through the dry season, followed by the growing of cover crops in the summer rainy season, these to be turned into the ground in the fall, has given very good results in a number of avocado groves. In others a system of permanent mulching is used with excellent success. The ground beneath the trees, as far out as the roots extend, is kept mulched the year through with a covering of hay, seaweed, manure, or other material. Excellent mulching material is cheaply secured in some groves by sowing velvet beans, pigeon peas, crotoliria, beggar weed, or natal grass in the row middles, cutting these crops from time to time, and adding the hay to the mulch beneath the trees.

FERTILIZING.

Avocados are heavy feeders and should be well fertilized if one wishes to secure the best results. The amount of fertilizer to be applied will vary, but as a general rule the trees should be fertilized four or five times the first year after planting, giving them at each application a pound of fertilizer containing about five per cent of nitrogen, six or seven per cent of phosphoric acid, and three or four per cent of potash. This amount may be increased to two pounds per application in the second year and gradually increased until the trees reach full bearing size, when they should receive from thirty to sixty pounds annually. The nitrogen used in the avocado fertilizers should be mostly derived from organic sources such as guano and tankage, rather than from nitrate of soda or other inorganic forms. Additional applications of stable manure or other fertilizer containing large amounts of organic nitrogen may be made with much advantage. It is difficult to overfeed an avocado tree.

IRRIGATION.

The avocado requires an abundant supply of water and should not be planted in very dry soils, unless some system of irrigation is installed. Even in more favorable soils irrigation is highly desirable as drouths are not infrequent in Florida. There are several cheap and satisfactory irrigation systems which are well adapted to Florida conditions. Information concerning these systems may be secured by addressing the United States Department of Agriculture, Washington, D. C.

PRUNING.

Most varieties of avocados require but little pruning if properly headed at planting time. Later pruning will consist largely in removing weak or undesirable growth. A few varieties tend to grow straggly, with long unbranched limbs, and these need considerable pruning and heading back to train them to the desired low-headed, spreading, aymmetrical shape.

INSECT PESTS AND FUNGOUS DISEASES.

Several insect pests and fungous diseases require the growers attention but their control has been fairly well worked out. The red spider, which is especially injurious in dry weather, may be checked by spraying with commercial lime - sulphur solution (1-70) or with sulphur dust. Scale infestation and white fly, with the sooty mold that follows, calls for the use of oil emulsion sprays, (1-70) in the dormant season, November to February. Avocado scab affecting both fruit and foliage and "black spot" affecting the fruit are the most serious fungous troubles to be guarded against. They are controlled by the use of Bordeaux mixture, (3-3-50) two or three applications usually being sufficient. The first application should follow very shortly after the blooming period is over or during the last of the bloom.

Avocado trees often become stunted, begin to die back, and the leaves commence to curl up and drop off. This condition, called by the growers "Die-back" or "leaf curl", is usually attributed to a fungous disease. The trouble is most common with trees on light dry land and in nearly all cases seems due to neglect rather than to the presence of any specific disease. When thoroughly mulched, watered, and fertilized with stable manure, or other fertilizer high in organic nitrogen, the sickly trees nearly always make a quick recovery. Where the trouble is due to unfavorable soil conditions, however, the recovery may not be permanent.

HARVESTING AND MARKETING.

The main harvest season extends from July to December, but when the very late Guatemalan varieties now being planted come into bearing the Florida avocado season will extend through most of the year. The fruit is picked when full grown and mature, but before it begins to soften on the tree. It is then carefully graded and sized. The soft and imperfect fruit is discarded or used locally, and only the firm, sound fruit shipped. Great care is taken in all these operations not to bruise or puncture the fruit as it has been found that such injuries are the cause of most of the decay in transit to market. When carefully picked, graded, packed and promptly shipped, avocados carry in excellent condition from Florida to the most distant markets in the United States.

By using printed wrappers, customers should be instructed in the use of avocados, and especially warned not to eat or serve the fruit until it is soft (not mushy) throughout. The attempt to eat an unripe avocado is not only disappointing but maybe so distressing as to discourage any further purchases of this excellent fruit. The grower or shipper should market only fully developed fruit in proper condition to complete the ripening process. The attempt to salvage windfalls and premature crops will only lead to disaster, both for grower and consumer.

The standard package for avocados in Florida is the tomato crate. Some growers wrap the fruit in tissue paper, and nearly all use cushions of excelsior between the fruits to prevent bruising. For the fancy trade, from two to four dozen fruits are packed to the crate. For long distance shipment in warm weather a special crate with a center compartment to hold ice is used with satisfactory results.

Cold storage for periods of a month to six weeks is possible with some varieties, as Trapp and Waldin, but the practice has not been developed in any large commercial way. It is usually adopted to meet some special demand.

CROPS, PRICES AND PROFITS.

Some varieties, including Trapp, tend to bear when very young and need careful thinning to prevent weakening the trees. No fruit should be allowed to mature the first year, nor during the second year, unless the trees are making a very vigorous growth. In the third season twenty or thirty fruits may be left to ripen on thrifty trees.

The yield of mature trees varies so greatly, depending on the variety, season, and skill used in caring for the grove, that no satisfactory yield averages can be given. Large seedling trees favorably located sometimes ripen several thousands of fruits in a single season, but such yields must not be taken as an average to be expected in commercial plantings. Some of the best cared for Florida groves average three, five, or even more crates to the tree annually, but the average for all groves, owing to the selection of unfavorable sites, or unprolific varieties, or to unskillful management and neglect, is very low. Many groves have been unprofitable, although the market demand for avocados is excellent and high prices have been received and good profits made by all growers who have secured good crops.

Prices netted by growers during the past five years have ranged from five to ten cents per fruit in midsummer to fifty cents, or even more, in the very late fall and winter months. One of the largest growers in Dade County has averaged for the season about $5. net a crate for Trapp, the average crate containing 36 fruits. The prices for the best Guatemalan fruit maturing in the winter months have largely exceeded this figure but the yields have often been disappointing.

There is little doubt that the avocado will eventually become an important and profitable crop in portions of Florida. Much still remains, however, to be learned about cultural methods and varieties, and until the industry has passed the experimental stage the prospective investor should proceed with caution. A thorough personal investigation of the groves in Dade County, and other localities where there are plantings, will be an invaluable aid in planning a grove.

For the home fruit garden the avocado is well adapted. Small variety collections should be planted out in protected localities in Florida with a view to having this valuable food available through a good part of the year. With the rapidly increasing population, especially in the winter, the local markets may well be as profitable as the distant centers of consumption.

Publications relating to the avocado, listed below should be consulted for more detailed information on pest control, and composition of fruit.

The Avocado: its insect enemies and how to combat them.
U. S. Department of Agriculture. Farmer's Bulletin. 1261
(free)

Red Spider on the Avocados.
U. S. Department of Agriculture Bulletin 1035. (10 cents)

Some changes in composition of California Avocados during growth. U. S. Department of Agriculture Bulletin 1073.
(5 cents)

Avocado Diseases.
Bulletin #161 of the Florida Agricultural Experiment Station.
Gainesville, Florida.

Remittances for publications desired should be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., by postal money order, express order or New York draft. If currency is sent it will be at senders' risk. Postage stamps and uncertified checks will not be accepted.

Publications listed as free may be secured by addressing the U. S. Department of Agriculture, Washington, D. C., except such as are published by State Experiment Stations.

U. S. Department of Agriculture,
Bureau of Plant Industry,
July 10, 1925.

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DIVERSIFICACION AGRICOLA

El grado de desarrollo y cultura de los pueblos se mide por el mayor o menor perfeccionamiento de su agricultura. Al principio, en su estado primitivo, los pueblos se manifiestan como nómadas, etapa en la cual esquilman, destruyen la flora y la fauna a su paso. Más tarde los pueblos descubren y cultivan las simientes, se asientan, colonizan y se forman comunidades agrícolas. Aún más tarde, en una etapa de mayor cultura, se transforman los productos agrícolas en productos elaborados que sirven para satisfacer las nuevas necesidades nacidas de la mayor cultura y ambición, y sirven como elementos de trueque con otros países, llegándose así al intercambio de bienes y servicios.

En la historia vemos las experiencias de muchos pueblos que se han estancado en su desarrollo agrícola. El estancamiento muchas veces obedece al monocultivismo, impuesto a su vez por razones de tradición social o de fuerzas económicas que imperan en el área en donde los excedentes de los productos agrícolas se mueven como artículos de intercambio. Pero como las formas y costumbres sociales están permanentemente en estado de fluidez y como el desarrollo económico es una función eminentemente dinámica, es muy necesario, para permanecer a la par de los requerimientos de la población, pensar en términos de una vigoroza, inteligente y bien planificada diversificación de la producción agrícola.

La diversificación no es nada nuevo en El Salvador, pueblo tradicionalmente agrícola, pero es posible que se nos olvide que ya hemos pasado algunas etapas de diversificación agrícola. Hasta mediados del siglo XIX nuestro mayor cultivo era el añil y no fué sino hasta después de 1850 que se empezó a sentir el efecto

de la introducción del café como cultivo nuevo, cuando, en la administración del Presidente Eugenio Aguilar se decretaron algunos privilegios para quienes lo sembraban, y luego cuando en el año 1861 bajo la administraci-ón del General Barrios se grava por primera vez su importación.
Es así como el naturalista alemán Dr. Wagner, en una visita a San Salvador en el año 1854 dice; "El Salvador talvez necesita un artículo de exportación más lucrativo, puesto que desde el punto de vista comercial, el añil no es tan ventajoso como por ejemplo el café, para el cual el clima y la tierra de Centro América parece particularmente apropiados, pero desafortunadamente su cultivo ha sido impedido por falta de confianza en el futuro de ese artículo". (3).

Algunas estadísticas (1) nos enseñan que en el año 1857 la exportación del añil fue de 1.117.500 libras con valor de $1.107.610.oo, no apareciendo el café como renglón de exportación. Pero ya en 1879 el valor añil se mantenía en $1.186.894 y el café acusaba en la exportación de 256.228 quintales con valor de $1.811.841.oo (2). Más o menos en la misma época se incrementaba la siembra de la caña de azúcar estimulada ésta por los precios especulativos causados por la nueva demanda de azúcar en el estado de California debida a la fiebre de oro.

Otro ejemplo de la acción gubernamental en la diversificación de cultivos, es una curiosa circular que hemos tenido la oportunidad de ver, dictada por el entonces Secretario del Tesoro norteamericano y fechada en el año 1827. En esta circular se dán instrucciones a todos los Cónsules norteamericanos en el mundo, de cómo deben recoger semillas y plantas de uso económico, ornamental ó industrial dando detalles minuciosos para su recolección, preservación, embalaje y transporte, ocupando para lo último los servicios de la Marina de Guerra, así como de la Marina Mercante.
Estas cifras son ejemplo de la diversificación agrícola inducida y estimulada por acciones gubernamentales o influencia de Gobierno.

Hay otras influencias nacidas de fuerzas económicas, sociales y políticas que influyen en la diversificación. Un ejemplo podría ser el ingreso del territorio de Hawaii y la isla de Puerto Rico al sistema político norteamericano. Es ésta la primera vez que se empieza a conocer y apreciar en ese mercado el valor de las frutas tropicales. Esto influyó grandemente en el establecimiento de los cultivos, ahora perfeccionados en el Hawaii, de; la piña, la caña de azúcar, la papaya, granadilla, macadamia y otros. Igualmente se estimuló el cultivo en Puerto Rico del cocotero, la papaya, la guayaba, el aguacate, el melón y otras frutas tropicales. Estas circunstancias que estimularon la introducción de ciertos productos tropicales al mercado norteamericano en tiempos pasados pueden ser aprovechados ahora por nosotros.

Sinembargo, no hay duda que el hombre, como individuo, es el que más influye en la diversificación agrícola; más aún que los movimientos económicos, políticos y sociales, más aún que las políticas de Gobierno. Tenemos el ejemplo de los grandes exploradores de plantas quienes son responsables de la introducción de cultivos de un contienente a otro, tales como; el tabaco, la soya, el trigo, ciertas gramíneas, el aguacate. Y aquí debemos hacer una cita de orden personal y que dará, estoy seguro, satisfacción a todo Amigo de la Tierra. Me refiero a la introducción del cultivo del aguacate a Norte América por esfuerzo personal de nuestro común amigo y socio honorario Dr. Wilson Popenoe. Fue en el año 1912 cuando en un viaje de exploración descubrió el Dr. Popenoe cerca de la ciudad de Atlisco, México, algunas variedades de aguacate. El tomó material de estas plantas, lo introdujo a California y esta industria hoy en día llega a una producción que supera anualmente las 100.000 toneladas.

También debemos citar los nombres de algunas personas que han contribuido grandemente a la introducción de plantas y diversificación de cultivos en El Salvador como son: Dr. Carl Renson, Químico; don Félix Choussy, Ingeniero

Agrónomo, General Lisandro Letona, militar; don José María Vides, agricultor; don Federico Bogan, don Fedor Deininger, Dr. Alfonso Quiñónez Molina, don Rafael Alvarez Lalinde; don Jaime Hill, don Winal Dalton, don Roberto Quiñónez Schlesinger y otros; algunos agricultores y políticos, otros comerciantes é industriales.

Hay otro tipo de diversificación que podemos citar, aunque realmente es una especialización, y es ésta, el uso de nuevas variedades dentro de un mismo cultivo. Ejemplo: el maíz híbrido que en El Salvador puede bien triplicar la cosecha de maíz. Lo mismo podría decirse del arroz y del frijol.

Debemos mencionar también la diversificación en el uso de la tierra. Así por ejemplo los algodonales de hoy en día eran los pastizales de antaño. Este cultivo se impulsó grandemente en el quinquenio 1920/25, fracasó entonces y volvió a resurgir a partir de 1940. Los cafetales de buena parte de la planicie de Santa Ana eran los cañales y moreras de otros años. Algunos de los cañales de los departamentos de San Salvador y Chalatenango eran las añileras del siglo pasado.

Podemos resumir entonces que alguna diversificación ya ha ocurrido en El Salvador. Pero también debemos reconocer que es urgente pensar en nuevas formas de usar la tierra a fin de mejorar su productividad y diversificar la economía agrícola. Nuestra situación de monocultivismo, café-algodón es peligrosa bajo varios aspectos; omito una discusión teórica/estadística sobre este tema puesto que es bien conocido de todos nosotros y doy por sentado que se reconoce así.

El Salvador como productor agrícola está dentro de cierta órbita o área de influencia dictada por su posición geográfica, razones de clima y de comunicaciones.

Hagamos ahora una recapitulación de las ventajas que esa situación nos brinda como productores para el mercado centroamericano, norteamericano y europeo.

Tenemos una posición geográfica privilegiada, con acceso a dos Océanos. En el Pacífico; uno de los mejores puertos en todo el Litoral, el Golfo de Fonseca. Por medio del Canal de Panamá tenemos acceso a todas partes del mundo, y estando ubicados en el corazón de las Américas nos cruza la carretera interamericana.

Tenemos un gran elemento humano, trabajador y eficiente con bastante experiencia en cultivos. Existe un núcleo de técnicos y prácticos que ya han hecho bastante trabajo experimental; gozamos de buen renombre y buen crédito en los mercados de consumo, y finalmente tenemos una gran ventaja cual es la nueva dimensión que ofrece en el panorama económico y social el Mercado Común Centroamericano. Esto nos coloca en nuevos ámbitos más amplios y debemos de movernos dentro de ese nuevo concepto de área. Es obvio que al hablar sobre la diversificación agrícola en El Salvador no podemos ignorar que debemos tomar en cuenta la posibilidad de diversificación en todo el área centroamericano.

Esto me lleva a considerar algunos cultivos sobre el cual se ha hecho alguna experimentación, otros sobre los cuales se conoce menos pero que han demostrado alguna promesa.

Los cítricos se adaptan muy bien en El Salvador. Falta comercializar su producción y pasar a la etapa de industrialización. Es muy factible pensar que corriendo el tiempo El Salvador y Centro América podrían ser lugar de producción de cítricos en gran escala para la exportación al mercado norteamericano. Es evidente que en el estado de Florida, California y Texas los costos de producción se están elevando tanto, así como el costo de la tierra por

efecto de urbanización e imposiciones fiscales, que no está remoto el día en que la producción de cítricos ya no será rentable en aquella economía. Además hay indicios de que los cambios climatológicos hacen más y más aleatorio el cultivo de plantas tropicales en esas áreas subtropicales.

La piña ya se está cultivando en forma semi-comercial en El Salvador teniendo las mismas posibilidades de éxito que los que he apuntado para los cítricos. Los melones ya han salido de la etapa de consumo interno y el año pasado se han hecho exportaciones a escala comercial las que se repetirán este año con mayor intensidad.

Tengo entendido que algunos cultivadores este año se dedicarán también al cultivo de verduras en escala comercial a base de mecanización, destinando su producción mayormente para la exportación a Norte América.

En materia de fibras el henequén no ha podido mantenerse y parece ser que pueda ser superado por el Kenaf cultivo que ya ha sido probado y es de fácil incremento e industrialización.

Como frutas exóticas ya sea para consumo directo, ya sea industrializadas para la fabricación de jaleas, saborantes y dulces, debemos citar; el mango, la granadilla hawaiana, la papaya, y la guayaba, ya que tienen mercado en Norte América y Europa. Estos podrían exportarse en forma de concentrados ya sea congelados, desecados o pasteurizados, a granel, para ser ocupados en los mercados de consumo por las grandes plantas enlatadoras, quienes a base de esta materia prima fabrican las bebidas y condimentos llamados "tropicales".

Es curioso observar que Centro América importa el equivalente de ₡1.000.000.oo de productos de tomate cada año, situación que bien podría invertirse pudiendo ser Centro América la exportadora de estos productos.

En Centro América hay un sector de gran extensión que apenas se ha explotado para cultivos aunque se está ocupando en algunos casos como pastizales en la época de lluvia. Esta es la región llamada de altura la que podríamos señalar como la región que supera los 1.500 metros de elevación sobre el mar y que por consiguiente goza de un clima templado. Por ejemplo en El Salvador según datos de la Dirección General de Cartografía hay entre las elevaciones 1.500 a 2.000 metros aproximadamente 29.000 hectáreas y entre los 2.000 y 2.500 metros aproximadamente 11.000 hectáreas, lo cual dá un total de tierras sobre los 1.500 metros de aproximadamente 40.000 hectáreas. En estas áreas, habida cuenta de las condiciones ecológicas pueden cultivarse frutas como la fresa, la zarzamora, la ciruela, la manzana, el durazno, el capulí (Prunus Saliciliana), la pera, y sobre las cuales ya tenemos alguna experiencia, por cierto favorable. Falta aún que hacer algún trabajo de introducción de especies y variedades para encontrar las condiciones óptimas para la producción comercial.

Tenemos ya alguna experiencia en el cultivo del Aceituno, Palma Africana, la granadilla hawaiana (Pasiflora), del higo, sapote, mamey, caimito, cardamomo, mango, jaboticaba, así como las nueces macadamia, pili, lichi. Todos estos cultivos prometen y pueden elevarse al nivel comercial.

EXPOSICION DE TRANSPARENCIA

Deliberadamente he dejado por último la consideración talvez más importante en un programa de diversificación, aunque no es propiamente un tema agrícola sino que cabe dentro del campo de estudios económicos. Es éste el elemento mercadeo y transporte. Esto implica un estudio completo de las condiciones imperantes en cada mercado de las condiciones de transporte, de las circunstancias estacionales, de los hábitos de consumo, de las costumbres, regulaciones y leyes abarcando calidad, empaque, etiquetado y aún las condiciones crediti-

cias de cada mercado. Creo que en este Auditorium habrán personas que ya han adquirido experiencia en la introducción de productos agrícolas nuevos a mercados nuevos y espero que ellos intervendrán a continuación dándonos el beneficio de sus experiencias.

Termino esta charla con la sugerencia de que los Clubs 4-C conjuntamente con Amigos de la Tierra se presenten ante las autoridades competentes pidiendo que se lleve a cabo un estudio minucioso en los mercados de consumo de los productos agrícolas que podríamos producir y servir para la exportación. Esta sería la base de nuestra diversificación y serviría no sólo como estímulo para nuestros agricultores sino que ayudaría a diversificar la dieta, crearía mayores fuentes de trabajo, y en general contribuiría al bienestar de los habitantes de El Salvador.

Francisco de Sola

1) Squier "Centro América". 1858.

2) Apuntamientos sobre la topografía física de la República de El Salvador. David J. Guzmán. 1883.

3) Travels in the Free States of Central America by Dr. Carl Scherzer. 1857.

Florida Agricultural Experiment Stations
Sub-Tropical Experiment Station
Homestead, Florida

BANANA ROOT BORER AND ITS CONTROL IN FLORIDA

By

D. O. Wolfenbarger

Banana root borers or tunnels, totals, on dates examined in each treatment.

Examination Date	Treatment Materials: Aldrin 2E	Dieldrin 1.5E	Heptachlor 2E	Dieldrin 10G	Heptachlor 10G	Check
1960, Oct.	0	0	0	0	Old tunnels	55 larvae Old tunnels
1961, May	0	1 tunnel	0	3 tunnels	0	22 larvae 46 tunnels
1962, April	0	3 tunnels	2 tunnels	5 tunnels	12 tunnels	1 adult 2 larvae 34 tunnels
1963, January	0	0	0	3 tunnels	2 tunnels	2 larvae 18 tunnels
1964, May	0	0	0	0	2 tunnels	2 larvae 37 tunnels
TOTAL	0	4 tunnels	2 tunnels	11 tunnels	16 tunnels	1 adult 82 larvae 135 tunnels

MANEJO DE LA CERDA DURANTE LA GESTACION Y LACTACION

Por: Dr. Clive Woodham
Médico Veterinario de La ODA
Inglaterra

La industria de la producción porcina está muy avanzada en Inglaterra, en ésta charla hablaré sobre una experiencia obtenida con las reproductoras.

Las razas más populares y apreciadas en Gran Bretaña son:

I. Wesh. - Tipo blanco y corto
II. Berkshire. - Color negro con blanco
III. Essex. - Color negro con blanco
IV. Hybrid. - Cruces entre Welsh, Landrace y Essex de gran valor genético.

Nosotros lo que buscamos es que el cerdo produzca carne de buena calidad con poca cantidad de grasa, sin embargo, en la mayor parte de los países centroamericanos aún buscan el cerdo tipo grasa.

En general el tipo de cerdo en Inglaterra tiene patas cortas, bajo porcentaje de grasa y poseen grandes jamones, las madres son proliferas producen de 11 a 12 lechones por camada y poseen suficiente cantidad de leche durante toda la lactación (6 a 8 semanas).

I. Manejo.

A. Selección de Marranas primerizas.

Es necesario e importante seleccionar las futuras reproductoras cuando ellas tienen entre 3 a 4 meses de edad; Debemos basarnos en lo siguiente:

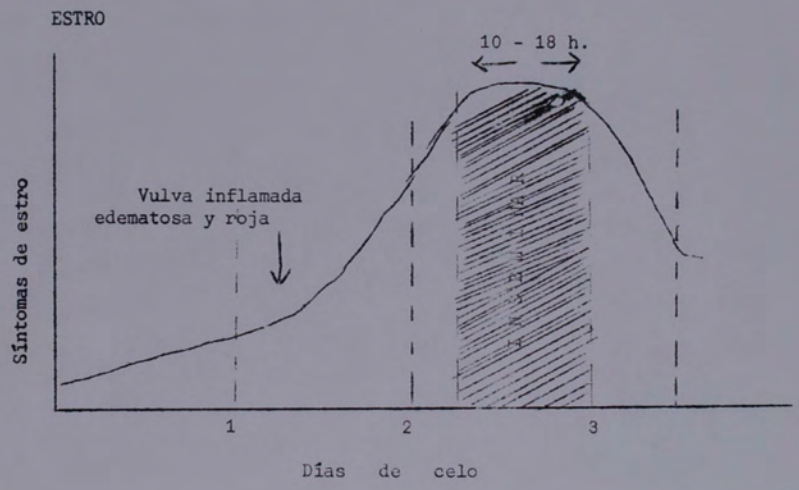
1. Buena conformación
2. Sin defectos hereditarios
   (a) hernias
   (b) mal formación de las tetas
   (c) defectos locomotores
3. Que procedan de buenas madres y de camadas que al destete promedien buen peso y sean numerosas y que no registren problemas de:

(a) Agalactia
(b) Mastitis
(c) Otras infecciones

B. Servicio de la marrana.

Las futuras reproductoras deben de entrar en servicio desde los 8 meses de edad, con un verraco jóven y de poco peso ó con la inseminación artificial, la experiencia nos ha enseñado que hembras servidas con menos de 8 meses, pierden mucho peso muscular durante su primera lactancia y no logran nunca ser buenas reproductoras, quedando en malas condiciones y salud durante su vida.

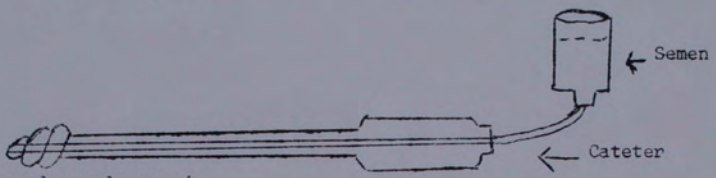
Cuando se usa la inseminación artificial debemos hacerlo con sumo cuidado, ya que el éxito depende en mucho del rol del Técnico inseminador y del momento oportuno de la inseminación (ver cuadro No. 1)



Reconocimiento de celo y tiempo para inseminar.

I. Acepta ser cubierta
2. Miembros posteriores rigidos
3. Vulva menos inflamada
4. Flujo mucuoso claro

Se emplean más o menos de 40 a 50 mls. de semen diluido, se emplea un cateter de goma con la extremidad de forma espiral.
(Ver cuadro No. 2)



colocarlo en la cervix

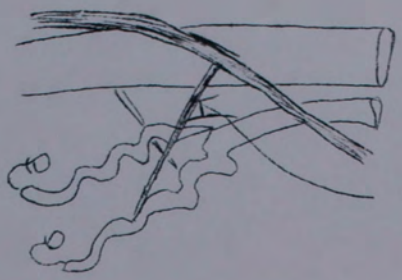
El diluyente que usamos en el Salvador es agua de coco con minerales y huevo. El semen diluido puede vivir en temperatura ambiente durante 8 días.
Para inseminar correcto una cerda se necesita de 20 minutos para inyectar todo el semen dentro del útero.

C. Diagnóstico de preñez en la cerda gestante.
Existe más dificultades que en la vaca debido a la estrechez del recto.

1, Puede ser hecho.

a). Palpación recto-vaginal. Solo es posible con manos pequeñas, las cerdas cargadas presentan en su arteria uterina media:

(1) Aumento en su diámetro
(2) Cambio en el curso
(3) Cambio en las pulsaciones que se tornan más rápidas y fuertes
(ver cuadro No. 3)



2. Biopsia: Se toma un pedacito de epitelio vaginal con instrumentos especiales, luego se fijan con formalina al 10%, alcohol absoluto y parafina, con el micrótomo se hacen cortes histológicos y se colorean con Hematosilina-Eosina, luego estas láminas coloreadas son examinadas a través del microscópio.
   a) Estro 16 filas de celulas escamosas
   b) Diestro 10 filas de celulas escamosas
   c) Preñada 2 filas de celulas cuadradas

3. Pruebas químicas: se buscan niveles de hormonas en la orina del animal estas pruebas son muy académicas.

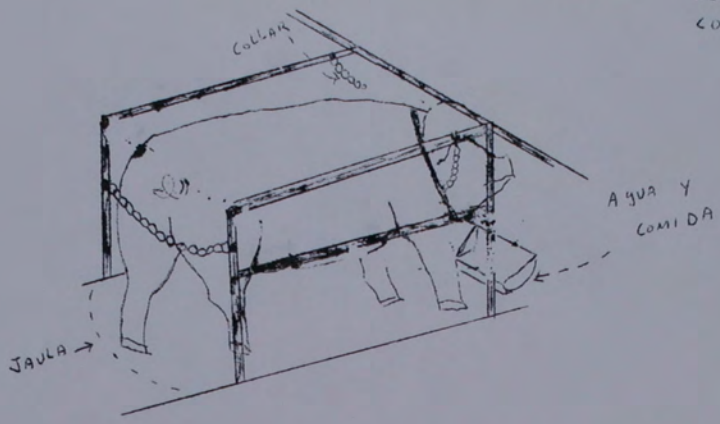
II. Alojamiento e instalaciones para cerdas.

A. Las futuras reproductoras deben vivir en pastoreo hasta su primer parto, con el fin de prevenir las infestaciones con parasitos, es necesario cambiar de potreros cada 6 semanas.

B. Los pastos y la tierra aumentaran los niveles de vitaminas y minerales de la ración.

C. En los lugares donde hay falta de tierras (Inglaterra) las reproductoras deben vivir en corrales de concreto y durante la gestación quedan en jaulas individuales sujetas con collares de metal Stal.
(ver cuadro No. 4)

STALL : JAULAS CON COLLARES



En Inglaterra hay granjas con más de mil reproductoras en "Stall"

D. Las reproductoras deben ser llevadas a las parideras 4 a 5 días antes del parto.
   (1) Para acostumbrar a la cerda en la jaula y piso.
   (2) Estará menos nerviosa durante las horas del parto.
   (3) Bajará la leche calostral, dandoles inmunidad a los cerditos contra las (E. Coli, Salmonella) enfermedades.

E. Debemos proteger a los cerditos del frío, poniendoles lámparas de rayos infrarojos para la prevención de hipotermia y también contra el aplastamiento poniendoles protectores.

III. Tipos de pisos en la sala de parto.

a) Concreto: fácil de lavar con antisépticos.
b) Colocho: (viruta de madera) económico.
c) Heno: (paja seca)
d) Arena: Excelente en los países tropicales fácil de limpiar y bueno para prevenir el "Stress" por el calor.

IV. Parto.

a) Es muy importante la asistencia a la cerda durante el parto, para limpiar a la cría, cortar el umbligo y los dientes.

b) Se debe llamar al Médico Veterinario cuando hay problemas en el parto, sobre todo cuando después de 1/2 hora de contracciones la cerda no logra parir, si no hay Veterinario se debe introducir la mano bien limpia y con antiséptico y tratar de hacer la corrección del lechón dentro del útero.

c) Terapéutica. La oxitocina (P.O.P.) es muy útil para estimular las contracciones del útero, cuando hay inercia uterina cansada por un parto distócico.

d) Después del parto debemos examinar a la cerda cada 8 horas con el fin de evitar:

(1) Mastitis
(2) Metritis
(3) Agalactia

e) Estas enfermedades son muy comunes en países tropicales y se debe de tratar durante 3 días con:

(1) Terramicina
(2) Cortisona
(3) Oxitocina

f) Durante el parto es muy común el estreñimiento se deben de usar laxantes para evitarlos, tales como:

(1) Parafina líquida
(2) Miel de purga.

V. Alimentación de la cerda durante la Gestación y Lactación.

(ver cuadro No. 5)

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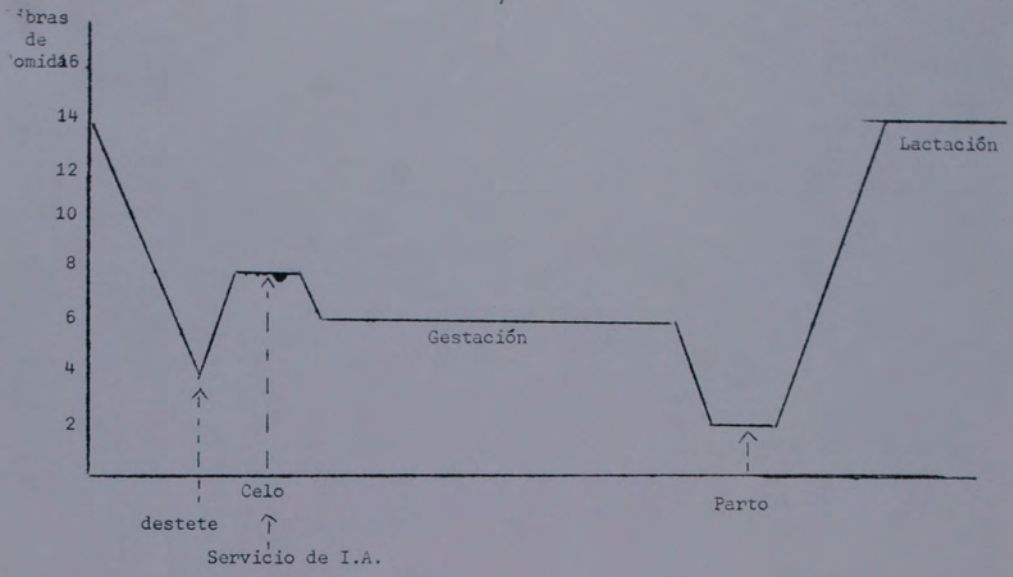


a) Para secar la cerda después del destete se debe dar menos comida (4 lbs. diarias).

b) Para aumentar el número de ovulos darle más comida durante el celo (8 lbs. diarias)

c) Para mantenerse durante la gestación darle 6 libras diaras.

d) Dos días antes del parto y un día después se reduce la comida a 2 libras y se le administra laxantes en el pienzo.

e) Durante la lactación se le debe dar a la cerda 4 libras para ella y una por cada cerdito, así tenemos que una cerda con 12 lechone necesita 16 libras de alimento.

f) Se debe administrar agua todo el tiempo.

g) La cerda debe recibir un buen concentrado que contenga 16% de proteína de preferencia de origen animal, tales como harina de carne, pescado, también debemos darle frijol soya, maíz, minerales y vitaminas.

VI. Alimentación de los lechones.

a) A los 3 días de nacidos se debe de inyectar hierro a los lechones. (200 mgrs-Intramuscular en el miembro posterior)

b) A los 8 - 10 días se le administra concentrado (pre-iniciación) con 60% de leche en polvo y colocar los comederos al abrigo de la cerda.

c) El destete se debe hacer entre 6 - 8 semanas dependiente del peso se prefiere cuando el lechón pesa más o menos 40 libras. El día del destete los lechones recibiran menos comida, se le debe dar antibióticos y laxantes.

VII. Parásitos.

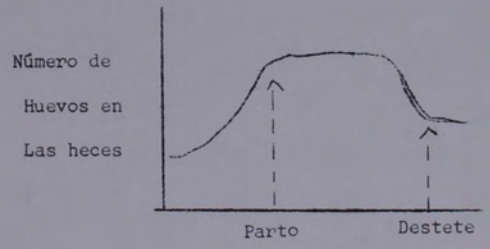
Los parásitos más importantes en la cerda son:

a) Ascaris lumbricoides var. suis.

b) Hyostrongylus Rubidus

c) Oesophagostomun Dentatus

El tiempo para desparasitar es de 2 semanas antes del parto y 2 semanas después del destete, el nivel o tasa de huevos producidos por los parasitos aumenta después del parto, entonces hay mucha más oportunidad de infectar los lechones con huevos de parásitos (ver cuadro No. 6)



En mi opinión el mejor producto para controlar los parásitos son:

1. Tetramisole (Ripercol L) Ascaris, Hyostrongylus y Oesophagostomun
2. Atgard: Shell
3. Citrato de piperazina . Ascaris.

Los lechones se deben desparasitar 2 semanas después del destete.

CW/gdet.

Junio de 1972

HP - ?

[1967]

PROPOSAL FOR

A FINE ARTS CENTER FOR TROPICAL CULTURES

AT THE UNIVERSITY OF FLORIDA

Recognizing the University of Florida's unique position as an institution making significant contributions in the various areas of Latin American Studies, a new and vital opportunity in the Fine Arts suggests itself. This opportunity exists for the development of a Fine Arts Center for Tropical Cultures structured within the College of Architecture and Fine Arts.

The need for such a Center should be obvious, but the fact that the fine arts provide the most direct access to unfamiliar or alien cultures is many times overlooked by academic planners who tend to think first of the more orthodox studies and curricula. The University of Florida, in establishing the art center suggested here, could be taking a bold and major step toward becoming a great University.

No significant center of this nature and scope exists within the present academic communities of the United States and, because of Florida's geographical and historical relationships to the Caribbean and Latin American areas, such a center is a logical evolution of the University's interests and programs. Through its established LATIN AMERICAN STUDIES CENTER, its CENTER FOR TROPICAL AGRICULTURE and its annual CONFERENCE ON THE CARIBBEAN the University, over a period of time, has proven its competency and intent in many diverse and related disciplines. These disciplines provide the logical platform for projecting and complementing a Fine Arts Center for Tropical Cultures.

The possibility of creating such a Center lies with the fact that various activities of Federal sponsored agencies (the National Foundation in Arts and Humanities Act and the programs of the office of Health, Education and

Welfare) and private foundations are now available for funding unique programs in the Humanities and the Arts. Their support can be especially substantial when funds from the state level are made available for new facilities and programs. Say for example that the scheduled Art Department building, in the Fine Arts Complex of the College of Architecture and Fine Arts, could be identified as a state commitment and this, along with a planned program for the Fine Arts Center for Tropical Cultures, be submitted to these Federal Agencies, it would not be at all unrealistic to think that this commitment by the State could be doubled or even possibly tripled by additional Federal monies. To qualify, however, the submitted program must be unique and strongly supported by the University on all levels.

The program for a Fine Arts Center for Tropical Cultures must be formed around a sound philosophical orientation and basic to its conception would be the equally important planning of the physical plant which would facilitate the implementation of such a program. The Center's physical plant should also be carefully planned not only to house the various activities of the Center but should be constructed to complement the already existant and expanding Fine Arts Complex of the University.

To assure a homogenous success for the Center, all areas and departments of the College should be involved, and called upon from the very beginning to plan the programs which would be significant not only to the Center, but to their own growth. The Department of Architecture, the Department of Building Construction, the Department of Art, the Department of Music, the College Library and the University Gallery would be the chief participants in planning the Center.

To give some idea of the possible scope of such a Center's program, it seems appropriate to project briefly some of the activities which might be pursued. For example, a program could be conceived which would be organized between the University of Florida's Art and Architecture Departments in conjunction with an Academy of Art and Architecture in, say, Sao Paulo, Brazil. This program

would arrange for a number of University of Florida's art and/or architecture students and several of their professors to spend an academic period attached to the Brazilian institution. In exchange an equal number of Brazilian students and faculty could be brought to the Gainesville campus. Similar programs in music, drama and dance could be undertaken with the additional related activity of exchanging performing groups between North and South America. The Music building, presently being planned for the Architecture and Fine Arts Complex, provides an immediate opportunity to consider new programs in music and music education.

The additional possibility of exchanging distinguished Latin American artists, architects, musicians and scholars with those on the University of Florida campus has unlimited merit and this would be true not only for the University but for the state and the whole nation. To maintain this aspect of the program, chairs for distinguished scholars and artists should be established. The impact, for example, created by the presence of an artist of the stature of Hector Villa Lobos in our midst can easily be imagined.

One of the major aspects of the Fine Arts Center would be the creation of a new art museum planned to complement and serve as the major physical focus of the Center. Its collections would emphasize the arts of Latin America and especially the area of Spanish Colonial Art. This museum would not only serve the University and the State, but it could become internationally unique and attract scholars, art oriented specialists and interested laymen from all over the world.

Specifically, the museum's Latin American emphasis should be strong in four distinct areas.

(1) Spanish Colonial Baroque Art should be the first and most important area. This historic period, with few exceptions, is not represented outside of Latin America by a major, significant collection. As a continuation of the late European Renaissance tradition in America, this art is an important study area and is significant not only for art historians of the Americas but for scholars of the

European Baroque.

(2) The second area of Latin American art which would form an appropriate satellite to the Baroque collection should be composed of a collection of contemporary paintings, sculptures and prints by 20th century Latin American artists. Again we are proposing a collection which would be unique in North America and would add to the understanding of the continuing art tradition in Latin America (one U. S. museum recently acquired twenty canvases by modern South American artists and this was hailed as a first in North America!).

(3) The third area of art in the Latin American collections would be a strong cross section of pre-Columbian and folk art of the Americas. Pre-Columbian art is well known and represented in numerous collections and museums in America and abroad, but as an adjunct to the Center's collection of Latin American art, it would be a necessity. Since fine objects from this area of art history are being daily excavated, there is no reason why this collection could not also become a major one. This could be accomplished through careful purchase and the attraction of private collectors who would feel secure in donating their collections to such a center. Many private collections with various art orientations exist in Florida and several collectors have already approached the University Gallery inquiring when a museum facility might become a reality for receiving gifts.

(4) The forth aspect suggested for the Center's museum would be an architectural collection. This, again, would be basically oriented to the Latin American area and would attempt a unique collection of not only historical documents and plans but actual examples of construction and other components of building design. Possible elements of this collection would be the acquisition of sections of antiquated buildings such as carved doors and even sculptured facades of churches. Certain areas in the museum's collections of plans and documents associated with architecture would complement and overlap the Center's library program which is another area that can easily be envisioned but can only be

referred to here in passing.

In outlining this nucleus collection of Latin American art for the museum, it is not proposed that other areas of art history, both ancient and contemporary, should be neglected. Indeed, outstanding items of art from all periods and all cultures should ultimately be represented in the museum's holdings. Since the Center would be called a Fine Arts Center for Tropical Cultures, it is not too soon to further recommend that a secondary collection be planned around an oriental art collection with an emphasis on the art of Africa and Asia. This suggestion is prompted by several factors. One of these factors is that the University of Florida, which is already oriented to Latin America, has started expanding its interests and studies to other international areas and, since this activity will increasingly be involved with Asia and Africa, it is possible that Florida could eventually also become the outstanding center for these tropical studies in the United States. At present, in the Southeastern part of the nation, there is no major collection of African or Oriental art either in a university or municipal museum. The fact might be mentioned here that one of the leading collectors of Indian art, in the United States, recently gave the University Gallery a $3,000.00 collection of miniature paintings and small sculptures from India.

In closing it should be noted that the recently established Center for International Graduate Studies on the campus of the University of Florida greatly underlines the value and contribution that a Fine Arts Center for Tropical Cultures might make to the University's total program. In fact, these two centers could uniquely complement one another in adding unending dimensions to the University's contributions to knowledge.

It is already evident that Florida is moving into a position of prominence as one of the major areas in the United States. Since this condition is activated, it is imperative that further plans for the intellectual and cultural growth of the State be put into action immediately. The University of Florida's

centers for medicine and engineering are presently developed and are justly renowned. The new Florida State Museum will bring to the campus one of the nation's outstanding natural science and anthropological museums and its presence automatically demands that it be complemented by an equally outstanding museum of art. A Fine Arts Center, such as outlined here, could become one of our major sources for aesthetic and cultural growth, but it must start taking form now; tomorrow will be too late.

PROYECTO
DEL
INSTITUTO DE EDUCACION AGRICOLA
DE
GUALACA

El interés del Gobierno Revolucionario por lograr un desarrollo agropecuario dinámico se ve seriamente obstaculizado por la evidente falta del elemento humano capacitado. Este déficit humano no sólo se refiere a la escaza cantidad de bachilleres agropecuarios que preparan los planteles educativos dedicados a tales fines, sino que también se refiere a la ausencia total de centros formativos de profesionales de las llamadas Carreras Intermedias que estan ubicados entre el bachiller agropecuario y el ingeniero agrónomo egresado de la Universidad de Panamá.

Es con miras a la solución de dichos problemas que se recomienda la creación del Instituto de Educación Agrícola de Gualaca bajo el patrocinio del Ministerio de Educación y la Universidad de Panamá.

OBJETIVOS

1. Ampliar y ubicar las facilidades mejores para los estudios del Bachiller Agropecuario que actualmente se ofrece en el Colegio Félix Olivares de David.
2. Establecer la carrera intermedia en ciencias agrícolas a nivel universitario.

3. Establecer una estación experimental de la Facultad de Agronomía.

4. Lograr la continuidad educativa del presente programa de Patos y Forrajes de la F.A.O., para que puedan llegar los beneficios económicos-culturales a todo el país.

ojo!

5. Contribuir en forma directa a la solución de los problemas que limitan el desarrollo agropecuario del país.

El Instituto ofrecerá el segundo ciclo agropecuario que actualmente se imparte en el Colegio Félix Olivares, pero en condiciones pedagógicas mas adecuadas. De esta manera no sólo permitirá aumentar el número de alumnos de dicho ciclo hasta tener una matrícula de 300 alumnos o más (actualmente la matrícula del Félix Olivares es de 158). sino que al existir ya las instalaciones básicas para la práctica agrícola, se podrá garantizar la adquisición de las destrezas y técnicas que no son posible impartir a los estudiantes en su ubicación actual.

Como es natural, la responsabilidad del funcionamiento de esta fase del Instituto deberá recaer en el Ministerio de Educación.

Al mismo tiempo, y para dar satisfacción a la necesidad cada vez mas sentida de profesionales de las carreras intermedias en las ciencias agrícolas, la Facultad de Agronomía de la Universidad de Panamá organizará y pondrá en funcionamiento, a partir del año académico de 1972, un programa de estudio de dos años de duración para

la preparación de Agrónomos. El programa de estudio será de nivel universitario y la Universidad reconocerá el título que se obtenga al cumplirse con los requisitos del mismo.

Esta carrera intermedia tiene los siguientes propósitos:

a. Permitir la superación profesional a bachilleres que por razones económicas o de otra índole no pueden graduarse de Ingenieros Agrónomos y de esta manera tienen la posibilidad de continuar una carrera a nivel universitario dentro de sus posibilidades;

b. Formar a profesionales tanto en la rama de fitotecnia como de zootecnia dentro de un proceso mas acelerado que aquel que permite la carrera de Ingeniero Agrónomo, y;

c. Preparar a técnicos agrícolas a nivel universitario con una formación eminentemente práctica.

El plan de estudio será diseñado en forma tal que las materias aprobadas serán reconocidas dentro del plan de estudio para la carrera de Ingeniero Agrónomo.

Como quiera que los estudios de esta carrera intermedia son a nivel universitario, la Facultad de Agronomía deberá operar en Gualaca una Estación Experimental que tenga como objeto:

a. Preparación de material didáctico para los cursos de Agrónomos;

b. Proyección en el ambiente rural de la Facultad de Agronomía

y del plan de estudio que habrá de impartir en el Instituto de Educación Agrícola de Gualaca y;

c. Investigación de los problemas agrícolas que afecten el desarrollo agropecuario en la región.

FUNCIONAMIENTO

El Instituto se regirá por una Junta Directiva compuesta por

1º el Ministro de Educación o su representante quien lo preside,

2º el Decano de la Facultad de Agronomía o su representante,

3º el Ministro de Agricultura y Ganadería o su representante,

4º el Director General del IFARHU o su representante,

5º el Director del Instituto de Educación Agrícola de Gualaca quien actuará como Secretario de la Junta,

6º un Profesor,

7º un Estudiante.

Los cinco primeros miembros durarán en sus funciones mientras permanezcan en sus respectivos cargos. El representante de los profesores será escogido por los profesores y durará en sus funciones dos años. El representante estudiantil durará un año en sus funciones y deberá haber cursado la mitad del plan de estudios en el cual se ha matriculado y tener un promedio de 4 o más. Los años pares será representante un estudiante del bachillerato y los impares un alumno de la carrera de Agrónomo.

ATRIBUCIONES DE LA JUNTA DIRECTIVA:

Son atribuciones de la Junta Directiva las siguientes:

I. Dirigir la política educativa y de producción del Instituto.

2. Aprobar el presupuesto anual del Instituto y someterlo a consideración de las autoridades superiores

3. Velar por el patrimonio del Instituto.

ORGANIZACION:

El Instituto será dirigido por la Junta Directiva y administrado por un Director quien deberá ser un profesor de la Facultad de Agronomía que ésta asigne para tales fines.

Las funciones del Director serán las siguientes:

a.- Ejecutar los acuerdos y disposiciones de la Junta Directiva;

b.- Supervisar las labores del Sub-Director del Bachillerato Agropecuario y de los Jefes de Departamento;

c.- Preparar el Proyecto de Presupuesto anual para la consideración de la Junta Directiva;

d.- Dirigir los consejos de profesores;

e.- Representar al Instituto en todos los eventos que participe oficialmente;

f.- Participar en las reuniones de la Junta de Facultad de la Facultad de Agronomía;

g.- Dirigir la carrera de Agrónomo;

h.- Organizar con los Jefes de Departamentos el calendario anual de actividades al igual que el horario de clases;

i.- Las demás funciones que la Junta Directiva le asigne.

El programa de estudio de bachillerato agropecuario será dirigido por un Sub-Director quien deberá ser un profesional universitario en ciencias agrícolas en educación vocacional y con por lo menos 3 años de experiencia docente con las siguientes funciones:

a.- Supervisar los planes de estudios de su respectiva escuela;

b.- Organizar con los Jefes de Departamento el calendario anual de actividades al igual que el horario de clases;

c.- Las demás funciones que el Director del Instituto le asigne.

CONSEJO DE PROFESORES

El Consejo de Profesores del Instituto de Educación Agrícola de Gualaca estará formado por el Director, el Sub-Director el Secretario y los profesores del Instituto; además del representante de los alumnos y el representante de los padres de familia cuando lo requiera el Consejo.

El Consejo tratará todos los asuntos de índole académico y deberá someter sus recomendaciones académicas a la aprobación de la Junta de Facultad de la Facultad de Agronomía.

El Secretario Administrativo depende directamente de la

y tendrá a su cargo los asuntos administrativos del plantel y la secretaría del Consejo de Profesores.

DEPARTAMENTOS

Los Departamentos son las unidades académicas mínimas. Al momento de la creación del Instituto, se crearán los siguientes Departamentos: (a) Producción, (b) Investigación, (c) Extensión (d) Ingeniería Agrícola y (e) Servicios Estudiantiles.

PROFESORADO

El personal docente del Instituto será nombrado por la Universidad de Panamá de común acuerdo con el Ministerio de Educación y a través de los canales establecidos en su Facultad de Agronomía.

PRESUPUESTO

Para el cumplimiento de sus funciones docentes y administrativas el Instituto contará con un presupuesto anual, que le será asignado conjuntamente por el Ministerio de Educación y la Universidad de Panamá. El Ministerio de Educación asignará una partida global en su presupuesto anual de rentas y gastos para sufragar los costos del bachillerato agropecuario que imparte el Instituto, y la Universidad cubrirá los gastos de la carrera de Agrónomo. Ambos fondos serán administrados a través del mecanismo administrativo operante en la Universidad de Panamá.

a) Costo de Instalación y equipo. Según el desgloce que se incluye como anexo, se requerirán un total de 7.050 m^2 de laboratorios, salón de clases, dormitorios y otros servicios. Estas instalaciones son comunes tanto para el bachillerato como para la carrera intermedia. Solamente se requieren dos instalaciones de campo (Lechería y Avicultura) para completar la infraestructura educativa existente en Gualaca.

El costo de las construcciones docentes se ha estimado en B/.878.400.00

El costo del equipo para estas instalaciones se ha estimado en B/.259.000.00

Total 1.137.400.00

b) Costo de Operación. Para sufragar los costos de operación tanto del Bachillerato como de la carrera intermedia de Agrónomo, asi como los gastos administrativos del Instituto se requerirá un presupuesto anual de B/.425.000.00.

Por otra parte es preciso señalar que el costo del internado de los estudiantes que incluye alimentación, alojamiento, lavandería y servicios diversos se debe de calcular sobre la base de B/.50.00 mensuales y por 11 meses al año, lo que representa B/.550.00 por año/alumno.

Plan de Estudio

Como anexo también se han incluido los proyectos de estudio

del Bachillerato Agropecuario y de la carrera intermedia con orientación en fitotecnia y en zootecnia

En el caso de estos dos últimos se incluyen a título de ejemplo pues los mismos deben ser sometidos a una revisión mas minuciosa de manera de lograr una mayor armonía con el plan de estudio de la carrera de Ingeniero Agrónomo de la Facultad de Agronomía.

P R O Y E C T O

DE

PLAN DE ESTUDIO

INSTITUTO DE EDUCACION AGRICOLA

DE

GUALACA

CARRERA INTERMEDIA

(ZOOTECNIA)

Matemáticas (Alg. y Geom. Anal.)
Botánica de Forrajes
Química Orgnánica
Física
Fisicología Animal
Economía Agrícola
Fisiología Reproducción
Bovinos de Leche
Agrimensura
Mejoramiento del Ganado
Fertilizantes
Sociología Rural
Bromatología
Avicultura
Conservación de Suelos

Genética
Bioquímica
Entomología General
Anatomía Animal
Zootecnia General
Edafología
Administración Rural
Parasitología
Bovinos de Carne
Nutrición Animal
Maquinaria Agrícola
Porcinotecnia
Industrias Lácteas
Extensión Agrícola
Mercadeo de Prod.

INSTITUTO DE EDUCACION AGRICOLA
DE
GUALACA

REQUISITOS DE INSTALACIONES Y EQUIPO

	M^2	Construcción	Equipo
Lab. de Química. (B/.135.00 m^2)	80	10.800.-	15.000.-
Lab. de Biología y Zoología	80	10.800.-	15.000.-
Lab. de Física	80	10.800.-	10.000.-
Lab. de Botánica y Entomología	80	10.800.-	10.000.-
Lab. de Zootecnia y Veterinaria	80	10.800.-	10.000.-
Lab. de Suelos	80	10.800.-	15.000.-
Lab. de Fitotecnia y Granos	80	10.800.-	10.000.-
Lab. de Tecnología de Alimentos	120	16.200.-	50.000.-
Lab. de Ingeniería Agrícola	80	10.800.-	10.000.-
Lab. de Fitopatología	80	10.800.-	10.000.-
Salón de clases (2 de 80 m^2 c/u; 4 de 50 m^2 c/u.	360	36.000.-	5.000.-
Salón de Proyecciones-Auditorio	300	45.000.-	10.000.-
Salón de Profesores	80	8.000.-	2.000.-
Biblioteca	120	12.000.-	5.000.-
Oficinas	240	24.000.-	5.000.-
Enfermería	80	8.000.-	2.000.-
Dormitorio (B/.120.00/m^2 para 600 alumnos)	4200	360.000.-	50.000.-
Lavandería	100	12.000.-	20.000.-
Comedor, Cocina y Salón de Estudios con equipo de cocina y mobiliario para 160 a la vez según plano de Divisa	580	90.000.-	- - -
Salón de recreo	150	150.000.-	5.000.-
Lechería - Instalaciones, equipo y semoviente		5.000.-	
Planta Avícola " " "		15.000.-	
	7050	878.400.-	259.000.-