# PROCEEDINGS

# OF THE

# CARIBBEAN FOOD CROPS SOCIETY

## EIGHTH ANNUAL MEETING
## SANTO DOMINGO
## DOMINICAN REPUBLIC

## 1970

## VOLUME VIII

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# CARIBBEAN FOOD CROPS SOCIETY

## OFFICERS 1969-70

| | | |
|---|---|---|
| President | Pedro E. Morales | Dominican Republic |
| Vice-president | Jack Waud | Dominican Republic |
| Secretary-Treasurer | George Samuels | Puerto Rico |
| ıard of Directors | | |
| Chai.man | F. Gabriel | Martinique |
| Member | F. Aponte | Dominican Republic |
| Member | L.A. Cross | Trinidad |
| Member | F. del Prado | Surinam |
| Member | E.G.B. Gooding | Barbados |
| Member | A.G. Naylor | Jamaica |
| Member | A. Sotomayor | Puerto Rico |
| Member | J. Spence | Trinidad |

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## MINUTES OF THE BUSINESS SESSION
August 29, 1970

The Business Session of the Eighth Annual Meeting of the aribbean Food Crops Society was held in Santo Domingo, Dominican epublic.

The meeting was called to order by the President, Mr. Pedro E. orales. The minutes of the previous meeting were read and approved. ne Treasurer's reoort was read and approved.

### Treasurer's Report

| | | |
|---|---|---|
| . BALANCE: Bank Statement, June 30, 1960 | | $2,124.30 |
| . RECEIPTS: July 1, 1969 to June 30, 1970 | | 1,401.99 |
| Subtotal | | $3,526.29 |
| . EXPENSES: July 1,1969 to June 30, 1970 | | |
| Travel grants, Martinique | $150.00 | |
| Travel expenses,Martinique meeting | 133.00 | |
| Travel expenses, Dom. Rep. meeting | 122.00 | |
| Opening account, Dom. Rep. Meeting | 50.00 | |
| Newsletters | 13.00 | |
| Secretarial work | 31.00 | |
| Postage | 79.96 | |
| Bank service charge | 3.00 | |
| Total Expenses | | 581.96 |
| . BALANCE: June 30, 1970 | | $2,944.33 |

### Board of Directors Meeting

A meeting of the Board of Directors was held in Santo Domingo, Dominican Republic on August 26, 1970. The main items decided were:

1. The Chairman of the Board for 1970-71 is Mr. Pedro Morales with Mr. Jack Waud, past vice-president serving when Mr. Morales can not assist.

2. The venue for the Ninth Annual Meeting was discussed. Mr. H.A.D. Chesney on behalf of his government offered Guyana as site of the Ninth Annual Meeting.

3. The Board lends its support to Puerto Rico for the site of the 1972 meeting with Barbados as alternate choice.

4. Plans were discussed for revitalization of the CFCS.

## Election of Officers 1970-71

| | | |
|---|---|---|
| President | H.A.D. Chesney | Guyana |
| Vice-president | John Brownman | Guyana |
| Secretary-Treasurer | George Samuels | Puerto Rico |
| Board of Directors | | |
| Chairman | Pedro Morales | Dominican Republi |
| Member | W. de Courcey Jeffers | Barbados |
| Member | Juan Pablo Duarte Jr. | Dominican Republi |
| Member | Francisco Aponte | Dominican Republi |
| Member | A.J. Naylor | Jamaica |
| Member | Antonio Sotomayor | Puerto Rico |
| Member | Jean E. Salette | Guadeloupe |
| Member | Lawrence Cross | Trinidad |

## Local Representatives

| | | | |
|---|---|---|---|
| Barbados | W. deC Jeffers | Jamaica | A. Naylor |
| Dominica | C. Dupigny | Martinique | F. Gabriel |
| Dominican Republic | F. Aponte | Puerto Rico | A. Sotomayor |
| Guadeloupe | J. Salette | Surinam | F. del Prado |
| French Guiana | J.F. Turenne | Trinidad | L.A. Cross |
| Guyana | H.A.D. Chesney | | |

## Ninth Annual Meeting

The general body agreed to have the Ninth Annual Meeting in Guyana in 1971. Puerto Rico was suggested for 1972 with Barbados as alternate choice.

A session of the 1971 meeting will be devoted to Root Crops

# REGISTERED PARTICIPANTS IN 8TH ANNUAL MEETING
# CARIBBEAN FOOD CROPS SOCIETY
# DOMINICAN REPUBLIC
# August 23-29, 1970

| | |
|---|---|
| Dr. Ernesto Hernández* | Puerto Rico |
| Dr. Miguel Lugo* | " |
| Dr. George Samuels* | " |
| Dr. Gene Spain | " |
| Mr. William Pennock | " |
| Mr. Carlos Aponte | " |
| Mr. Francisco Miranda | " |
| Mr. Rafael Fuentes | " |
| Mr. Miguel González | " |
| Mr. Antonio Vélez | " |
| Mr. Enrique González | " |
| Mr. A. Santiago | " |
| Dr. Antonio Sotomayor | " |
| Mr. Samuel Johnson | " |
| Mr. R.H. Martin | Jamaica |
| Mr. Alfred G. Mullings | " |
| Mr. W. Shirley | " |
| Mr. S.W.A. Lechtomore | " |
| Mr. John Grace | Barbados |
| Mr. Decoursey Jeffers | " |
| Mr. Nazeer Ahmad | Trinidad |
| Mr. R.E. Osborne | " |
| Mr. J.E. Salette* | Guadeloupe |
| Mr. P.G. Scoch* | " |
| Mr. Rudolph Shulterbrandt* | St. Croix |
| Mr. Edgar Hall | " |
| Mr. Charles J. Batiste | Dominica |
| Mr. J.L. Dupugny | " |
| Mr. George Rembaud | Martinique |
| Mr. Henry Riese | Curacao |
| Mr. H.A.D. Chesney | Guyana |
| Mr. Oakland Swift* | Antigua |
| Dr. St. Clair de Forde | " |
| Mr. Philippe Blancancaux* | French Guyana |
| Dr. Villena | México |
| Dr. Jack Waud | Dominican Republic |
| Mr. Francisco Aponte | " " |
| Mr. Peter Hirsch | " " |
| Mr. Jacques Teissier | " " |
| Miss Miriam Soto P. | " " |
| Mr. Lidio Martínez | " " |
| Mr. Romeo Balbuena | " " |
| Mr. César Meyreles Torres | " " |
| Mr. Marcos González | " " |
| Mr. Carlos Aquino | " " |
| Mr. Rafael Metra | " " |
| Mr. Guillermo Villanueva | " " |

* Accompanied by wife

GENERAL PROGRAM

| | |
|---|---|
| Sunday, 23 August 1970 | Arrival of Participants |
| Monday, 24 August | |
| 8:00 to 9:00 a.m. | Registration and Reception |
| 9:00 to 9:30 a.m. | Ladies' Meeting |
| 9:30 to 10:20 a.m. | Inauguration Ceremonies<br>César Sandino de Jesús, Secretario de Estado de Agricultura |
| Recess | |
| 10:30 to 12:00 p.m. | Opening Address of Working Session |
| 2:00 p.m. | Hotel Embajador |
| 7:00 p.m. | Cocktail and Reception<br>El Embajador Hotel |
| Tuesday, 25 August | |
| 6:00 a.m. to 6:30 p.m. | Field Trip to Southeast part of the Republic (Azua)-Processing of Fruits & Vegetables, Bananas, Plantains, Cantaloupe, Tomatoes, and Peppers. Agricultural Reform Family Project Lunchat Beach. |
| Wednesday, 26 August | |
| 8:30 to 11:00 a.m. | Hotel Embajador;<br>Working Session No.2<br>Topic - Tomatoes and Peppers |
| 1:30 p.m. to 4:00 p.m. | Visit to Centro Nacional de Investigaciones Agropecuarias (CNIA), at San Cristóbal, to observe research on fruits and vegetables. Orientation lectures on Dominican Agriculture. |
| 4:00 to 6:30 p.m. | Visit to Trujillo Mahogany House and Cerro Castle. |
| 8:00 p.m. | Water Ballet Show |
| Thursday, 27 August | |
| 6:00 a.m. to 6:30 p.m. | Field Trip to Central Part of the Republic (El Cibao). Visits to observe Rice, Potatoes, Onions, Garlic, Tomatoes, Flowers, Grain, and Oil Crops. |
| Friday, 28 August | |
| 8:30 to 11:00 a.m. | Hotel Embajador<br>Working Session No.3 |
| 11:00 a.m. to 12:00 Noon | Business Meeting and Elections |
| P.M. | Free time for shopping and sightseeing |
| 7:00 p.m. | Banquet at Hotel Embajador |

## FIELD TRIPS

### VISIT TO AZUA (SOUTH COAST)
### TUESDAY, AUGUST 25

| | |
|---|---|
| 5:00 a.m. | Board buses |
| 7:30 to 8:30 a.m. | Breakfast and visit to Famosa Canning - Factory (fruit juices, fruits, and vegetables) at Baní. |
| 8:30 a.m. | Depart for Azua. |
| 9:45 a.m. | Arrive at Azua. |
| 9:45 to 10:00 a.m. | Visit banana and plantain plantations and packing facilities. |
| 10:00 to 11:15 a.m. | Visit vegetable and fruit production - area including modern cleaning, grading, and packing facilities for cucumbers, peppers, and tomatoes. Visit field to see cantaloupes and field preparation - for planting of tomatoes. |
| 11:15 to 12:30 p.m. | Visit to Agrarian Reform Project farmers settlement to see plantings of peppers and tomatoes, irrigation, and housing, for worker's families. |
| 12:30 to 4:00 p.m. | Board bus to beach for lunch sponsored by United Fruit Company. Bathing facilities available bring you own suit and towel. |
| 4:00 p.m. | Board bus to return to hotel. |
| 6:30 p.m. | Arrive at Hotel. |

### VISIT TO SAN CRISTOBAL
### WEDNESDAY, AUGUST 26

| | |
|---|---|
| 1:30 p.m. | Board buses for visit to Centro Nacional de Investigaciones Agropecuarias (CNIA), San Cristóbal. |
| 2:00 p.m. | Arrive at CNIA, welcome by Director Ing. Agrón. Juan Pablo Duarte Jr. and staff. |
| 2:00 to 2:45 p.m. | Brief presentation of Agriculture of Dominican Republic including soils, climate crop locations, economics including marketing and agronomic practices. |
| 2:45 to 3:30 p.m. | Visit to seed cleaning and treating plant (corn, rice), soil laboratory, veterinary laboratory, feed analyses laboratory. |
| 3:30 to 4:40 p.m. | Visit to experimental fields to see corn, pigeon peas, tomatoes, onions, carrots, cabbage, mangos, avocados, oranges, grapefruit, etc. |
| 4:00 p.m. | Board buses to visit interesting historic places of the area including Trujillos country retreat, Casa de Caoba (Mahogany House); La Toma, a natural spring bathing resort; and Cerro Palace, an extravagant, baroque style, residence. |
| 6:00 p.m. | Depart for hotel. |

VISIT TO CENTRAL REGION OF THE REPUBLIC
THURSDAY, AUGUST 27

| | |
|---|---|
| 6:00 a.m. | Board bus. |
| 7:00 to 8:00 a.m. | Breakfast at Constanza. |
| 9:00 to 9:45 a.m. | Visit Constanza mountain valley to see potatoes, onions, garlic, and flowers. |
| 9:45 a.m. to 1:00 p.m. | Drive to Santiago, lunch will be courtesy of BARCELO & CO. C x A' |
| 2:00 to 4:00 p.m. | Visit Tomato Processing Plant, Pineapple Production, and View Vegetable Production in The Cibao Valley. |
| 4:00 to 6:00 p.m. | Return to Santo Domingo. |

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## THE ORIGIN OF THE NATIONAL AGRICULTURAL RESEARCH CENTER

The National Agricultural Research Center began in Constanza as a Horticulture Center due to the demand for fresh vegetables for the U.S. Market, created by the closing of the production centers in Cuba and the frost in the southwest of the U.S. in 1964-65.

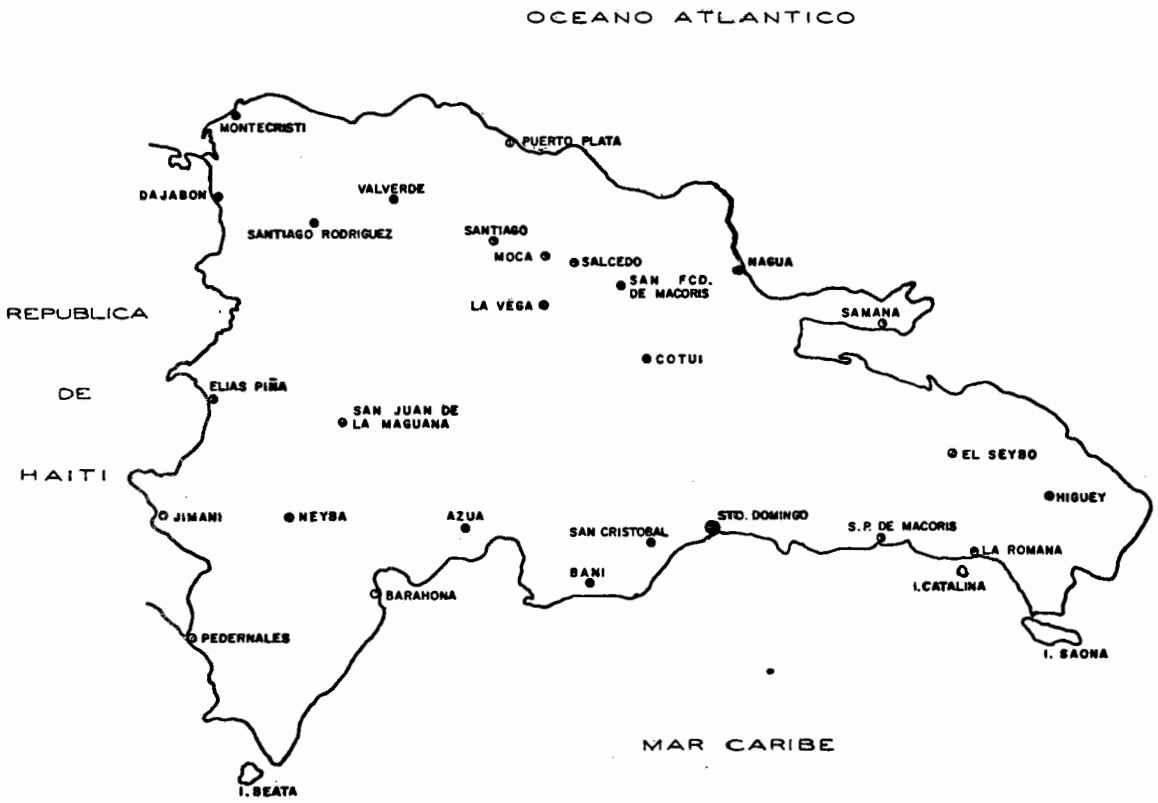
Later on, this Horticulture Center by agreements between the Dominican Government through the Secretariat of Agriculture and the Agency for International Development became the National Agriculture Research Center. Its official name is the Department of Agriculture Research. Because it has several branches in different parts of the country with its headquarters in San Cristobal is known as the National Agriculture Research Center (CNIA).

It is a dependency of the Secretariat of Agricultural under the direction of the Undersecretary of Research and Agriculture Extension.

Its internal organization consists in the Divisions of Soils, Cereals, Horticulture, Fruiticulture, Traditional Crops, Animal Production; Horticulture Center; programs on leguminous grains; Meteorology; laboratories in Plant Pathology, Soils, Veterinary and Bromatological; and the maintenance and transportation section.

The National Agriculture Research Center is situated at 18° 15' north latitude and 70°06' west longitude in the former "Hacienda Fundación" at 4 km from San Cristobal and at 31 km from Santo Domingo; its grounds are 43 meters above the sea level,as general average.

The Research Center is located in a tropical humid climate with an average rainfall of 1,834 mm (73.4 inches); 213.7 days of rain per year; 22.7 days in May (rainy season). The average maximum annual temperature is 29.8°C (85.6°F); the minimun annual average is 21.4°C (70.5°F); and the medium annually average is 25.6°C (78.1°F).




MAP OF THE DOMINICAN REPUBLIC

# T E C H N I C A L  P A P E R S

# A N D

# S U M M A R I E S

# CHLORONEB (1,4 dichloro-2,5 dimethoxybenzene) AN INTERESTING FUNGICIDE FOR THE CONTROL OF SEEDLING BLIGHT IN VEGETABLES

A. Beyries and C.M. Messiaen

Station de Pathologie végétale
Centre de Recherches Agronomiques des Antilles Guyane (INRA)
Petit-Bourg - Guadeloupe

Rhizoctonia solani, Sclerotium rolfsii and several Pythium spp (e.g. P. aphanidermatum) are very often the cause of destructive seedling blights in tropical countries, either on seed beds (Tomatoes, Cucurbits) or in the field (french beans). Especially with species which germinate with the cotyledons above soil level, the control of such seedling blights with classic organic fungicides (captan, TMTD) is not always satisfying, since very often the seed coat follows the cotyledons, and the fungicide used for seed dressing is no more effective.

Since a few years the pesticide industry has produced some systemic fungicides, which may be very interesting to control these seedling-blight fungi.

We shall give here the results of some experiment realized either in Avignon (in the Mediterranean South Eastern part of France) or in Guadeloupe.

## RESULTS

### Experiment No.1

French beans, cv. "Mistral", soil strongly inoculated with a Mediterranean strain of Rh. solani. The severity of the disease was noted from 0 to 4 on each seedling, the mean of these notes multiplied by 25 to obtain a 0 to 100 notation.

| Fungicide | Seed dressing g/kg of seeds | Disease severity |
|---|---|---|
| Check inoculated | - | 100.0 |
| Benlate 50% | 2.5 | 60.0 |
| | 5 | 40.0 |
| Carboxine 75% | 2.5 | 1.6 |
| | 5 | 0 |
| Oxycarboxine 75% | 2.5 | 63.7 |
| | 5 | 100.0 |
| PCNB 30% | 2.5 | 32.6 |
| | 5 | 19.8 |
| Chloroneb 65% | 2.5 | 3.3 |
| | 5 | 0 |

Experiment No.2

French beans cv. "Mistral", soil inoculated by Sclerotium Rolfsii

| Fungicide | Seed dressing g/kg of seeds | Disease severity |
|---|---|---|
| Check inoculated | - | 73.8 |
| Benlate 50% | 2.5 | 52.6 |
| | 5 | 34.1 |
| Carboxine 75% | 2.5 | 0 |
| | 5 | 0 |
| PCNB 30% | 2.5 | 50.9 |
| | 5 | 41.1 |
| Chloroneb 65% | 2.5 | 0 |
| | 5 | 0 |

Experiment No. 3

French beans cv. "Mistral" soil spontaneously infested by Pythium spp. seedling blight after emergence. Notes from 0 to 100 (obtained in the same way as in experiment No. 1) were given for seedling vigor, Pythium attack and phytotoxicity on primary leaves.

| Fungicides, used at 2g/kg seeds | Emergence % | Seedling vigor | Pythium disease severity | Phyto-toxicity | Mean seedling weight, gm. | Phytium positive isolation from hycopotyls (% |
|---|---|---|---|---|---|---|
| Carboxine 75% | 97.0 | 77.2 | 26.0 | 10.8 | 2.76 | 70.0 |
| TMTD 80% | 88.0 | 66.8 | 24.1 | 1.6 | 2.77 | 65.0 |
| Carboxine + TMTD (2g + 2g) | 94.0 | 83.8 | 15.6 | 27.0 | 2.73 | 68.2 |
| Chloroneb 65% | 97.0 | 97.3 | 0.8 | 0.9 | 3.53 | 25 |
| Check | 63.2 | 84.2 | 50.6 | 0 | 1.72 | 90 |

Experiment No.4

Muskmelon - cv. "Cantaloup charentais". Soil inoculated by a Pythium aphanidermatum strain islated from Cucumber.

| Fungicide | Seed dressing g/kg of seeds | Emergence % | Pythium disease severity |
|---|---|---|---|
| Check-sterilized soil | - | 100.0 | 0 |
| Check-inoculated soil | - | 4.1 | 88.9 |
| TMTD 80% | 5 | 76.5 | 53.3 |
| | 10 | 84.3 | 17.3 |
| Benlate 50% | 5 | 14.1 | 93.3 |
| | 10 | 24.1 | 76.2 |
| Chloroned 65% | 5 | 67.2 | 29.9 |
| | 10 | 92.2 | 0 |

## D I S C U S S I O N

From these experiments it appears that amongst the systemic fungicides we have tried, Benlate is not very effective against the seedling blight fungi. Oxicarboxine is effective only with Sclerotium Rolfsii. Carboxine shows an interesting efficiency towards the two basidiomycetes, Rhizoctonia solani and Sclerotim rolfsii, but - is not very effective against Pythium. The mixture carboxine + TMTD is more polyvalent, but Chloroneb seems to be the most interesting fungicide, since it controls at the same time Rhizoctonia, Sclerotim rolfsii and Pythium.

This efficiency can probably be explained by the broad-spectrum fungicide activity of Chloroneb (HOCK & Sisler 1969) LITTRELL, GAY & WELLS 1969) and by its systemic activity (demostrated in cotton - by DARRAG & SINCLAIR 1969). Chloroneb 65% can be used safely in - seed dressing up to 5g/kg of seeds on french beans, up to 10 g with Cucurbits. With other vegetable plants phytotoxicity experiments - must be done before use.

Having observed in another experiment with Rh. solani and mung - beans (Phaseolus aureus) that a soil application of 60g cubic meter was very effective, we have tried to control seedling blights at their beginning in seed beds on Tomatoes and muskmelons with drenches of Chloroneb 65% at 1,5 g/l, always with full success. Sclerotium rolfsii can also be controlled on adult plants by similar drenches.

This fungicide, which was used in USA for cotton seed dressing -

is therefore interesting also for the control of vegetable seedling blights and basal rots.

## R E S U M E N

Los fungicidas clásicos (Captan, TMTD) usados en tratamiento de las semillas no son bastante eficaces para contender los daños de - Rhizoctonia solani, Sclerotium rolfsii y Pythium spp. en plántulas de hortalizas.

La aparición de nuevos fungicidas sistemicos nos ha conducido a investigar si su eficacia no sería mejor.

Pruebas fueron realizadas en Francia (Avignon) y en Guadeloupe con Benlate, Carboxina, Oxicarboxina y Chloroneb. Estos fungicidas fueron aplicados en tratamiento de semillas en judias var. "Mistral" y melones var. "Cantaloup charentais".

## LITERATURE CITED

BEYRIES A. 1969 Efficacité de quelques fongicides sustémiques contre Rhizoctonia solani "Kuhn" par traitements de semences de Haricot et de Radis. Phytiatrie-Phytopharmacie.

DARRAG I.E.M. and SINCLAIR J.B. 1969. Evidence for sustemic protections against Rhizoctonia solani with Chloroneb in Cotton seedling. Phytopath. 59: 1102-1105.

HOCK W.K. and SISLER M.D. 1969. Specificity and mechanism of action of Chloroneb. Phytopath. 59: 627-632.

LITTRELL R.H., GAY J.D. and WELLS H.D. 1969. Chloroneb fungicide for control of Pythium aphanidermatum. P. Dis. Reptr. 53: 913-915

# PRIMERAS INDICACIONES SOBRE UNA PODREDUMBRE DE LOS FRUTOS DE BERENJENA, O ANTRACNOSIS, CAUSADA POR UN COLLETOTRICHUM

J. FOURNET

Station de Pathologie Vegetale
Centre de Recherches Agronomiques des Antilles Guyane (INRA)

## R E S U M E N

La Antracnosis es despuès del marchitamiento bacteriano, la causa principal de las perdidas en los cultivos de Berenjena que se desarrollan actualmente en Martinica y Guadalupe. El agente de esta enfermedad es un Melanconiale del gènero Colletotrichum; la forma y las dimensiones de sus esporas, su aspecto cultural, su velocidad de crecimiento y su espectro de hospedadores conducen a considerarlo como una forma especializada de Colletotrichum gloeosporioides. El parasito ataca igualmente el pimiento y las bayas de Solanum torvum. Estas ùltimas constituyen sin duda la fuente natural de inoculum.

El remojo en soluciones de Thiabendazole solamente es eficaz contra las contaminaciones muy recientes. Parece que el remojo en agua a 50°C prolonga el tiempo de aparición de los sìntomas y constituye una via interesante de investigación.

Es recomendable tratar los cultivos lo menos una vez por semana al Mancozebe o al Manebe y evitar maltratar los frutos durante la cosecha y durante la manipulación.

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# FIRST INDICATION OF A ROT OF EGGPLANT FRUITS OR ANTHRACNOSIS CAUSED BY A COLLETOTRICHUM

## SUMMARY

The Anthracnosis is, after the bacterial rottening, the main cause for loss of the eggplant cultivation taking place in Martinique Guadeloupe. The agent of this disease is a Melanconiale of the genus Colletotrichum. The form and the dimensions of its spores, its cultural aspect, its rapid growth rate and its spectre of lodgers suggest it is a specialized form of Colletotrichum gloeosporioides. This parasite also attacks the peppers and berries of Solanum torvum. These last ones constitute without doubt the natural source of inoculum.

The soaking in solutions of Thiabendazole is only effective againt recent contaminations. It seems as if the soaking in water at 50° or 55°C prolongues the time of apparation of the Symptoms and constitute an interesting branch for investigation.

It is recomended to treat the crops at least one time a week to Mancozebe or to Manebe and prevent mishandling of the fruits during harvest an shipping.

# EFFECT OF FRITTED TRACE ELEMENTS ON THE YIELD, OIL AND PROTEIN CONTENTS OF PEANUTS, ARACHIS HYPOGEA L - VAR AK 62, ON EBINI SANDY LOAM, GUYANA

H.A.D. Chesney and R.B. Diyaljee
Central Agricultural Station
Mon Repos, Guyana

No work has been done on the 'brown sands' of Guyana to determine the effect of trace elements on peanuts. It is known that trace elements especially molybdenum and copper affect both the quantity and quality of peanut production (Harris 1959). Stark et al (1959) has suggested that for proper utilisation of the 'brown sands' trace elements are essential. The investigation reported here was to obtain information on the effect of trace elements, in a fritted form, on peanuts.

## MATERIALS AND METHODS

SOIL: This investigation was done during the short season of 1968 -69 (Nov. - Jan.) and the long wet season of 1969 (May - August) on Ebini sandy loam. The soil is a Red-yellow podzol (Typic normochrult), drained and of low water holding capacity. Some physical and chemical properties of, the top 15 cms are presented in table 1.

Table 1. Some physical and chemical properties of the top 15 cms of Ebini sandy loam.

| pH | Truog-P (ppm) | Total N % | PBS | m.e./100 g | | | | % | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Exch. K | Exch. Ca | Exch. Mg | CEC | Sand | Silt | Clay |
| 5.3 | 1.1 | 0.04 | 61 | 0.02 | 0.30 | 0.30 | 1.22 | 60 | 24 | 16 |

The experiments were of a randomised block design with four treatments and six replicates. The treatments were o, 22, 44 and 66 kg/ha of F.T.E. 503*, applied at planting. F.T.E. 503 is guaranteed to provide the following minimum quantities of trace elements, Boron, ($B_2O_3$),9.75%; Copper (CuO), 3.75%; Iron ($Fe_2O_3$), 25.70%; Manganese, (MnO) 9.50%; Molybdenum ($MoO_3$), 0.30%; and Zinc (ZnO), 8.75%. All plots received 325 kg/ha 13-33-16 and 8.0 kg/ha MgO (as kieserite) at planting plus 8.0 kg/ha MgO and 55 kg/ha N (as ammonium sulphate) at 35 days after. Gypsum (504 kg/ha) - was applied to the rows at flowering.

Savannah grass (Trachypogon plumosus) which was present on the site, was disced into the soil two months previous to the start of the first experiment. Dolomitic limestone (1650 kg/ha) was applied two weeks before the first experiment was planted to bring the soil pH to about 6.5. No limestone was applied for the second experiment which was on the same site.

Peanuts were sown at a distance of 60 cm. between rows and 20 cm within the row in plots 6 m x 3 m. Where necessary plants were thinned to two per hole. Plants were sprayed wekly with zinc-propylene-bis-dithiocarbamate (Antracol) after they were two weeks old, for protection against leaf-spot (Cercospora sp).

Plants were harvested, the border rows discarded and weights of sun-dried pods per plot recorded. Samples from each plot were taken for oil and protein analysis.

Pods were shelled and the nuts ground in a stainless steel mill. Separate samples of the ground nuts were then analysed for oil and protein contents according to the A.O.A.C. Handbook (1955).

*With the compliments of Ferro Corporation. Agric. Chemicals.

All results were statistically analysed following Steel and Torrie (1960).

## RESULTS AND DISCUSSION

The results of yield for both experiments and percent oil and protein for experiment two are presented in table 2.

Table 2. Effect of varying levels of F.T.E. 503 on yield, percent protein and oil of peanuts - Var. AK 62.

| kg/ha F.T.E. 503 | Expt. 1 | Expt. 2 | | |
|---|---|---|---|---|
| | Yield (kg/ha) | Yield (kg/ha) | %Oil | % Protein |
| 0 | 508 a | 1466 a | 38.1 a | 27.5 a |
| 22.0 | 559 a | 1597 ab | 39.6 a | 26.8 a |
| 44.0 | 549 a | 1833 a | 40.0 a | 27.7 a |
| 66.0 | 559 a | 1718 bc | 41.0 a | 27.6 a |

Values in the same vertical columns, followed by the same letter are not significantly different at 5% level.

Application of trace elements had no effect on yield in experiment 1. There was a significant response to trace elements in experiment 2. The response was linear but showed signs of curvature, with no further yield increase was obtained after 44 kg/ha F.T.E. 503 was applied.

The failure to bbtain a response in the first experiment may have been to the generally low yields. At such low yields there were probably more serious limiting factors than that under study, which therefore could not manifest itself.

The better yields in the second experiment may have been due to greater rainfall during the period - cm compared to 32 cm. and or a build up of active Rhizobia in the soil.

Trace elements had no effect on the oil content. However, because of their positive effect on yield of pods, yield of oil also increased with the application of up to 44 kg/ha F.T.E. 503.

Percentage portein was not affected by the application or trace elements.

It could be concluded from this investigation that 44 kg/ha of F.T.E. 503 or of a similar formulation is about optimum for peanuts, Var AK 62, on Ebini sandy loam. Effects of the trace elements will only be seen when there are no other limiting factors.

Protein and oil contents are unaffected by trace elements.

## LITERATURE CITED

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# YIELD RESPONSE OF PEANUTS TO FERTILIZER NITROGEN, PHOSPHORUS AND POTASSIUM ON THE "BROWN SANDS" OF GUYANA

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Since 1963, investigations were started to determine the suitability of Groundnuts (Arachis hypogea) as a crop for the "Brown Sands" situated in the Intermediate Savannahs of Guyana. Unfortunately, the fertilizer investigation* were confined to the comparison to complete fertilizers that were commercially available. This program had serious limitations as no estimation of the nutrient requirements of the crop has been obtained.

The present studies, done during the short rainy season 1968 and the long wet season of 1969, were designed to obtain an indication of the requirements of groundnuts of nitrogen, phosphorus and potassium.

## MATERIALS AND METHODS

SOIL: The experiments were carried out on the soil, Ebini sandy loam a Red-yellow podzol (Typic normachrult), at the Ebini Crop Station, - Berbice River. Some of the chemical and physical features of the top - 15 cm (six inches) are presented in table 1.

Table 1. Some chemical and physical properties of the top 15 cm (six inches) of Ebini sandy loam.

| pH | Truog-P (ppm) | Total N % | PBS | m.e./100 g | | | | % | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Exch. K | Exch. Ca | Exch. Mg | C.E.C. | Sand | Silt | Clay |
| 5.3 | 1.1 | 0.04 | 61 | 0.02 | 0.30 | 0.30 | 1.22 | 60 | 24 | 16 |

The experiments were of a $3^3$ factorial design replicated twice. Each replicate was divided into three blocks of nine plots each with the (W) and (X) components of the N P K interation confounded in replications one and two respectively. The treatments within each block were randomised.

The experimental variables are shown in table 2. Nitrogen, potassium and phosphorus was applied as ammonium suphate, potassium chloride and triple superphosphate respectively.

Plots were six by three metres (20 x 10 feet). The rows were 60 cms (two feet) apart and the plants 20 cms (eight inches) within the row.

Table 2. Rates of experimental variables in kg per hectare.

| Levels | Experiment 1 | | | Experiment 2 | | |
|---|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ |
| 1 | 108 | 108 | 100 | 36 | 55 | 165 |
| 2 | 133 | 165 | 143 | 72 | 110 | 220 |
| 3 | 165 | 222 | 177 | 108 | 165 | 275 |

*Wagenaar, G.W., 1965. Report of the Soil Survey Project of British Guiana, Vol.2.
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The site used was under natural savannah grass (Trachypogon plumosus) vegetation. Before planting the area was disced twice and any remaining savannah grass was raked off. Dolomitic limestone (1680 kg/ha) was broadcast about three weeks prior to planting of the first experiment. Three seeds treated with Agrosan were planted per hole and then thinned to two on germination. Plants were sprayed against Cercospora sp with zinc-propylenebis-dithiocarbamate (Antracol) when two weeks old and then at weekly intervals. Gypsum, (504 kg/ha) was applied to the rows at flowering.

The nitrogen and potassium fertilizers were put on in two equal applications, at planting and at 35 days after. All phosphorus were applied at planting.

The plants were harvested and the yields of sun-dried pods per plot recorded. The results were statistically analysed according to Cochran and Cox (1957).

Soil samples were taken before the planting of the first and second experiments and again at harvest of the second experiment. Soil samples were analysed for N by the micro-kjheldahl method; available-P colorimetrically after extracting with Truog's solution (o.002 N-$H_2SO_4$, buffered with $(NH_4)_2SO_4$ at pH3); and potassium flame-photometrically after extracting with IN-$NH_4OAC$ at pH 7.0.

## RESULTS AND DISCUSSION

### YIELDS

EXPERIMENT 1. The yield results are presented in the two-way tables of mean yields (table 3).

Table 3. Two-way tables of mean yields of sun-dried pods (kg/ha)

| | | Nitrogen | | | Potassium | | | |
|---|---|---|---|---|---|---|---|---|
| | | $N_1$ | $N_2$ | $N_3$ | $K_1$ | $K_2$ | $K_3$ | Means |
| Phosphorus | $P_1$ | 615 | 661 | 581 | 433 | 638 | 786 | 619 |
| | $P_2$ | 444 | 421 | 359 | 313 | 410 | 501 | 408 |
| | $P_3$ | 421 | 604 | 479 | 570 | 285 | 649 | 501 |
| | | | | Means | 439 | 441 | 645 | |
| Potassium | $K_1$ | 490 | 479 | 348 | | | | |
| | $K_2$ | 342 | 569 | 422 | S.E.(mean of 18 plots)± 33 | | | |
| | $K_3$ | 649 | 638 | 649 | S.E.(mean of 6 plots)± 57 | | | |
| Means | | 494 | 662 | 473 | | | | |

NITROGEN: Increasing nitrogen from 110 to 168 kg/ha had no significant effect on the peanut yield. The yield at the highest level was lower than those at the second level; although this difference was not significant, it does indicate that high levels of nitrogen tend to depress yields.

PHOSPHORUS: Increasing phosphorus from 108 to 222 kg/ha had a very significant depressing effect on yields. The yield of the third level was higher than that of the second level but the difference was not significant.

POTASSIUM: Potassium had a very significant positive effect on peanut yields. Increasing K from 100 to 177 kg/ha caused an increased of 207 kg peanuts per hectare, 204 kg of which was caused by the increase of K from 143 to 177 kg/hectare. Indications are that higher levels of K will cause further yield increases.

P K INTERACTION: This was the only significant two-factor interaction. Examination of the interaction showed that increasing K from 100 to 177 kg/ha caused a significant increase in peanut yield only at the lowest level of phosphorus. This is in agreement with the general finding that the higher levels of P depressed the yields of peanuts.

These results indicate that with the exception of potassium the range of nutrient levels tried was too high. As a result, no exact recommendation could be given for optimum levels of N and P, as these may be considerably lower than the lowest level tried in this experiment. For K it appeared that levels greater than 177 kg/ha will give increased yields.

EXPERIMENT 2: Yield results are presented in table 4. Examination shows that neither applied N, or K within the ranges tested, had any significant effects on yield. There were also no significant two-factor interactions.

Table 4. Two-way tables of mean yields of sun-dried pads (kg/ha).

| | | Nitrogen | | | | Potassium | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $n_1$ | $n_2$ | $n_3$ | | $k_1$ | $k_2$ | $k_3$ | Means |
| Phosphorus | $p_1$ | 1238 | 1434 | 1509 | | 1293 | 1445 | 1444 | 1393 |
| | $p_2$ | 1183 | 1199 | 1478 | | 1238 | 1352 | 1279 | 1290 |
| | $p_3$ | 1439 | 1428 | 1481 | | 1496 | 1205 | 1647 | 1449 |
| Potassium | $k_1$ | 1371 | 1258 | 1395 | Mean | 1341 | 1334 | 1457 | |
| | $k_2$ | 985 | 1675 | 1341 | S.E. (Mean of 18 plots) ± 94 | | | | |
| | $k_3$ | 1503 | 1127 | 1740 | S.E. (Mean of 6 plots) ± 162 | | | | |
| Means | | 1287 | 1354 | 1492 | | | | | |

The lack of response to N and K may be attributed to the increase of the levels of these two nutrients in the soil (table 5); this was caused by the heavy applications in the previous experiment. The reason given above cannot explain the lack of response to P (table 5); it is therefore probable that the levels of P tested were still too high.

Table 5. Levels of N, P and K before planting Expts. 1 and 2.

| Nitrogen (%) | | | | Truog-P (ppm) | | | | Available-K (ppm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Native | Before planting Expt. 2 | | | Native | Before planting Expt. 2 | | | Native | Before planting Expt. 2 | | |
| | $n_1$ | $n_2$ | $n_3$ | | $p_1$ | $p_2$ | $p_3$ | | $k_1$ | $k_2$ | $k_3$ |
| 0.04 | 0.10 | 0.12 | 0.11 | 1.1 | 1.9 | 1.8 | 1.4 | 7.8 | 19.5 | 19.5 | 19.5 |

The yields obtained in this experiment were generally higher than those of experiments. Probable reasons for this difference are:

1. The supply of rain during this growing period was more adequate than during the growing period of experiments, compared to 32 cm.

2. A build up of active Rhizobia in the soil. This suggests that the belief that inoculation has no effect on the yields of peanuts on "Brown sands" will have to be tested.

3. The application of the elements in better balanced ratios.

From the work reported, it is not yet possible to give absolute recommendations for the optimum levels of N, P and K for peanuts on the "brown sands"

RESUMEN

Durante la breve temporada de las lluvias del 1968 y la larga sequía del 1969 se llevaron a cabo, en los terrenos franco-arenosos de Ebini, Guyane, dos experimentos con NPK 3 x 3 x 3. En el primer experimento el nitrógeno (110 a 168 kg/ha) no produjo significativamente el rendimiento, y el potasio (100 a 177 kg/ha) los aumentó grandemente. En el segundo experimento los rendimientos por lo genral fueron mayores aunque no fueron efectuados por las aplicaciones de N.P y K. Se dan las posibles explicaciones.

# LAS RESPUESTAS DE YAME A FERTILIZANTES EN PUERTO RICO

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## RESUMEN

Varios niveles de fertilizante de nitrógeno, fósforo, potasio y magnesio fueron evaluados en yames (Diascorea sp.) en un barro corozal, un ácido (pH 5.8) lateritico (Ultisol) suelo de montaña húmedo en el interior de Puerto Rico. Los resultados fueron los siguientes:

1) Ninguna respuesta significativa a nitrógeno, fósforo o abono de potasio.

2) La usencia de fertilizante de potasio produjeron raíces de menor tamaño.

3) Hubo una significante respuesta en rendimientos por acre y tamaño de raíz al magnesio a 1,000 libras de MgO por acre, pero no con sal Epsom ($MgSO_4 . 7H_2O$) a razón de 30 a 120 libras Mg por acre.

4) Compuestos orgánicos hechos de desperdicios fallaron de aumentar rendimientos con o sin fertilizante adicional.

5) Fuentes de fosfato como triple superfosfato (46% $P_2O_5$) y diammonium fosfato (18-53-0) fallaron de aumentar los rendimientos significativamente.

6) No hubieron diferencias en rendimientos de yames al tiempo de aplicación de nitrógeno en el tiempo de la siembra; 1/2 al tiempo de la siembra y 1/2 a los 3 meses; o tres aplicaciones equivalentes a la siembra, 3 meses y 6 meses.

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# THE RESPONSE OF YAMS TO FERTILIZERS IN PUERTO RICO

## SUMMARY

Various fertilizer levels of nitrogen, phosphorus, potassium and magnesium were evaluated on yams (Diascorea sp.) on a Corozal, clay, an acid (pH 5.8) lateritic (Ultisol) soil of the humid mountain terraces in the interior of Puerto Rico. The results were as follows:

1) No significant response to nitrogen, phosphorus, or potassium fertilizers.

2) The absence of potash fertilizer produced smaller sized roots.

3) There was a significant response in yields per acre and root size to magnesium at 1,000 pounds of MgO per acre, but no with - Epsom salt ($MgSO_4 . 7H_2O$) at rates of 30 to 120 pounds Mg per acre.

4) Organic composts made from garbage failed to increase yields with or without additional fertilizer.

5) Sources of phosphate as triple superphosphate (46% $P_2O_5$) and diammonium phosphate (18-53-0) failed to increase yields significantly.

6) There were no differences in yields of yams to time of application of nitrogen whether all at planting; 1/2 at planting, 1/2 at three months; or 3 equal applications at planting, 3 months, and 6 months.

# INFLUENCIA DE LA DENSIDAD POBLACIONAL EN LA PRODUCCION DE LA VARIEDAD DE PIÑA ESPAÑOLA ROJA BAJO LAS CONDICIONES DE PUERTO RICO

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## INTRODUCCION

La industria de la piña se está expandiendo rápidamente, habiendo alcanzado la producción mundial unas 3,680,000 toneladas métricas el año 1967. La zona tropical cuenta con grandes extensiones de terreno que se presentan para este cultivo. Sin embargo, las condiciones del mercado mundial de los productos elaborados de la piña son cada día más competitivas. Los precios bajos gravitan en la mayoría de los países importadores (4).

De las frutas que se cultivan en Puerto Rico la piña es la más importante. Esta aportó $3.5 millones al ingreso agrícola de la Isla en el 1968 (1). Actualmente nos enfrentamos a un continuo aumento en los costos de producción mientras que los precios se mantienen más o menos fijos. Por lo tanto es necesario aumentar la producción por unidad de área para poder subsistir entre los países productores de piña.

El sistema de siembra de la doble hilera es el que extensamente se ha usado en Puerto Rico, sembrándose alrededor de 13,000 plantas por acre de la variedad Española Roja y 17,000 de la variedad Cayena Lisa.

Los estudios que mencionaré se iniciaron con el propósito de determinar el efecto de las distancias de siembra en la producción de piña bajo las condiciones de Puerto Rico.

## MATERIAL Y METODOS

En el 1967 se establecieron dos pruebas de campo en un suelo lateríticó (Bayamón arcilloso lómico), típico de la región piñera más importante de Puerto Rico. Todas las prácticas de campo con excepción de las distancias de siembra se llevaron a cabo siguiendo los métodos corrientes usados por los cooperadores, i.e. el programa de piña de la Autoridad de Tierras de Puerto Rico, y el señor L. Landrón.

En la primera prueba, cada parcela experimental consistía de ocho hileras dobles de 40 pies de largo, con las plantas separadas a 22 pulgadas entre hileras y 52 pulgadas entre cada par de hileras. Los tratamientos consistieron en cinco distancias entre plantas en la hilera, a saber 8 pulgadas, 13 pulgadas, 18 pulgadas, 23 pulgadas y 28 pulgadas, equivalentes a una población de 6,000 a 18,000 plantas por acre. En la segunda prueba la distancia entre la doble hilera se varió de 40 a 70 pulgadas a intervalos de 6 pulgadas, mientras que las distancias entre plantas en la hilera y entre hileras se mantuvo constante a 12 y 22 pulgadas, respectivamente, lo que equivale a una población aproximada de 11,400 a 16,800 plantas por acre. En ambas pruebas se sembraron hijuelos (brotes que aparecen en la parte superior del pedúnculo inmediatamente debajo de la fruta) de un tamaño aproximado de 10 a 20 pulgadas de largo.

Se tomaron muestras de la hoja "D" (hojas adultas más jovenes que han llegado a la etapa en la que el crecimiento prácticamente ha terminado) a los 4 y 8 meses luego de la siembra para determinar el contenido de nutrimentos (N, P, K, Ca, Mg, Fe y Mn) durante el desarrollo vegetativo de la plantación.

Para provocar la floración en el primer experimento se usó el compuesto BOH (betahydroxythylhydrazina) a una concentración de 0.06 por ciento aplicada a los 11 meses de edad mediante el uso de una rociadora mecánica. En la segunda prueba se usó carburo de calcio (12 onzas en 36 galones de agua) aplicado por gravedad al corazón de la roseta de cada planta mediante bombas mochila.

Se tomaron datos de producción de fruta, de material de propagación y valores de calidad del jugo de la fruta (grado Brix, pH y acidez total.

## RESULTADOS

### Experimento Núm. 1.- Distancia entre plantas en la hilera.

**Producción de Fruta:**

Los datos de producción del primer retoño demuestran lo siguiente: Las distancias cortas entre plantas en la hilera causaron un aumento significativo en la producción de fruta, hasta un máximo de 32.1 toneladas por acre cuando las plantas se sembraron a 8 pulgadas, en contraste con 19.1 toneladas cuando se sembraron a 28 pulgadas (cuadro 1). Las distancias usadas no ejercieron influencia significativa sobre el peso medio de la fruta. El peso menor fue de 2.69 libras, que se obtuvo cuando se usó la distancia más corta (8 pulgadas) mientras que el peso mayor de 2.89 libras se logró a 18 pulgadas. Estos resultados confirman que las densidades de siembra en relación al peso medio de la fruta no causan efecto alguno en los retoños según ha sido observado por otros investigadores (2,8).

**Calidad del Jugo:**

Ninguna de las distancias estudiadas influyó significativamente en la calidad del jugo, condición que tambien prevaleció en la plantilla. Los sólidos totales en solución fluctuaron entre 14.9 y 15.4 grados Brix. La acidez total, expresada en miligramos de ácido cítrico por cada 100 mililitros de jugo, no fue afectada significativamente por las distancias usadas. El valor más alto fue de 656 mg. y el más bajo de 611 mg. para las distancias de 18 pulgadas y 13 pulgadas, respectivamente.

### Experimento Núm. 2- Distancia entre la doble hilera

**Producción de Fruta:**

Los datos de producción revelan lo siguiente: Las distancias cortas aumentaron la producción significativamente tanto en la plantilla como en el retoño (cuadro 2). La densidad mayor (16,800 plantas por acre) produjo 23.1 toneladas de fruta en la plantilla y 24.0 toneladas por acre en el retoño (cuadro 2). El peso promedio de la fruta disminuyó significativamente con un aumento en la población (cuadro Núm.2). Los resultados demuestran que la separación entre hileras dobles influye en grado menor en la producción que la separación entre plantas en la hilera. Esta condición ha sido observada por otros investigadores (3, 5, 7, 9).

Las distancias estudiadas no afectaron en una forma significativa el diámetro de la fruta y el del corazón. Se especulaba que siembras densas provocarían la producción de frutas con un corazón delgado. Esta condición es muy importante en la variedad Cayena Lisa que, bajo las condiciones de Puerto Rico produce frutas con el corazón demasiado grueso, las cuales no se pueden utilizar para rodajas de calidad superior. Tampoco se afecto significativamente la producción de material de propagación. La producción de este material es muy importante en el cultivo de la piña, ya que de los brotes se obtiene la cosecha de los retoños y los hijuelos son la fuente de semilla para las nuevas siembras. Algunas variedades producen muy pocos hijuelos, particularmente en algunas estaciones del año. Si las frutas producidas se destinan para el mercado en estado fresco no se les puede remover la corona o tope, que tambien se utiliza como material de propagación.

Calidad del Jugo:

Una vez más las distancias de siembra no afectaron significativamente la calidad del jugo de la fruta de la variedad de piña, Española Roja.

## DISCUSION

En ambos experimentos la presencia de las malas hierbas se acentuó más a medida que se aumentaron las distancias de siembra, dando lugar a que los costos de producción se aumentasen.

En los predios de distancias cortas las hojas crecieron más largas pero angostas, en contraste con las distancias más amplias, en las cuales eran más pequeñas pero más anchas.

En densidades altas es necesario seleccionar bien el material de propagación en cuanto a su tamaño se refiere. Las plantas pequeñas adyacentes a las plantas grandes se atrasan en su crecimiento porque la competencia por espacio, agua, nutrimentos y luz solar es más fuerte (6). En muchas ocasiones esta condición da lugar a una floración desigual y a la vez aumenta los costos de recolección.

Naturalmente, la mejor densidad es la que permite un mayor ingreso al combinarse la producción de la plantilla y los retoños. Sin embargo, el señor Py, (6) hace mención de tres factores que hay que considerar al determinar la distancia de siembra más adecuada: 1- La variedad, su hábito de crecimiento, el vigor y la presencia de espinas. 2-- Las condiciones ecológicas (clima y suelo), tomando en cuenta la fertilidad del suelo para determinar si el aumento de la población conlleva un incremento en las materias fertilizantes. 3- El propósito de la cosecha, o sea si la fruta está destinada para venderse en estado fresco o para conserva, en cuyo caso se requieren distintos tamaños que en parte pueden ser regulados por las distancias usadas, particularmente en las frutas de plantillas.

## SUMMARY

Experiments were conducted with distance of planting for pineapples. An experiment varying the distance between plants in the row from 8 to 23 inches by 5 inches intervals showed that the tons of pineapples per acre increased with decreasing distance between plants. The 8 inch distance between plants was significant over all other distances. Mean-fruit weight per fruit was not influenced by the various planting distances.

An experiment varying the distance between the double rows from 40 to 70 inches at 6 inches intervals produced highst yields at 40 inches distance and lowestat 70 inches for plant and ratoon crop. Mean weight por fruit increased with increasing distance being significant for the plant crop, but not for the ratoon crop.

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Cuadro No.1

El efecto de la distancia de siembra entre plantas en la hilera sobre la producción de piña Española Roja, 1er. retoño

| Tratamientos | | Producción Frutas/acre | Peso medio de la fruta |
|---|---|---|---|
| Número | Distancia | | |
| | Pulgadas | Toneladas | Libras |
| 1 | 8 | 32.1 d | 2.69 a |
| 2 | 13 | 29.4 c | 2.85 a |
| 3 | 18 | 26.5 b | 2.89 a |
| 4 | 23 | 21.1 a | 2.78 a |
| 5 | 28 | 18.1 a | 2.79 a |

Cuadro No.2

El efecto de la distancia de siembra entre doble hilera sobre la producción de piña Española Roja.

| Tratamientos | | Producción frutas/acre | Peso medio de la fruta |
|---|---|---|---|
| Número | Distancia | | |
| | | Plantilla | |
| | Pulgadas | Toneladas | Libras |
| 1 | 40 | 23.1 b | 3.22 a |
| 3 | 52 | 22.4 b | 3.54 b |
| 2 | 46 | 22.1 b | 3.35 ab |
| 5 | 64 | 19.4 a | 3.69 c |
| 6 | 70 | 18.5 a | 3.77 c |
| 4 | 58 | 17.8 a | 3.50 ab |
| | | Primer Retoño | |
| 1 | 40 | 24.1 b | - |
| 2 | 46 | 23.4 b | 2.81 |
| 5 | 64 | 22.9 b | 2.94 |
| 4 | 58 | 22.2 ab | 2.90 |
| 3 | 52 | 22.1 ab | 2.79 |
| 6 | 70 | 18.7 a | 2.66 |

# CRECIMIENTO DE LA HOJA DEL AJI (CAPSICUM ANNUUM) Y LA INFLUENCIA DE LA SIEMBRA FUERA

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## RESUMEN

El estudio de divisiones y expansión de ajíes (Capsicum annuum) células epidermicas de la hoja permitidas para especificar un ejemplo del crecimiento de la hoja. Durante la primera fase, las divisiones celulares son muy numerosas, coincidiendo con la nutrición de la planta. El estómata aparece en la fase final. En la segunda fase el crecimiento de la célula prevalece.

El crecimiento foliar es así discutido. La influencia del método de cultura (la forma de siembra) es especificada.

Una atención particular es ofrecida al número de estómatas en la superficie de arriba de la hoja y en el número de variaciones del estómata.

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# LEAF GROWTH OF PEPPER (CAPSICUM ANNUUM) AND THE INFLUENCE OF PLANTING OUT

## SUMMARY

The study of the division and expansion of Pepper (Capsicum annuum) leaf epidermal cells permitted to specify a leaf growth sample. During the first phase, the cellular divisions are very numerous, coinciding with the plant nutrition. The stomata appear at the end of the phase. In the second phase, cell growth prevails.

The foliar growth in discussed. The influence of the culture method (planting out) is specified.

Particular attention is given to the number of stomata on the upper leaf surface and on the stomata number variations.

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# ENSAYO COMPARATIVO DE VARIEDADES EN EL CULTIVO DEL PIMIENTO

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## INTRODUCCION

El cultivo de pimiento es básico en la economía del país por ser un generador de divisas por concepto de exportación (1), principalmente el tipo Cubanella.

El objetivo principal de este ensayo es evaluar las distintas variedades, para medir la producción y obtener las informaciones experimentales necesarias para recomendar la siembra comercial las variedades más prometedoras e incrementar su consumo interno y ampliar las posibilidades de exportación.

Creemos que en esta forma podemos proporcionar a los agricultores mejores beneficios y tratar de solucionar en parte los problemas que se les presenten en las diferentes explotaciones hortícolas y abrir el camino para lograr una eficiente intensificación de nuestra agricultura, especialmente los explotaciones comerciales que están cerca de las zonas urbanas, donde los costos de producción son cada día más elevados.

## MATERIALES Y METODOS

### Climatología:

Las Condiciones Climatológicas del Estudio (2)

| Meses | TEMPERATURA MEDIA C° | | | Precipitación en mm. | % Humedad Relativa |
|---|---|---|---|---|---|
| | Máxima | Media | Mínima | | |
| septiembre 1966 | 32.5 | 27.6 | 22.7 | 206.0 | 74.9 |
| octubre | 31.5 | 26.2 | 21.8 | 352.4 | 79.0 |
| noviembre | 29.9 | 25.2 | 20.5 | 255.5 | 73.1 |
| diciembre | 29.8 | 25.2 | 20.6 | 35.1 | 75.1 |
| enero 1967 | 29.7 | 25.0 | 20.3 | 58.5 | 75.8 |
| febrero | 29.5 | 24.8 | 20.1 | 42.6 | 76.1 |

El estudio se ejecutó en el Centro Nacional de Investigaciones Agropecuarias (CNIA), San Cristobal, con altura aproximada de 43 M.S.N.M. y una pluviometría de 1250mm. El terreno escogido para la prueba es de textura limoso-arcilloso, aluvial reciente indiferenciado (3), con pendiente plana y drenaje bueno.

Los semilleros se hicieron el 23 de septiembre de 1966, el trasplante se realizó a los 42 días de la siembra del semillero.

Las variedades sometidas a prueba fueron: Florida Grant, Rubyking, Cubanella, Yolo Wonder, Yolo Wonder A, Yolo Wonder 43, California Wonder.

El diseño experimental utilizado: Bloques al azar con 4 repticiones. La distancia entre plantas fue de 0.40 m. y 0.90 entre hileras. El fertilizante se aplicó 7 días despues de el trasplante en cantidades de Nitrógeno (60 kgs/ha) $P_2O_5$ (90 kgs/ha) $K_2O$ (40 kgs/ha).

La humedad se mantuvo a un nivel adecuado mediante riego - por gravedad con intervalo de 8-10 días. Se efectuaron aplicaciones necesarias de insecticidas y fungicidas para mantener el estado fitosanitario en buenas condiciones. Se realizaron doce cosechas.

## RESULTADOS Y DISCUSION

Presentamos la producción de las variedades en Kgs/ha):

| Variedades | Producción |
|---|---|
| Cubanella | 10,220 |
| Florida Grant | 8,956 |
| Rubyking | 7,899 |
| Yolo Wonder A | 7,240 |
| California Wonder | 7,146 |
| Yolo Wonder 43 | 4,764 |
| Yolo Wonder | 4,293 |

Diferencia significativa al nivel 5%= 1,222 Kgs/ha.

Como se observa la variedad Cubanella es significativamente superior a las restantes con una producción de 10,220.00 kgs/ha.

Otras variedades que mostraron una buena producción fueron: Florida Grant, con 8,956 Kgs/ha y Rubyking con 7,899 Kgs/ha. Las variedades Yolo Wonder 43 y Yolo Wonder A y Yolo Wonder, tuvieron una producción muy baja en relación con las otras.

La variedad Cubanella es la de mayor aceptación tanto en el mercado interno como para la exportación, lo cual unido a su alta producción hace que Esta sea la más recomendada para siembra comercial.

## CONCLUSIONES

1.- La variedad Cubanella demostró ser la de mejor producción, seguida por las variedades Florida Grant y Rubyking.

2.- Aunque las variedades California Wonder y Yolo Wonder dieron baja producción es recomendable su siembra en pequeñas escalas para suplir la demanda del mercado interno para este tipo de pimiento.

3.- Es conveniente la introducción y ensayo de variedades con caracterlsticas (forma del fruto) de las Yolo Wonder, que demuestren tener una producción más alta.

## SUMMARY

This test was made at the San Cristóbal Training Center (CNIA) San Cristóbal, Dominican Republic, to evaluate the production of pepper varieties. Out of the seven varieties tested, the Cubanella pepper variety was the highest yielding followed by the Florida Grant an Rubyking varieties.

## LITERATURA CITADA

1) AID Productos Exportados de la República Dominicana durante los años 1967, 1968 y 1969. (Hoja mimeografiada).

2) División de Agroclimatología. Secretaria de Estado de Agricultura, Boletines Agroclimatológicos Nos. 10-27 de septiembre, octubre, noviembre, diciembre de 1966 y enero y febrero de 1967.

3) Unión Panamericana, 1967. Anexo sobre la clasificación de los Recursosos Naturales de la República Dominicana.

# PRUEBAS DE LABORATORIO Y DE CAMPO CON INSECTICIDAS USADOS PARA COMBATIR EL OEBALUS POECILA DALLAS, Y TECNICA A SEGUIR CON LA PULVERIZACION POR DERIVA A VOLUMEN BAJO

B. K. Rai

## R E S U M E N

Se llevó a cabo una comparación de la toxidad por contacto residual con 35 insecticidas, con tres concentraciones, para combatir el Oebalus poecilae Dallas (Pentatomidae: Hemiptera). Diecisiete insecticidas que resultaron relativamente más tóxicos que el resto fueron probados también para conocer la duración de su efecto en plantas colocadas en tiestos atacadas por el Oebalus poecila adulto. En base a estos estudios fueron seleccionados el MONOCROTOPHOS y el CARBARYL para someterlos a pruebas de campo.

En las pruebas de campo se pudo comprobar que una aspersión de emulsión de MONOCROTOPHOS a razón de 270 gramos de ingrediente activo por hectáreas resulta mejor que una aspersión de suspensión de CARBARYL a razón de 1.4 kg/ha, y ambas resultaron mejor que el polvo Gamma BHC a 1.4 kg/ha para proporcionar una protección más duradera de los arrozales contra el Oebalus poecila migratorio. Las aspersiones de MONOCROTOPHOS protegió la cosecha del Oebalus poecila por un período de 15 días.

La determinación de residuos de MONOCROTOPHOS en el arroz blanco y a medio cocer sin pulir y en la cáscara demostró que el tratamiento recomendado con MONOCROTOPHOS no ofrece peligros para el consumidor.

La velocidad natural del viento en los terrenos costeros de la Guyana es de 10 a 15 kilómetros por hora; por lo tanto, puede llevarse a cabo la pulverización por deriva cada 6 metros, usando una bomba mochila con motor. Se requiere como media hora para tratar una hectárea de arroz.

Se ha dado instrucciones para el control de Oebalus poecila.

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## S U M M A R Y

Comparative residual contact toxicity of 35 insecticides, at three concentrations, to adult paddy bug, Oebalus poecila Dallas (Pentatomidae: Hemiptera) was worked. Seventeen insecticides which were comparatively more toxic than the rest, were further tested for their duration of effectiveness on potted paddy plants, against the adult paddy bug. Based on these studies, Monocrotophos and Carbaryl were selected for field trial.

In field tests, Monocrotophos emulsión spray at 270 gm a.i./ha was found to be better than Carbaryl suspensión spray at 1.4 kg/ha., and both these were better than gamma BHC dust at 1.4 kg. a.i./ja, for giving longer protection to paddy crop against the migratory paddy bug. Monocrotophos spray protected the crop from paddy bug for about a period of 15 days.

The determination of residues of Monocrotophos in unpolished white and parboiled rice and husk, indicated that the recommanded treatment of Monocrotophos was safe to consumers.

The natural wind velocity on coastland in Guayana is 10-15 km/hour and thus drift spraying after every 6 meters, using a motorized knapsack sprayer, can be carried out. It takes about half an hour to treat one hectare of paddy.

Recomendations for the control of paddy bug have been given.

## ALGUNOS RESULTADOS DE EXPERIMENTOS CON *VIGNA SINENSIS* EN SUELOS DEL WEST INDIES

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Dos razas de *V. sinensis* fueron usados en tres diferentes suelos representando grandes áreas en West Indies: Vertisoils, Andosols, latosols. Los resultados están dados en formas de rendimientos y contenido de nitrógeno para diferentes tratamientos que incluyen fertilizante usado, cal, rhizobium para inocular.

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## SOME RESULTS OF POT EXPERIMENTS WITH *VIGNA SINENSIS* IN WEST INDIAN SOILS

### S U M M A R Y

Two strains of *V. sinensis* were used in three different soils representing large areas in West Indies: Vertisoils, andosols, latosols. Results are given in terms of yield and nitrogen content for different treatments including fertilizer use, liming, rhizobium inoculating.

# POSIBLE EXPANSION DE USO PARA BIXA ORELLANA (ACHIOTE, ANNATTO, ROUCOU) UNA PLANTA CARIBEÑA

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## RESUMEN

Concerniente a los desperdicios del procesamiento de semillas de Bija (Achiote) en los costos de semilla para la venta, las sugerencias siguientes son consideradas como una posible vía de exploración o experimentación:

1) Como una cubierta fertilizante o un acondicionador de suelos.

2) Como un suplemento alimenticio para aves o animales de laboratorio, si no como un producto para alimento humano.

3) Como un agente insecticida o pesticida.

4) Como relleno para artesanía de ladrillos de construcción, si se pudiera encontrar una base de plástico o cemento - como agente unificador.

Los extensos usos de otras partes de la planta son también sugeridos. Preguntas, comentarios y críticas son aceptadas por el autor por correspondencia o personal de otras personas interesadas en el mismo problema de la producción de Bija.

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# POSSIBLE EXPANDED USE FOR BIXA ORELLANA (ACHIOTE, ANNATTO, ROUCU) A CARIBBEAN CROP PLANT

## S U M M A R Y

Concerned over the waste involved in the processing of seed of Bixa in the disposal cost for the spent seeds, the following suggestions are considered as possible avenues of exploration or experimentation on the question:

1) As a fertilizer-mulch or soil conditioner
2) As a supplemental feed for fowls or laboratory animals, if not a food product for man.
3) As an insecticide or pesticidal agent.
4) As a "Filler" for crafting brick construction materials, if a suitable plastic or cement base could be found as an imbedding agent.

Expanded uses of other parts of the plant ara also suggested. - Questions, coments or criticisms are welcomed by the author by correspondence or personal contact by other interested in the same problems of production of Bixa.

# RESPUESTA DE LA HIERBA PANGOLA (DIGITARIA DECUMBENS STENT) BAJO DISTINTOS SISTEMAS DE MANEJO (FRECUENCIA DE CORTE, ABONAMIENTO, NUMERO DE APLICACIONES DE ABONO)

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## R E S U M E N

La hierba Pangola representa en la República Dominicana la principal hierba de pastoreo.

Los trabajos en curso tienen la finalidad de estudiar el comportamiento de la hierba Pangola bajo el sistema de corte. Se comparó la producción y las variaciones de la tasa de materia seca en parcelas sin abono y con abono bajo tres frecuencias de corte (4, 6 y 8 semanas).

Se observó que:

a) La producción anual y la tasa de materia seca aumenta con la frecuencia de corte en el caso de parcelas testigo;

b) Manteniendo la frecuencia de corte constante, la respuesta a diferentes dosis de abono completo (14-4-10) fue siempre positivo medido en materia seca, mientras que la tasa de materia seca disminuye cuando la dosis de abono aumenta;

c) La mejor respuesta se obtuvo con una frecuencia de corte cada 6 semanas y una dosis de abono completo (14-4-10) de 1700 kg/ha/año en 6 aplicaciones.

Un manejo eficaz puede reducir las variaciones en la producción de la hierba entre la estación seca y la estación húmeda.

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# RESPONSE OF PANGOLA GRASS (DIGITARIA DECUMBENS STENT) UNDER DIFFERENT SYSTEMS OF MANAGEMENT (FRECUENCY OF CUTTING, FERTILIZATION, NUMBER OF APPLIANCE OF FERTILIZER)

## S U M M A R Y

Pangola grass represents, in the Dominican Republic, the principal pasture grass.

The purpose of this current work is to study the behaviour of Pangola grass under different cutting systems. The yield and the changes of the percentage of dry matter in the plots, without fertilizer and with fertilizer, under three frecuencies of cutting (4, 6 and 8 weeks) is compared.

It was observed that:

a) The yearly yield an the percentage of dry matter increase with the frecuency of cutting in the case of the control;

b) With a constant frecuency of cutting, the response to increasing quantities of total fertilizer (14-4-10) has always been positive, measured as dry matter; meanwhile the percentage of dry matter decreased when the quantity of fertilizer increase;

c) The best response has been obtained with a frequency of cutting every 6 weeks and a quantity of total fertilizer (14-4-10) of 1700 kg/ha/year in six applications.

An efficient management can reduce the seasonal variability in pasture production.

# PRODUCTIVIDAD DE LA HIERBA PANGOLA (DIGITARIA DECUMBENS, STENT) BAJO PASTOREO

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## R E S U M E N

Con el propósito de estudiar el rendimiento de la hierba Pangola (Digitaria decumbens, Stente) bajo pastoreo, se usó media hectárea sembrada de esta hierba, sin fertilizar (parcela A), y se trató media hectárea (Parcela B) a razón de 250 kg. de N, 71.4 kg de $P_2O_5$, y 178.5 kg de $K_2O$ por Ha./año. Este experimento duró 250 días, y se usaron novillas, el promedio de cuyo peso era, al comenzar, de 267 kg. Los potreros se comenzaban a pastorear cuando la hierba tenía 22 cms. de altura, y los animales se sacaban cuando el pasto medía 10 cms.

La carga por Ha. variaba entre 1.6 y 5.2 unidades de ganado mayor (UGM) para la parcela A y entre 3.0 y 6.7 UGM para la parcela B.

Los intervalos entre pastoreos fueron de 32, 35, 61 y 104 días para la parcela A, y de 27, 35, 45, 53 y 61 días para la parcela B. En la Parcela A, la producción de materia seca fué a razón de 5.6 TM/Ha., y en la parcela B, de 6.8 TM/Ha.

Este experimento ha demostrado que en la parcela abonada la producción aumenta, permitiendo incrementar la carga y reducir los intervalos entre pastoreos por un promedio de 14 días.

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# PRODUCTIVITY OF PANGOLA GRASS (DIGITARIA DECUMBENS, STENT) UNDER GRAZING

## S U M M A R Y

In order to study the yield of Pangola grass (Digitaria decumbens, Stente) under grazing, a half hectare planted with Pangola grass (Plot A) was left unfertilized and a half hectare (Plot B) was fertilized in the proportion of 250 Kg of N, 71.4 Kg of $P_2O_5$ and 178.5 Kg of $K_2O$ per hectare per year.

This experiment lasted 250 days, and heifers were used whose average weight at the start was 267 Kg. Grazing was begun when the grass was 22 cms. high, and the animals were removed when the Pangola measured 10 cms.

The rate of stocking per hectare varied between 1.6 and 5.2 animal units (AU) for plot A, and between 3.0 and 6.7 AU for plot B.
The intervals between grazing periods were 32, 35, 61 and 104 days for plot A, and 27, 35, 45, 53 and 61 days for plot B. In plot A, the production of dry matter was 5.6 MT/hectare, and in plot B, 6.8 MT/hectare.

This experiment shows that production goes up in the fertilized plot, allowing the rate of stocking to be increased and the intervals between grazing periods to be reduced by an average of 14 days.

# ESTADO MORFOLOGICO Y RENDIMIENTO DE LA HIERBA PANGOLA (*Digitaria decumbens*, Stent)

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*Centro de Investigaciones Agropecuarias (CNIA)*

*República Dominicana*

## R E S U M E N

*A fin de establecer algunas normas para el uso adecuado de Pangola en la República Dominicana, se estudió el estado fisiológico, las variaciones morfológicas y el rendimiento de esta hierba cortada a edades que variaron entre las 2 y 20 semanas. Para el experimento se utilizaron campos no abonados por ser éstos los más representativos del país.*

*Se observó que al aumentar la edad de la planta correspondían un incremento de materia verde y de materia seca (1.6 a 23.2 TM/Ha. y 0.4 a 8.5 TM/Ha., respectivamente), y una disminución en el contenido de proteína cruda (11.7 a 3.9%), fibra cruda (32.9 a 31.0%), calcio, fósforo y potasio, además de variaciones irregulares en el contenido de extracto etéreo y ceniza.*

*Los resultados indican que la producción de proteína cruda fué de 0.35 TM/Ha. a las 2 semanas y de 0.46 TM/Ha. a las 20 semanas, mientras que el rendimiento óptimo de Pangola (0.52 TM/Ha.) se obtuvo cuando el corte se realizó entre las 8 y 10 semanas.*

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# MORPHOLOGICAL CONDITION AND YIELD OF PANGOLA GRASS (*Digitaria decumens*, Stent)

## S U M M A R Y

*In order to establish some standards for adequate use of Pangola grass in the Dominican Republic, a study was made of the physiological state, morphological variations and yield of this plant cut between 2 and 20 weeks of age.*

*This experiment was done with un fertilized pasture because they are more representative of this country. It was observed that, as the plant grew older, there was an increase in the yield of green roughage and dry matter (1.6 to 32.2 MT/Hectare, and 0.4 to 8.5 MT/Hectare, respectively), and a decrease in the crude protein (11.7 to 3.9%), crude fiber (32.9 to 31.0%), calcium, phosphorus, and potassium, besides irregular variations in the nitrogen-free extract and ash.*

*The results show that the crude protein production was 0.35 MT/hectare at two weeks and(0.46 MT/hectare at twenty weeks, whereas the maximum yield (0.52 MT/hectare) was obtained when the plant was cut at between eight and ten weeks.*

# ESTADO FISIOLOGICO Y RENDIMIENTO DE LA HIERBA ESTRELLA AFRICANA (CYNODON PLECTOSTACHYUS)*

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**Centro Nacional de Investigaciones Agropecuarias (CNIA)**
**(Laboratorio Control de Alimentos)**
**En colaboración con la Universidad Autónoma de Santo Domingo**
**Facultad de Ciencias Agronómicas y Veterinarias**
**Departamento de Zootecnia**
**República Dominicana**

## R E S U M E N

*El gran interés que ha despertado esta forrajera en el ambiente ganadero nacional y la escasa y contradictoria información de que se dispone en el país sobre esta gramínea, han hecho necesario hacer un estudio sobre las cualidades de esta hierba.*

*Se dispuso para ello de un campo experimental sin abonar de 12,25 x 22 mts. dividido en 30 parcelas de 2 x 2,75 mts. Los cortes se realizaron a 10 y 20 cms. de altura con una frecuencia de 2, 4 y 6 semanas. Las observaciones se refieren a rendimiento en materia seca, materia verde, estado fisiológico, altura, contenido de nutrientes (Weende) incluyendo Ca y P.*

*Los rendimientos en materia seca y materia verde indican una tendencia a aumentar con la edad de la planta sin guardar relación aparente con la frecuencia de corta (1,627,4 kg/ha. hasta 2,129,6 kg/ha. en materia verde para una frecuencia de corte de 2 semanas. Desde la segunda hasta la sexta semana, el porcentaje de materia seca aumenta casi un 9% (25.0 a 33.8%) independiente de la frecuencia de corte. El estado fisiológico se puede definir como estado vegetativo en la gran mayoría de los casos.*

*El contenido de nutrientes en la hierba adulta es aproximadamente similar al indicado en la literatura. La investigación está aún en proceso de desarrollo recomendándose estudiar el comportamiento de la hierba en función de la productividad en carne y/o leche.*

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## PHYSIOLOGICAL STATE AND YIELD OF AFRICAN STAR GRASS (CYNODON PLECTOSTACHYUS)

*The great interest which this forrage plant has awakened in the national livestock environment, and the scarce and contradictory information available here about this grass, have made it desirable to make study about characteristics of the plant.*

*For this purpose an unfertilized experimental field, measuring 12.25 x 22 meters, was divided into 30 plots of 2 x 2.25 meters each. The grass was cut down to 10 and 20 cm high at intervals of 2, 4 and 6 weeks. Observation were made according to yield of green and dry roughage, physiological state, height, and nutrient content (Weende), including Ca and P.*

*The yield of green and dry roughage indicate a tendency to increase with the age of the plant without any apparent relation to the cutting intervals (1,627.4 kg per hectare to 2,129.6 kg per hectare of green roughage for a two-week cutting interval). Between the second and sixth week, the percentage of dry roughage increased by almost 9% (25.0 to 33.8%), regardless of the cutting interval. The physiological state can be defined as vegatating in most cases.*

*The nutrient content in the adult plant is similar to that indicated in the literature. This study is still being conducted and it is recommended that a study be made of the plant as it relates to meat and milk production.*

A PARTIAL SUMMARY OF THE GROWING OF TOMATOES IN THE CARIBBEAN

| COUNTRY | MAJOR USAGE Fresh Market | Process-ing | EXPORT MARKET | VARIETIES* | CROPPING SEASON Winter | Summer | PROBLEMS |
|---|---|---|---|---|---|---|---|
| Antigua | yes | no | - | F:Manalucie Manapal, Indian River | yes | yes | irrigation |
| Barbados | yes | no | yes | F:Floralou Bounty, Indian River | yes | exp** | birds |
| Dominica | yes | no | yes | - | yes | - | |
| Dominican Republic | yes | yes | yes | P: Roma VF Chico II, Napoli | yes | exp | herbicides disease |
| French Guiana | yes | no | - | - | yes | - | disease |
| Grenada | yes | no | - | - | yes | - | |
| Guadeloupe | yes | no | yes | F:Manapal, Floradel, Floralou | yes | - | |
| Guyana | yes | no | - | - | yes | exp | |
| Jamaica | yes | yes | yes | - | yes | exp | |
| Martinique | yes | no | - | - | yes | exp | |
| Monserrate | yes | no | yes | Indian River Manalucie | yes | - | irrigation |
| Puerto Rico | yes | yes | yes | P:Chico, VF 145-21-4S, VF 145 B VF 145 M.H. F:Homestead Manalucie | yes | exp | labor costs, labor scarcity |
| St. Croix | yes | no | - | - | yes | - | irrigation |
| St. Kitts | yes | no | yes | Indian River | yes | - | |
| St. Lucia | yes | no | no | - | yes | - | |
| St.Vicent | yes | no | yes | - | yes | - | |
| Trinidad | yes | no | no | - | yes | - | |

* P=processing F=fresh
**experimental plantings

# THE EVALUATION OF TOMATO VARIETIES IN THE LEEWARD ISLANDS: A PROGRESS REPORT

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## INTRODUCTION

In the Leeward Islands the production of tomatoes is largely in the hands of peasant farmers who make use of commercially available varieties. The crop is established during the period September-November and matures in December-March which coincides with the dry season and also the period of lowest mean minimum temperatures (70-72°F). Even at the peak of production, local market demands in Antigua and St. Kitts are not satisfied, but production levels in Montserrat allow for some export of produce to the New York as well as other Caribbean markets.

The main problems associated with the industry are the evaluation of commercially available varieties according to time of planting, and extending production into the dry season by the introduction of irrigation. At the University of the West Indies research in tomato breeding is aimed at developing varieties for increased yield under dry season conditions and high yielding varieties that will set fruit at night temperatures above 72° for wet season production. However there is a pressing need in the Leeward Islands to examine the performance of the commercial varieties available in the area, especially in relation to time of planting. It is against this background that this work was undertaken.

## MATERIALS AND METHODS

Five 6x5 randomised complete block trials were carried out in Antigua, Montserrat and St. Kitts. The varieties tested were: Manalucie, Manapal, Urbana, Rutgers, Indian River, and Oxheart. In one of the trials in Montserrat, Rutgers and Urbana were replaced by Roma and Supermarket. Each gross plot consisted of six rows 32 feet long and 3 feet apart with plants 2 feet apart in the rows. Each end of the row being discarded. A basal dressing of NPK fertilizers mixed to give 60 lb/N, 80 lb $P_2O_5$ and 80 lb $K_2O$ per acre was made to all plots, and a side dressing of 30 lb N/acre applied at formation of first fruits. Planting dates were as follow:

| Experiment No. | Location | Date of Planting |
|---|---|---|
| 1 | Antigua, Diamonds Estate | 29 September, 1969 |
| 2 | Antigua, Diamonds Estate | 4 December, 1969 |
| 3 | Montserrat, Trants | 22 December, 1969 |
| 4 | Montserrat, Trants | 9 February, 1970 |
| 5 | St. Kitts, Ottley's | 3 October, 1969 |

Weeds were controlled with diphenamid applied at the rate of 5 lb/acre at transplanting. Sevin and zineb were used to protect the crop from insect and disease attack.

## RESULTS AND DISCUSSION

The mean yields of marketable fruit are shown in Table I. The mean yields obtained in Experiment 1 in Antigua were better than those in Experiment 2 which was planted later in the year. The same was true of the earlier planting in Montserrat where both crops had supplementary irrigation applied.

TABLE I Mean yields of marketable tomato fruit in tons/acre.

| Experiment No. | Variety | Mean Yields |
|---|---|---|
| No. 1 Antigua | Manalucie | 12.0 |
| | Manapal | 11.9 |
| | Indian River | 11.8 |
| | Oxheart | 10.4 |
| | Urbana | 10.2 |
| | Rutgers | 9.6 |
| | C.V = | 13.0% |
| No. 2 Antigua | Manalucie | 9.6 |
| | Manapal | 9.3 |
| | Indian River | 9.1 |
| | Rutgers | 8.9 |
| | Urbana | 7.7 |
| | Oxheart | 6.2 |
| | C.V = | 15.3% |
| No.3 Montserrat | Indian River | 13.7 |
| | Oxheart | 11.9 |
| | Urbana | 11.5 |
| | Manalucie | 10.5 |
| | Rutgers | 9.4 |
| | Manapal | 9.3 |
| | C.V = | 21.5% |
| No.4 Montserrat | Supermarket | 6.5 |
| | Indian River | 6.0 |
| | Manalucie | 4.8 |
| | Oxheart | 4.5 |
| | Manapal | 4.4 |
| | Roma | 4.4 |
| | C.V = | 35.9% |
| No.5 St. Kitts | Indian River | 19.0 |
| | Urbana | 18.5 |
| | Rutgers | 16.0 |
| | Manapal | 15.9 |
| | Manalucie | 15.2 |
| | Oxheart | 13.2 |
| | C.V = | 17.9% |

Lines indicate common subsets at the 5.0% level of significance according to Duncan's Multiple Range Test.

Table 2. Climatological data recorded at experimental sites

| Month | ANTIGUA | | | MONTSERRAT | | | ST. KITTS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Air Temp. °F Mean Min | Rain-fall in. | P.E.[1] in. | Air Temp. °F Mean Min | Rain-fall in. | P.E.[1] in. | Air Temp. °F Mean Min | Rain-fall in. | P.E.[2] in. |
| | | | | 1969 | | | | | |
| Sept. | 74.7 | 4.08 | 5.8 | 77 | 1.46 | 5.81 | 77 | 8.10 | 6.80 |
| Oct. | 72.6 | 6.25 | 5.4 | 74 | 9.12 | 5.70 | 75 | 11.55 | 5.35 |
| Nov. | 72.3 | 4.33 | 4.8 | 75 | 11.01 | 5.08 | 74 | 7.39 | 5.11 |
| Dec. | 70.9 | 1.09 | 4.3 | 71 | 4.82 | 4.61 | 73 | 5.44 | 6.06 |
| | | | | 1970 | | | | | |
| Jan. | 70.4 | 1.07 | 4.0 | 70 | 2.96 | 4.03 | 77 | 0.78 | 5.44 |
| Feb. | 68.5 | 1.01 | 3.8 | 69 | 1.14 | 4.10 | 69 | 2.49 | 4.68 |
| March | 69.1 | 0.84 | 4.3 | 70 | 0.48 | 4.64 | 70 | 2.70 | 4.47 |
| April | 72.6 | 1.78 | 5.4 | 72 | 3.34 | 5.36 | 73 | 4.25 | 5.32 |

1 Estimated by Thornwaithe's Method. 2 Measured in Evapotranspiration from Zoysia grass.

With the exception of Experiment 4 the yields shown in Table I were very satisfactory with averages being 8 to 11, 11 and 16 tons/acre in Antigua, Montserrat and St. Kitts respectively. Indian River and Manalucie gave the best results.

The varieties were also assessed for acceptability by consumers on the basis of the following fruit characteristics: shape and size, seed content, colour (both interior and exterior), and flavour. Indian River and Manalucie were the varieties preferred. Because of its large fruit size, there was a strong preference on the part of hoteliers for Oxheart, but it has been dropped from further testing since it did not stand up well to packing for shipment and was very susceptible in the field to damage by rats. Urbana has also been dropped because the fruit appears to be affected by a spotting condition which is associated with a bacterial infection.

Climatological data taken at the experimental sites is given in Table 2. An examination of mean minimum temperatures and rainfall during the period of active growth of the crop would suggest that the most important factor limiting production in the dry season was soil moisture. This was especially true in Antigua where soil moisture deficits ranged from 2.96 inches in December to 3.46 inches in March. In Montserrat where sprinkler irrigation was at times available, the amount of water applied was not measured, and there is therefore an indication that more work is needed to determine the water requirements of various crops grown under irrigation.

It should be noted that even if there may be some association between poor fruit setting and high night temperatures during the period April-June when mean minimum temperatures range from 74-76°F at this time there is a pronounced scarcity of tomatoes on the local markets. Even with reduced yields, it would be economical to make the produce available because of high market demands.

In Appendix I, an estimate is given of the costs of production and net returns per acre from tomatoes in Antigua. Labour rates are based at $0.80 per hour and the cost of fruit at $0.30 which is the price paid to producers by the marketing depot in Antigua. At these rates, and with a minimum yield of 20,000 lb fruit/acre, the net returns would be about $4,700. It is also worth noting that in Antigua, it requires a minimum yield of 4,280 lb of marketable fruit per acre in order to meet costs of production.

## ACKNOWLEDGEMENTS

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## RESUMEN

En las Islas Leeward hay un potencial para desarrollar la producción de tomates frescos al igual que otros mercados cercanos al Caribe. El problema principal de centros de producción en relación a la evaluación de variedades y su desarrollo con el tiempo de siembra. Variedades comerciales de tomates que estaban a disposición fueron examinadas en cinco ensayos llevados a cabo en Antigua, Montserrat y St. Kitts hacia el final de 1969. Rendimientos promedios fueron de 8.5 a 19.0 tons/acre de fruta para el mercado con el Río Indio y Malucie siendo estos los mejores.

Estimated Costs of Production and Net Returns per acre of Tomatoes: Antigua.

| COST | Amount (Man-Hours) | Cost and Value $ |
|---|---|---|
| (a) LABOUR per acre | | |
| Nursery | 35 | 28 |
| Transplanting | 80 | 64 |
| Weed Control (Chemical and Mechanical) | 100 | 80 |
| Pest & Disease Control (knapsack sprayers) | | |
| Fertilizer application | 20 | 16 |
| Harvesting | 280 | 224 |
| Sorting for Market | 100 | 80 |
| Value of Supervision | | 300 |
| Total Cost of Labour | | 840 |
| (b) SUPPLIES | | |
| Seeds | | 5 |
| Chemicals - Weedicides | | 55 |
| - Insecticides | | 25 |
| - Fungicides | | 52 |
| Fertilizers | | 50 |
| Total Cost of Supplies | | 187 |
| (c) SERVICES | | |
| Ploughing | | 40 |
| Harrowing | | 10 |
| Rent - 6 months | | 6 |
| Transport | | 200 |
| Total Cost of Services | | 256 |
| TOTAL COSTS (a+b+c) | | 1,283 |
| MIMINUM EXPECTED YIELD | 20,000 lb. | 6,000 |
| NET RETURN | | 4,717 |

Labour rate $0.80/hr.

# TESTING TOMATO VARIETIES IN GUADELOUPE

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## Material and crops methods

Twenty five tomato varieties were compared. 4 repetitions of 5 plants per variety were grown. This trial was seeded 12/26/69, planted 1/26/70, harvested till 4/20/70.

Rainfall amounted only to 260 mm during the trial, making some irrigation (by aspersion) neccessary. Maximum temperatures and minimum night temperatures average 26,9°C and 19,7°C respectively.

The type of soil is ferralitic. The preceding plantation was sugarcane. The parcel was limed (3 metric tons of lime/ha) before planting. Mineral fertilizer was added (N 120 kg/ha, $P_2O_5$ 140 kg/ha, $K_2O$ 200 kg/ha). Nitrogen dressing was fractionated.

Planting density was 17 000/ha. The trial was performed on stakes and plants pruned to one branch.

Some phytosanitary treatments were made necessary: a) insecticide - Aldrin, soil treatment before planting and Diazinon (Basudin) after occurrence of leaf miners. b) fungicides - Copper (cupravit) and mancozebe (Dithane M 45) alternated.

## R E S U L T S

### Disease Resistance

The prevalent disease was the bacterial wilt (Pseudomonas solanacearum). No variety was found resistant or tolerant. This result was in conformity with other studies (1). Three fungal diseases caused some defoliation. Phoma destructiva, Cladosporium fulvum, Stemphylium solani. They were previously observed in French West Indies (2) (3).

All the varieties tested were found susceptible to the first disease. On the contrary, some of them were rated resistant to the two other ones (Table I).

### Fruit Qualities

Fruits were harvested at turning stage. Fruits were rotten rapidly after maturity in spite of moderate rains. This was the reason for frequent harvests (5 days intervals). Fruits of commercial value were the only ones to be rated.

### Cracking resistance

Crack ratings were increased three fold after rains. Statistical analysis of the data of four harvests was made (see Table 2).

Fruit weight and color: A strong decrease in fruit weight was observed in the last harvests (Table 3). Some varieties presented - fruits of low coloration. This is possible due to excessive temperature.

Earliness and Yield: Earliness is measured from seeding till the first ripe fruit. The meadians of individual data are given in Table 4. Commercial yield is given.

Table I RESISTANCE RATING TO TWO FUNGAL DISEASES FOR 25 TOMATO VARIETIES

| Variedades | Cladosporium | Stemphylim |
|---|---|---|
| Anahu | Very susceptible | Resistant |
| Atkinson | S | R |
| Bradley | S | S |
| Campbell 17 | S | S |
| Campbell 135 | S | S |
| Campbell 146 | S | S |
| Cuyano | S | S |
| Scout | S | S |
| Floradel | R | R |
| Floralou | R | R |
| C 17 | R | R |
| Glamour | S | S |
| Gulf state Market | Not very susceptible | S |
| Hotset | S | S |
| Indian River | R | R |
| Manalucie | R | R |
| Manapal | R | R |
| Marglobe | S | S |
| Marion | S | R |
| Pearl Harbor | Very susceptible | S |
| Pink dal | S | S |
| Saint-Pierre | S | S |
| Sioux | S | S |
| Supermarmande | S | S |
| Supersioux | S | S |

R=resistant
S=susceptible

Table 2 CRACKING RESISTANCE OF 25 TOMATO VARIETIES

| Varieties | Average crack ratings (from 0 to 5) | |
|---|---|---|
| Pinkdeal | 0,1 | a* |
| Campbell 146 | 0,4 | ab |
| Campbell 17 | 0,5 | abc |
| Supermarmande | 0,5 | abcd |
| G 17 | 0,6 | abcd |
| Campbell 135 | 0,8 | abcd |
| Scout | 0,9 | abcde |
| Floradel | 0,9 | abcde |
| Indian River | 1,0 | abcde |
| Bradley | 1,1 | abcde |
| Floralou | 1,3 | abcdef |
| Glamour | 1,4 | bcdef |
| Gulf state Market | 1,4 | bcdef |
| Hotset | 1,4 | bcdef |
| Marglobe | 1,4 | bcdef |
| Anahu | 1,5 | bcdef |
| Cuyano | 1,5 | bcdef |
| Manalucie | 1,5 | bcdef |
| Manapal | 1,6 | cdef |
| Marion | 1,6 | cdef |
| St-Pierre | 1,6 | cdef |
| Pearl Harbor | 1,8 | defg |
| Atkinson | 2,1 | efg |
| Sioux | 2,5 | fg |
| Supersioux | 3,0 | g |

*Varieties sharing the same letter are not significantly different. (Duncan's multiple range test 5%).

Table 3 FRUIT WEIGHT AND COLOR FOR 25 TOMATO VARIETIES

| Varieties | Coloration | Weight/fruit (g) |
|---|---|---|
| Atkinson | 5* | 208 a** |
| Campbell 146 | 2 | 205 ab |
| Floradel | 4 | 193 abc |
| Marion | 4 | 185 bcd |
| Manalucie | 4 | 183 cd |
| Campbell 135 | 1 | 173 cde |
| Pinkdeal | 3 | 170 def |
| Glamour | 2 | 168 def |
| St-Pierre | 5 | 168 def |
| Manapal | 4 | 165 defg |
| Marglobe | 3 | 165 defg |
| Bradley | Pink | 155 efg |
| G 17 | 3 | 155 efg |
| Indian River | 4 | 155 efg |
| Campbell 17 | 1 | 148 fg |
| Supersioux | 2 | 148 fg |
| Floralou | 4 | 145 g |
| Gulf state Market | Pink | 143 gh |
| Anahu | 2 | 143 gh |
| Hotset | 3 | 123 hi |
| Cuyano | 3 | 118 ij |
| Sioux | 3 | 115 ijk |
| Supermarmande | 2 | 105 ijk |
| Pearl Harbor | 1 | 100 jk |
| Scout | 1 | 95 k |

*5 very well colored to 1 badly colored
**Varieties with the same letter not significantly different (Duncan's multiple range test 5%).

Table 4 YIELDS AND EARLINESS OF 25 TOMATO VARIETIES

| Varieties | Yield Kg/plant | Earliness days seeding to maturity |
|---|---|---|
| Manapal | 2,30 a* | 88 |
| Floradel | 2,20 ab | 88 |
| Floralou | 2,20 ab | 87 |
| Indian River | 2,15 abc | 86 |
| Hotset | 2,00 abcd | 81 |
| Atkinson | 1,95 abcd | 86 |
| Supersioux | 1,90 abcd | 85 |
| G 17 | 1,90 abcd | 86 |
| Campbell 146 | 1,85 abcd | 87 |
| Manalucie | 1,85 abcd | 89 |
| Marion | 1,85 abcd | 86 |
| Pinkdeal | 1,85 abcd | 87 |
| Anahu | 1,80 abcd | 85 |
| Scout | 1,75 abcd | 87 |
| St-Pierre | 1,75 abcd | 89 |
| Pearl Harbor | 1,70 bcd | 82 |
| Sioux | 1,70 bcd | 81 |
| Bradley | 1,65 bcd | 86 |
| Gulf state Market | 1,65 bcd | 86 |
| Campbell 17 | 1,60 cd | 85 |
| Campbell 135 | 1,60 cd | 86 |
| Supermarmande | 1,60 cd | 78 |
| Cuyano | 1,55 d | 78 |
| Marglobe | 1,50 d | 88 |
| Clamour | 1,45 d | 87 |

*Varieties sharing the same letter are not significantly different.
(Duncan's multiple range test 5%).

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# TOMATO AND PEPPER PRODUCTION IN BARBADOS

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## INTRODUCTION

Both Tomatoes and Peppers are two vegetable crops produced in Barbados on a relatively small scale. This does not mean that they are not popular. On the contrary, they are reasonably popular with the consumer, but there are several problems which have seriously affected production of these two crops. The same problems have, to a great extent, also limited to amount of research undertaken on these crops.

There have been few farmers who have paid any real interest in the production of these two crops. However, these crops have been planted to some extent in Sugar Cane preparation land at relatively wide spacing, or to put it another way at low plant population densities, with varying results (from one to two tons per acre)*. Of the two crops, Tomatoes and Peppers, the farmer has been by far the more important crop as is seen by the sale of planting material from the Ministry of Agriculture Seed Store.

## TOMATOES AND PEPPER VARIETIES

Very little research has been undertaken on varieties of these crops. The Ministry of Agriculture operates a vegetable seed store which makes vegetable seeds available to the Farmer. Whereas this is not the only source of vegetable planting material available to farmers, it probably caters to the majority of farmers.

The tomato varieties sold to farmers over the last five years or so have been: Bounty, Indian River, Flora Lou, and Success, with Bounty being by far the most popular. Manalucie has also been used, but only in the dry season.

Over the same period the pepper varieties sold to farmers have been: Ruby King, California Wonder, Yolo Wonder and Early Wonder.

## THE MAIN FACTORS AFFECTING THE PRODUCTION OF TOMATOES AND PEPPERS

### Birds

Probably the biggest single factor operating against the economic production of tomatoes and peppers in Barbados is that of birds. The two types mainly responsible are the Sparrow and the Black birds. Some research was undertaken, with a view of eliminating the bird damage problem with varying degrees of success. Sarran Netting was used to cover areas, but whereas this was somewhat successful, the costo involved was prohibitive. Areas up to one acre were enclosed under nylon netting and these too gave almost perfect control but the cost was exceptionally high, and the farmer, of necessity, was forced to plant his crop continuosly resulting in a nematode build up. In initial stages as much as 30 tons of tomatoes were harvested from one acre. Simple bird acares and explosive devices were also used but in a relatively short period of time the birds became accustomed to the devices.

*Vegetable Production in Barbados by K.A. Ingersent, A.H. Brathwaite and J.O.J. Nurse.

In trials carried out by the Ministry of Agriculture in 1966 the percentage of bird damage experienced in control plots was as high as 58%, while commercial farmers have reported as high as 80% bird damage.

The bird damage problem is by no means solved and this is beyond doubt the biggest deterrent to both commerdial production and research trials.

## Seasonality

There are basically two seasons in Barbados; the wet season and the dry season. The dry season starts late in the year or very early in the year. There is sufficient moisture in the early part of the dry season to permit good land preparation, germination and establishment, permitting maturity to take place when there is little precipitation. The nights are also coolest and these overall conditions apparently favour tomato and pepper production, and the largest acreages are planted at this time.

There are a tremendous amount of difficulties experienced in wet season production. Land preparation is difficult as a result of sodden conditions. Young plants are lost to damping off as a result of excessive moisture and the indidence of insect and fungal disease problems are high as a result of an adversaly effected spray programme. For this reason only very few farmers take the risk of planting during this season, and the do so as a result of the high retail prices which prevail during this period ($1.00 - 1.80 per lb retail).

It has been found that varieties which do well in the dry season need not do well during the wet season. Night temperatures are different, being somewhat higher during the wet season, and this no doubt has an adverse effect. A variety like Manlucie for instance performs very well in the dry season, but produces a dense mass of vegetative growth and sometimes little or no fruiting during the set season. A variety like Bounty does not do as well in wet as in dry season, but considerably better than Manalucie.

## Marketing and Labour Problems

Marketing uncertainties do exist and to some extent affects production of vegetable crops in general. Many plantations would probably also plant larger acreages of both crops if labour shortages could be overcome or if mechanization could replace a larger amount of labour.

More recently with the introduction of the Staley Precision Seed Drill, there has been increased interest in vegetable production since nursery preparation for vegetables is eliminated and direct seeding carried out.

## Weedicide Damage

Sugar Cane occupies approximately 80% of the arable acreage of land in Barbados. More and more farmers, particulary the larger plantations (there are 210 of these) are employing weedicides for weed control. Vegetable crops in general are adversely affected as a result of spray drift, volatility, incorrect technique etc.

## Price

Price to some extent tends to have an effect on the production of these crops. There are times particularly during the later part of the wet season and the early dry season when retail prices soar. This tends to act as an incentive and acreages are increased. When this happens, there tend to be over production, and prices fall rapidly particularly since the crops are perishable, and acreage is subsequently witheld or planted to alternative crops. In a situation as outlined above, acycle is put in motion.

## IMPORTATION AND EXPORTATION

As mentioned earlier, large quantities particularly of tomatoes are imported into Barbados at high value. Table I below shows quantity and value of tomatoes imported into Barbados over the period 1967 to 1969. Unfortunately no statistics are available on peppers since these are grouped with 'other vegetables' in the Import - Export statistics.

Table 1.- Imports of Tomatoes (Fresh)

| Year | IMPORTS | |
|---|---|---|
| | Quantity 1000 lb. | C.I.F. Value $1000 |
| 1967 | 117.6 | 50.6 |
| 1968 | 149.4 | 97.2 |
| 1969 | 179.7 | 161.4 |

Table 1 clearly shows that increasing quantities and value of tomatoes are being imported into Barbados.

It was mentioned earlier that there are occasional periods of - glut when tomatoes are exported. There are also times when tomatoes are imported and re-exported. Table 2 show quantity and value of tomatoes Exported and Re-exported over the period 1967 - 1969.

Table 2.- Exports and Re-Exports of Tomatoes (Fresh)*

| Year | Exports and Re-Exports | |
|---|---|---|
| | Quantity 1000 lb. | C.I.F. Value $1000 |
| 1967 | 12.3 | 5.6 |
| 1968 | 21.2 | 8.2 |
| 1969 | 4.1 | 1.5 |

*Import - Export statics, Government Statistical Services, Barbados.

## ESTIMATED ACREAGE AND PRODUCTION

Accurate information is not available for acreage and production of the crops. During 1967-1968 however, the Ministry of Agriculture Barbados, undertook a survey of Vegetables Production and from this umpublished data, together with umpublished Food Crops Inspector's Reports the following figures were extracted and presented below as Table 3. Peppers are again grouped with other vegetables so that specific information is not available for peppers.

Table 3.- Estimated Gross Output of some Vegetables from Estates and Small Holdings

| Crop | Estimated Acreage | | | Estimated Production 000 lb. | | | Estimated Gross Output $ 000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | E | S | T | E | S | T | E | S | T |
| Tomatoes | 123 | 35 | 158 | 551 | 161 | 712 | 127 | 29 | 156 |
| Other Vegetables | 47 | 748 | 795 | 211 | 3,394 | 3,605 | 44 | 577 | 621 |

E = Estates, S = Small holders, T = Total Producers.

Table 3 shows that whereas the Estates or Plantations have been the Principal producers of Tomatoes, small farmers have been the main producers of other vegetables.

Within the last year or so a new pattern of production is emerging. There is a discinct effort at specialisation in the production of vegetable crops an acreages ranging from about twenty to sixty - acres. Whereas onions appear to be the main crop of specialisation, both tomatoes and peppers have been include, and ultimately this will inevitable give rise to increased production.

## SUMMARY

Wheareas the Production of tomatoes and peppers have not been of tremendous importance in Barbados in the past, more recently they are increasing in importance. There are several problems involved - in Tomato and Pepper Production which have had adverse effects on both production and research. The principal problem is that of bird damage, caused mainly by Sparrows and Black Birds. If bird damage - problems can be solved, this in itself would of necessity lead to in creased interest in these crops. More recently, there is a new -- trend in Vegetable Production in Barbados which should ultimately - lead to increased production of tomatoes and peppers.

# THE TOMATO INDUSTRY IN THE DOMINICAN REPUBLIC

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## INTRODUCTION

The industry had its first faint beginnings about 29 years ago. However, we usually consider its first official beginning from 1967. In both cases, the industry was begun by Mr. José Barceló, Hato del Yaque near Santiago. What we term "the" tomato industry actually has its its origin much later. Barceló Industrial acquired new equipment in 1962 and began processing in earnest. The addition of Peravia Industrial in Baní and Industrias Portela in Navarrete approximately 4 years ago and further expansion by Barceló Industrial in 1968 provides the country with a capacity of about 1,500 tons per 24 hours. These plants, with Brugal Industrial in Puerto Plata, represent an investment of approximately 4 million pesos in equipment and buildings.

## AREA

The pear-shaped tomato used for processing is grown for the industries in Azua, Bani, Manzanillo, Guayubin and in the areas of Esperanza y Mao Last year, approximately 6,150 acreas were grown. This year, it is expected that an area of about 9,000 acreas will be planted. This increase has been due to climatic factors. The plantings represent an investment of about 1,800,000 dollars for production costs, in the field. Financing is furnished by the Agricultural Bank and AID and by the respective companies. The labor force varies from 1,000 to 15,000 laborers. The primary areas of Manzanillo, Guayubin, Mao and Esperanza were previously planted in bananas by the United Fruit Company. With the departure of the United Fruit, the area soon declined in economic importance to the country. The growth of the tomato industry has provided new life to the area and it has now returned to be of economic importance. Of the approximately, 9,000 acres to be planted this year, 2/3 of the planting will be in these areas. Azua is a new area for tomato production. However, this area have two future problems: lack of water and mosaic. Further studies on the water table in the Azua basin area are a must. If we continue to pump out water indiscrimanately, the area may return to its former dry status. Most of the plantings in Azua will be with the Agrarian Reform. Planting with the Agrarian Reform in the country is taking on an important significance. It is estimated that about 3,000 acres will be planted with this organization this year. The industry has provided the Reform farmers with a good cash crop. Here to fore these farmers had been forced to plant secondary crops of low income. The industry grows under contract with approximately 460 farmers.

## VARIETIES

Our basic tomato variety is Roma VF. Las year, successful plantings of Napoli and Chico II were made. We expect that these two varieties will be planted on a much larger scale. Both look quite good. However, we do not foresee any rapid changes made in our varieties. The Roma variety has proven to be a good producer and will probably continue to be our basic variety for some to come. Solid concentrates vary from 2.7 to 5.2 depending on our climatic conditions which is to say rainfall. Napoli and Chico III offer one distinct advantage in that they can be doubled rowed on our spacing of 60 to 63 inches and the pickers still can get in and harvest without causing too much damage. But again, early plantings will make a heavier growth than our later plantings. Chico III shows one disadvantage in that it does no like to be transplanted. It must be hardened off and this is a new process that we will have to teach our farmers. Therefore, only our most experienced farmers are growing Chico III and they are direct seeding. Napoli apparently does not suffer this disadvantage. Both varieties are about 5 to 10 days earlier than Roma.

## SOILS AND FERTILIZERS

Soils in the primary area may be classified as clay loam and sandy loam. The pH varies from 7.0 to 8.1 or 8.2 an average would be about 7.4 to 7.5. Our soils are normally low in phosphate and nitrogen. Potash is usually high to very high but we are not sure that it is all assimilated. Further work needs to be done. Magnesium is adequate and calcium usually high to very high. Organic matter runs from 2.0 to 3.5%. Soluble salts vary from a low of 1.00 to a high of 11.00 toward the end of the river Yaque del Norte at Manzanillo. However, the salt content was reduced considerably by the flooding of the river Yaque in December 1968 and the high rainfall in 1969 and this year (1970).

Many of our farmers are forming the habit of taking soil samples for analysis. The Food and Agricultural Organization at the Institute for Superior Agriculture in Santiago analyzes the samples for a small fee. The National Laboratory in San Cristóbal also does analysis. However, in lieu of or with the analysis most of our farmers use the formulas 16-20-0 and 12-24-12. Rates vary from 260 to 600 lbs per acre. Some farmers sidedress at the rate of 60-120 lbs. of Urea at the second flower stage. Nutrileaf and other foliage fertilizers are quite popular.

## PLANTING

We use both the direct and transplanted systems of plantings. The former made its appearence in January 1969 after the Yaque floods. It was the only way to get back into production rapidly. Some of our farmers have built their own planting units. Others plant by hand or use a one wheel Planet Junior.

In general most of our farmers use the transplanting method. Spacing is usually 60 to 63 inches between the rows and 12 to 18 inches between plants in the row. We have found that our variety Roma VF gets quite bushy during our planting of September and October. This is specially true if we do not hold down our nitrogen. This heavy growth makes its more difficult to spray and harvest.

## HERBICIDES

We desperately need an effective, short-term residual and non-incorporated herbicide. Cultivation is one of our highest costs, particularly in direct seeding. Weeds and the lack of adequate equipment are the principal deterrents to direct seeding. We need a short-term residual herbicide so as not to interfere with our crop rotation. At present, little or no rotation is practiced. However, grain sorghum, corn and soybeans offer new possibilities.

## INSECTS

Insects in the field as yet have not constituted a major problem. The most prevalent insects are tomato fruit worm, Heliothis armigera, hornworm Protoparce Sesta, leaf miners, Liriomyza pusilla, and occasionally aphids. Products used to control insects are Rothane, Cygon, Dipterex, Metasystox, Jeboderix, Malathion, and Forbidan. Parathion and aldrin are used in extreme cases. Sevin is recommended just before and during the harvest.

Nematodes have been reported in the Baní and Azua area.

## DISEASES

Our most serious problem in the field is plant diseases. In the seed bed for our September plantings we may expect various organisms causing damping off. Later on, Alternaria solani, (Early Blight), shows up as does Stemphylium solani (Grey leaf spot). Last year, because of unusual conditions, Phytophora infestans presented us with great difficulties. In

some cases, late blight in conjunction with heavy rainfall and the in ability to spray effectively virtually wiped out our early plantings. Rhizoctonia solani (rot) becames a problem at this time as well. Coleetotrichum phomides (anthraenose) has been observed but is not a mayor disease. Claudisporium is prevalent in Azua. In all cases, control is the application of Dithane-45 and Anthracol. Some Captan, Maneb, Zineb, Copper and Manzate are used, but to a lesser extent. By far the most popular product is Dithane-45. Applications are made by hand sprayers, ground rigs, and by plane.

## HARVESTING

Harvesting was previously done in wooden lugs holding approximately 50-55 lbs. of tomatoes. These were loaded into the trucks and transported to the plants. Then plastic boxes were introduced. Two crops ago, the large wooden bins appeared for transport after picking with the plastic crates. Hauling and handling at the plant is much more efficient with the larger crates. Harvesting is one our most serious problems. In general, our pickers have no sense of responsability. stepping on the vine and on the fruit. Most of the pickers are women and children. Costs of picking vary from 15¢ per 100 pounds at the beginning of the season to - 35¢ at the end of the season. The lack of sufficient pickers also presents a problem. Although there are probably sufficient people in the area may times we are forced to haul people from to 20-25 miles away. The tomatoes are bought in the field by the processors at $28 per ton, fixed by governmental decree.

This year tomatoes will be hauled from distances of 5 to 170 miles. Freight per 100 pounds varies from 10 to 50¢ depending on the distance and road conditions. The processing plants pay all transportation costs. Production costs up to the harvest stage vary from 90.00 to $195.00 per acre. This spread is so notable because it depends on whether the farmer has equipment, who he is, and his capability. Ironically as it may seem, we have found that farmers with no equipment can usually produce at lower costs. In many cases, these are family plantings and usually not over ten acres.

Our highests costs are the following:

| | |
|---|---|
| Land preparation, farmers W/O equipment | $20/A |
| Transplantings | 10 |
| Chemicals and application | 18 |
| Cultivation | 15 |
| Fertilizer and application | 25 |

Yields vary from 4 to 20 tons per acre. We know that we have capacity to reach at least 26 tons. Profit, therefore, varies from 14 to $355 per acre. Our average yields have been exceptionally low for the past two - years. Consequently, both the industry and its farmers are approaching a crisis. We must produce more this year.

## PROBLEMS

First naturally is the heavy rains. The industry has had 2 consecutive bad years. We should have been able to cut off al imports of tomato to paste in the crop years 1963-69. We trust that we will be able to do so this year. Year before last we had 60 inches of rainfall during our harvest period and this past year 45 inches.

Secondly is the problem of credit. The Agricultural Bank, backed by AID, processes the loans entirely too slow. We have had cases where it has taken 4 to 5 months to process and approve or disapprove a loan. Private banks do not loan money in this sector of agriculture. Our planting season begins in September and ends in January. It is difficult for the growers to set up and keep a planting schedule. Since each plant has a fixed capacity, each delay throws the planting schedule off and puts more pressure on the processing plant. In a normal climatic year, this could be disatrous for the industry.

Lack of equipment is our third basic problem. Due to the rains our farmers have not been and are not in a position to buy equipment to help lower production costs. Fully equiped , a farmer might be able to produce for as low as 90 dollars per acre.

As previously stated, the need of a good effective herbicide for use under our conditions would be our fourth problem.

Fifthly, a good cash crop for rotation with our tomato plantings and a credit source. Fortunately, FAO work in soy beans looks promising. As stated another promising crop, for our larger farmers, may well be grain sorghum.

As the following data suggests, we have been able to substantially reduce our imports.

NATIONAL PRODUCCION/TONS

| | 1965 | 1966 | 1967 | 1968 | 1969 |
|---|---|---|---|---|---|
| Paste: | 847 | 1922 | 3056 | 6957 | 4100 |

IMPORTS

| | | | | | |
|---|---|---|---|---|---|
| Paste: | 1911 | 2480 | 1114 | 607 | 148* |
| Puree: | 146 | 158 | 119 | 112 | 31* |

The industry usually starts processing around December 20 and terminates in May. During the off-season, the industry maintains a part of its work force canning nectares, fruit juices, and pigeon peas. Future projects for the plants are soups, marmalades and jelly, vinegar, peppers and perhaps frozen vegetables for export. Within the next five years,the author predicts that the industry will be quite diversified and not so dependent upon tomatoes. We are looking at the export market and appears that we will enter it.

*First 4 months.

# INFLUENCIA DE EPOCA DE SIEMBRA EN LA PRODUCCION DE VARIEDADES DE TOMATE

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## INTRODUCCION

El cultivo de tomate para uso industrial es uno de lo más importantes en la economía del País, ya que en el año 1966 se importó pasta de tomate por valor de $880,000 (1). Actualmente están en explotación alrededor de 2,062 Has., principalmente en las zonas de Baní y la Línea Noroeste (Valverde, Guayubín, etc.).

La firma industrial Barceló & Co., C. por A., fué la primera que se dedicó a la explotación comercial de este cultivo por lo que a la variedade Roma, la más conocida y explotada del País, se le llama vulgarmente "Barceló". A partir del año 1967 se instalaron dos nuevas industrias y por consiguiente aumentó la producción de tomate para uso industrial.

En la República Dominicana la época de siembra está limitada a los meses de octubre,-enero, causada principalmente por las condiciones ambientales adversas para el cultivo fuera de esta época, tales como exceso de lluvia o sequía y temperaturas altas.

Una de las enfermedades más malignas en la República Dominicana en este cultivo es el tizón temprano (Alternaria solani), otras enfermedades son: Mancha bacteriana (Xanthomona versicotaria) Mosaico (virus), Podredumbre del tomato por Phytophthora y manchas en las hojas por Septoria Lycopersici (2).

El objetivo principal del estudio es buscar y seleccionar variedades para siembras tempranas ó tardías, fuera de la época normal de siembra, de alto rendimiento.

## MATERIALES Y METODOS

Cuadro No.1: Las Condiciones Climatológicas del Estudio (3)

| Meses | TEMPERATURA MEDIA C° Máxima | Media | Mínima | Precipitación mm. | Evaporación mm. | Humedad Media Higroscópica % |
|---|---|---|---|---|---|---|
| | | (Siembra Temprana) | | | | |
| octubre 69 | 30.4 | 26.3 | 21.9 | 241.6 | 156.4 | 84.8 |
| noviembre | 29.2 | 25.2 | 22.7 | 254.3 | 88.0 | 83.0 |
| diciembre | 28.8 | 24.8 | 20.5 | 41.3 | 121.4 | 79.1 |
| enero 70 | 28.6 | 24.5 | 20.0 | 155.7 | 100.5 | 81.5 |
| febrero | 28.6 | 24.3 | 19.8 | 75.2 | 124.8 | 79.4 |
| | | (Siembra Tardía) | | | | |
| febrero 69 | 29.8 | 23.8 | 17.0 | 90.8 | 156.8 | 78.0 |
| marzo | 31.0 | 25.3 | 20.7 | 9.2 | 221.4 | 77.9 |
| abril | 31.9 | 27.0 | 22.5 | 62.0 | 199.8 | 79.9 |
| mayo | 31.7 | 26.8 | 22.7 | 130.2 | 152.2 | 84.2 |

Localización.- El estudio se ejecutó en los terrenos del C. N. I. A., en San Cristóbal, con una altura aproximada de 43 M.S. N.M. y con una precipitación media anual de 1250 mms.

Suelo.- El terreno es de estructura granular, textura franco-arcillo-arenosa y un pH 6.5. Aluvial reciente indiferenciado (4).

Fecha de siembra temprana 3-X '69
Fecha de siembra tardía 12-II-'69

Diseño Experimental.- Se utilizó el diseño experimental de Bloques al azar con 3 repeticiones. En la siembra de octubre se hicieron 5 repeticiones.

Todas las variedades recibieron igual atención referente a aplicaciones de insecticidas, fungicidas, labores culturales y demás para la debida conservación.

En las diferentes etapas del período vegetativo de los cultivos se llevaron a efecto todas las observaciones necesarias para la recopilación de los datos más importantes de las características de las variedades. La evaluación de los frutos en cada variedad se realizó en la etapa de mayor producción.

El método de siembra empleado fué directo, la distancia entre hileras fué de 1.50 m. y 0.15 m. entre plantas. El fertilizante aplicado fué de fórmula comercial 10-20-10 a razón de 727 kilos por hectárea, más dos aplicaciones de área al 45% a razón de 108.8 kilos por hectárea.

La humedad del suelo se mantuvo a un nivel adecuado por medio de riegos por surcos con sifones. En la siembra tardía se dieron 7 riegos con intervalos de 10 días mientras que en la temprana se dieron 5 con intervalos de 10 días.

La cosecha de la siembra tardía comenzó el 5 de mayo del 69 hasta el 26 del mismo mes, en total cinco. La de la siembra temprana comenzó el 31 de diciembre de 1969 y terminó el 11 de febrero de 1970.

## RESULTADOS Y DISCUSION

Los datos obtenidos para cada variedad con relación al rendimiento de los ensayos aparecen en el Cuadro No.2, en kg/ha.

Cuadro No.2: El rendimiento de 14 variedades de tomate.

| Variedades | Siembra temprana | Siembra tardía | Promedio |
|---|---|---|---|
| Chico | 32,010 | 36,524.8 | 34,267.8 |
| Roma | 26,090 | 31,881.6 | 28,985.8 |
| Heinz 1370 | 24,650 | 19,819.2 | 22,234.6 |
| VF-Roma | 23,400 | 39,168.0 | 31,284.0 |
| Chico III | 22,730 | 43,077.6 | 32,903.8 |
| Chico Grande | 22,690 | 33,510.4 | 28,100.2 |
| VF-Red Top #9 | 21,810 | 25,387.2 | 23,598.6 |
| VF-145 B | 18,380 | 24,486.4 | 21,433.2 |
| VF-145-21-4p | 16,150 | 19,705.6 | 17,927.8 |
| Heinz 1350 | 14,940 | 16,580.8 | 15,760.4 |
| VF-13 L | 10,840 | 19,576.0 | 15,208.0 |
| VF-36 | 9,010 | 13,398.4 | 11,204.2 |
| Ace | 8,530 | 9,230.4 | 8,885.2 |
| San Marzano | 5,540 | 16,201.6 | 10,870.8 |
| Diferencia significativa al nivel 5%= | 15,432.8 kgs/ha. | 10,356.32 kgs/ha. | |

Evaluación de Algunas Características de 14 Variedades de Tomate
(Evaluation of Some Characteristics of 14 Tomato Varieties)

| Variedades (Varieties) | Cubrimiento de la planta (Coverage of plant) | Parición (Fruit Set) | Tamaño (diámetro) del fruto (Size of fruit diameter) |
|---|---|---|---|
| Chico | 3.3 * | 4.2 ** | 2.0 *** |
| Chico III | 5.0 | 4.6 | 2.0 |
| Chico Grande | 2.5 | 4.0 | 2.0 |
| Rf-Red Top #9 | 3.0 | 4.0 | 1.8 |
| VF-Roma | 2.3 | 4.0 | 2.0 |
| Roma | 2.0 | 3.6 | 2.0 |
| VF-145-B | 3.5 | 3.0 | 2.5 |
| VF-145-21-4P | 3.7 | 3.0 | 2.8 |
| Heinz 1370 | 1.8 | 2.3 | 3.0 |
| Ace | 1.0 | 1.3 | 3.3 |
| VF-36 | 1.8 | 1.8 | 3.3 |
| VF-13-L | 4.3 | 2.5 | 2.7 |
| San Marzano | 1.0 | 3.2 | 1.8 |

Scale (Escala)

* 1 a 5 - Uno es bien cubierto y 5 es abierto completo como Chico III. (1 is co ver and 5 is open or poor coverage).

** 1 a 5 - Uno es poco parido en número y 5 es muy bien parido. (The lower the number, the poorer the set).

*** 1 a 5 - Representa el tamaño de los frutos maduros en pulgs. (Size of fruit in inches).

La producción total de todas las variedades fué baja en la siembra temprana debido a condiciones climatológicas adversas que se presentaron, especialmente el exceso de lluvia que ocasionó inundaciones a la plantación. Se presentó bacteriosis conocida con el nombre de "mancha bacteriana de los frutos". La variedad Chico ha demostrado características favorables en esta época de siembra, por lo tanto, los cosecheros pueden usar esta variedad con más probabilidades de éxito que otras variedades. Las variedades que tienen los frutos en forma redonda o esférica tuvieron mayor porcentaje de pudrición que las que tienen el fruto en forma ovalada. Sospechamos que la causa está relacionada con el contacto directo del fruto con el suelo.

En la siembra temprana las variedades de rendimiento más alto fueron: Chico (32,010 kgs/ha), Roma (26,090 kgs/ha), Heinz 1370 (24,650 kgs/ha), VF-Roma (23,400 kgs/ha), Chico III (22,730 kgs/ha).

En la siembra tardía las variedades de mayor rendimiento fueron: Chico III (43,077.6 kgs/ha), VF-Roma (39,168.0 kgs/ha), Chico (36,524.8 kgs/ha), Chico Grande (33,510.4 kgs/ha), Roma (31,881.6 kgs/ha).

La producción obtenida en algunas variedades como ACE, VF-36, San Marzano, Heinz 1350 y otras fué baja tanto en una siembra como en la otra.

La variedad Chico III demostró que tiene una buena capacidad de frutificación a altas temperaturas y se adapta a la recolección mecanizada lo que concuerda con la información que nos fué suministrada por el Centro de Investigación y Extensión Agrícola de la Universidad A&M de Texas.

En la siembra tempraana las variedades de rendimiento más alto fueron: Chico, Roma, Heinz 1370, VF-Roma, Chico III.

En la siembra tardía las variedades de mayor rendimiento fueron: Chico III, VF-Roma, Chico, Chico Grande, Roma.

La variedad Chico III puede ser de mucho futuro para la República Dominicana debido a que por su precocidad, forma de crecimiento (determinado), y maduración uniforme, permite ser recolectada en un tiempo menos que la variedad Roma u otras variedades, por lo tanto, baja el costo de producción por concepto de mano de obra.

## SUMARY

Since two years ago comparative tests involving fourteen - U.S.A. - originated tomato varieties have been underway.

Tests were made at San Cristobal Training Center (CNIA), - San Cristóbal, Dominican Republic, during two different seeding seasons to evaluate the production of the respective varieties under - such tests. According to results obtained the outstanding varieties were Chico, Chico III, Chico Grande and Roma.

## AGRADECIMIENTO

Agradecemos la maravillosa cooperación que nos brindó el - Dr. William N. Lipe, técnico en Horticultura de la Misión Texas A&M.

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# ENSAYO SOBRE DIFERENTES NIVELES DE FERTILIZANTES EN TOMATE

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## INTRODUCCION:

En las diferentes regiones del cultivo del tomate en el país nos existe hasta la fecha un estudio de las cantidades de fertilizantes favorables al mismo, observándose una tendencia de un aumento creciente en las áreas de cultivo y un incremento en todo el país, por lo tanto es nuestro propósito encontrar los niveles de fertilización más favorables con la finalidad de orientar a las personas interesadas através de nuestro organismo de divulgación con miras a incrementar su consumo interno y las posibilidades de exportación como fruto fresco.

Contreras (2) en México, observó que la aplicación de fertilizantes aumentó la producción, especialmente la aplicación de Nitrógeno y Fósforo combinados, encontrado que las cantidades económicamente más aceptables para esa zona fue de 40 kgs. de Nitrógeno y 50 kgs. de $P_2O_5$. Además encontró que la adición de 50 kgs/ha de $K_2O$ no elevó el rendimiento.

Bascone et al (1) en el valle de Aragua, Venezuela, no encontró diferencia significativa con varias dosis de Nitrógeno. Con el Fósforo observó un aumento significativo de producción. Con el Potasio observó un ligero aumento en la producción, pero éste no era significativo.

Lorla y Torres (4) llegaron a las conclusiones siguientes:

1. El N aumentó el rendimiento de tomate en forma lineal, obteniéndose la máxima producción con 150 kgs/ha.

2. El P aumentó el rendimiento en forma cuadrática dando las mayores producciones en los niveles de 200 y 400 kgs/ha.

3. Es necesario mantener un balance entre N y P en la fertilización. Cualquiera de los dos que falte produce rendimiento muy bajo de las plantas de tomate.

4. Ni el K ni las interacciones NK, PK, y NPK afectaron el rendimiento.

## MATERIALES Y METODOS

Cuadro No.1. Las Condiciones Climatológicas del Estudio (3)

| Meses | TEMPERATURA MEDIA C° | | | Precipitación en mm. | %Humedad Relativa |
|---|---|---|---|---|---|
| | Máxima | Media | Mínima | | |
| Octubre 67 | 32.5 | 27.5 | 22.5 | 72.6 | 78.9 |
| Noviembre | 31.6 | 26.8 | 22.2 | 140.1 | 74.6 |
| Diciembre | 30.0 | 25.6 | 20.0 | 51.7 | 72.3 |
| Enero 68 | 28.7 | 24.5 | 20.2 | 49.6 | 73.6 |
| Febrero | 29.3 | 24.7 | 20.0 | 68.1 | 71.8 |

El estudio se ejecutó en el Campo Experimental del Instituto Politécnico Loyola, San Cristóbal, con una altura aproximada de - 43 M.S.N.M.

El terreno escogido para sembrar el experimento es de textura limonoso-arenoso-aluvial reciente indiferenciado (5) con drenaje bueno y declive plano.

El diseño experimental usado fue Bloques al azar, con distribución factorial de $3^3$ con tres repeticiones. El área útil de - experimento fue de 14 $\frac{1}{2}$ 56 $m^2$.

La variedad utilizada en el experimento fue"Indian River". - La distancia entre hileras fue de 1m y 0.40 entre plantas.

Los tratamientos estudiados fueron NPK y sus posibles combinaciones. El Nitrógeno se aplicó en tres partes: al momento de la siembra, a las tres semanas despuls del trasplante y en el momento de la floración. El Fósforo y el Potasio se aplicaron en - dos partes: al momento de la siembra y a las tres semanas de trasplante. La siembra (trasplante) fue el 26-10-67.

Se practicó el estaquillado y amarre, según fue creciendo la planta para evitar pérdidas por el contacto de los frutos con el suelo. La humedad se mantuvo a un nivel adecuada por medio de - riego por aspersión al principio y luego por gravedad. La cosecha se inició el 3 de enero de 1968 y finalizó el 14 de febrero de 1968. Todos los tratamientos recibieron igual atención referente a aplicaciones de insecticidas, fungicidas, labores culturales y demás para la debida conservación.

## RESULTADOS Y DISCUSION

En el cuadro No.3 presentamos las interacciones de NP, NK, PK. No hubo significancia.

En el cuadro No.4 presentamos los efectos totales de NPK.

El Nitrógeno (Urea 45%) produjo significancia en el comportamiento lineal, siendo no significativo el componente cuadrático. Demuestra que la dosis doble de Nitrógeno (Urea 45%) usada en esta investigación es más recomendada por mostrar respuestas positivas a las producciones obtenidas.

La acción del Fósforo (Superfosfato triple 46%) mostró significancia en sus componentes lineal y cuadrático, pero los valores de producción con nivel 1 y 2 de P son muy cercanos y para el punto de vista del campo el componente lineal no explica tanto como el cuadrático. Esto parece indicar que la dosis favorable es cercana a 200 kgs/ha.

Cuadro No. 2. Tratamiento de Abono

| Abono | Nivel de Material kg/ha 0 | 1 | 2 | Nivel de Elemento kg/ha 0 | 1 | 2 |
|---|---|---|---|---|---|---|
| Urea (45% N) | 0 | 75 | 150 | 0 | 34 | 68 |
| Superfosfato triple (46% $P_2O_5$) | 0 | 200 | 400 | 0 | 92 | 184 |
| Sulfato Potásico (50% $K_2O$) | 0 | 80 | 160 | 0 | 40 | 80 |

Cuadro No.3. Producción de Tomate con varios niveles de Abono en Kg/ha

NITROGENO Y FOSFORO

| | | N | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Efecto de P |
| P | 0 | 16,435 | 19,319 | 18,109 | 17,288 |
| | 1 | 17,076 | 20,670 | 20,861 | 19,535 |
| | 2 | 17,134 | 19,611 | 20,819 | 19,188 |
| Efecto de N | | 16,882 | 19,200 | 19,929 | |

NITROGENO Y POTASIO

| | | N | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Efecto de K |
| K | 0 | 16,485 | 18,100 | 19,446 | 18,011 |
| | 1 | 17,329 | 19,645 | 19,168 | 18,714 |
| | 2 | 16,824 | 19,855 | 21,175 | 19,284 |
| Efecto de N | | 16,879 | 19,200 | 19,929 | |

FOSFORO Y POTASIO

| | | P | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Efecto de K |
| K | 0 | 17,200 | 18,716 | 18,115 | 18,011 |
| | 1 | 16,876 | 19,671 | 19,595 | 18,714 |
| | 2 | 17,788 | 20,220 | 19,846 | 19,284 |
| Efectos de P | | 17,288 | 19,535 | 19,185 | |

Cuadro No.4 Resumen de Efectos (totales N PK)

| | Nivel (Level) | | |
|---|---|---|---|
| | 0 | 1 | 2 |
| N | 16,879 | 19,200 | 19,929 |
| P | 17,288 | 19,535 | 19,185 |
| K | 18,011 | 18,714 | 19,284 |

Por el análisis económico verificamos que la aplicación de 146 a 204 kgs/ha resulta económico en el cultivo y las condiciones señaladas, pero con la aplicación de 146 Kgs/ha podemos obtener el máximo de producción, siendo una información favorable, por lo tanto, revelando de esta manera que nivel del Fósforo más alto en el experimento no es necesario, demostrando no ser necesario realizar investigaciones con la dosis doble correspondiente a 400 kgs/ha, - en igualdad de condiciones.

En relación al Potasio (sulfato potásico 50%) no hubo significancia en sus componentes lineal y cuadrática, informando la acción indiferente de los niveles empleados, lo cual puede ser atribuido a factores existentes en el suelo.

## CONCLUSIONES

1.- La acción de los niveles de Nitrógeno (Urea 45%) mostraron linearidad y atravéls del análsis económico verificamos que el nivel ideal es 210 kgs/ha., para obtener una máxima producción. - Es aconsejable, hacer experimentos con dosis más elevada de Urea - 45% para ver si dosis cercanas de 210 kgs/ha es factible en la práctica de producción.

2.- El P mostró significancia en sus componentes lineal y - cuádratica. Con la aplicación de 146 kgs/ha podemos obtener un máximo de producción, siendo una información favorable.

3.- No hubo significancia en los abonos potásicos.

## SUMMARY

Tests were made at the Experiment Field Instituto Politécnico "Loyola", San Cristóbal D.R. Three levels of N-P-K were tested - in connection with tomato crop yields.

Responses were determined for nitrogen an phosphorus when - planted to tomatoes. No effects of potassic fertilizers were obtained, because of favorable quantities of such element already existing in the soil.

Economically favorable quantities to be applied on this crop are shown.

## AGRADECIMIENTO

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# FIELD TRIALS ON FUNGICIDAL CONTROL OF PHOMA DESTRUCTIVA PLOWR. A LEAF PATHOGEN ON TOMATO

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Phoma destructiva Plowr. is commonly described as a tomato fruit rot fungus (GOVI 1953 GUNTHER & GRUMMER 1958, CIFFERI 1959, GROVER 1965, AULAKH, MALHOTRA & GROVER 1969). Often confused with the pycnidial stage of Didymella lycopersici Kleb. (JONES, OVERMAN & GERALDSON 1966) it can be distinguished from it, following KNIGHT (1960) by its virulence on tomato fruits, its incapacity to produce stem cankers and its always unicellular conidia. In the caribbean area, Phoma destructiva seems to be mostly a leaf pathogen. Fruits can be invaded, but in most instances from wounds. Leafspots were also described in Italy by CECI (1955), in Hawaii by OBRERO, TRUJILLO & ARAGAKI (1968).

In the rainy areas of Guadeloupe this fungus is one of the most serious leaf pathogens of Tomato. In dry areas, where it is seldom observed, non-negligible damage can however occur in overhead irrigated crops.

## SYMPTOMS

Phoma leaf spots in Guadeloupe are of the same shape that those described by OBRERO, TRUJILLO & ARAGAKI (1968) and CECI (1955); they are very similar to Alternaria solani leaf spots, or to spots caused by a Corynespora sp., recently observed in Guadeloupe.

The spots are first dark, very little, surrounded by a yellow halo, then enlarge with concentricalzonation to a diameter of one or two cm. Sometimes pycnidia can be observed in transmitted light with the naked eye.

On stems and petioles the spots remain generally small, longitudinally elongated. When the spots are very numerous the leaves become yellow and wilt.

## ARTIFICIAL INOCULATION

When a conidial suspension (prepared from a test-tube culture onoatmeal agar) is sprayed on plants which are incubated under 100% R.H.(relative humedity), the first little dark spots appear after 48 hours. If the plants are incubated only 24 hours at 100% R.H. and then placed in dry atmosphere the spots do not appear; but the symptoms are quickly observed if the plants are placed again under saturated humidity. A statistical study has shown us that the contaminations, which can remain latent in dry air, are strongly improved by a first exposition of 24 hours at 100% R.H., and by the presence of an aqueous extract of the conidial matrix.

Wet conditions are therefore necessary not only for spore germination, but also penetration into the leaf and for disease symptoms appearance.;

Nevertheless the inoculum sprayed on tomato plants place inmediatly in non-saturated conditions can ramain alive more than 4 weeks (under cover). Probably, in the field the fungus is not destroyed by dry periods which in rainy areas are seldom longer than one month.

## FUNGICIDE TRIALS

MESSIAEN, BEYRIES & BERAMIS (CFCS Vth Annual Meeting, Fort-de-France, July 1969) have tried fungicide apraying with Daconil, Maneb and TMTD; Daconil was the best. This fungicide trial was done during a moderately dry season (December to February).

We have realized a second trial during the rainy season (April toJune).

### Design of the Experimental Plots

4 randomized blocks with 5 treatments (20 plots of 20 plants).

The tomato variety was an $F_1$ hybrid Floralou x UPR 199-15, resistant to southern bacterial wilt.

4 fungicides were compared with the check:

| | |
|---|---|
| Benomyl (Benlate) | 50% (100 gr./100 liters) |
| Mancozebe | 80% (300 gr./100 liters) |
| Daconyl | 75% (300 gr./100 liters) |
| Methilzineb (Anthracol) | 70% (300 gr./100 liters) |

The transplantation was done at he end of March, and the Phoma inocolum introduced on April 20th (Solanum torvum stem pieces, 2 to 3 cm. long were sterilised, Phoma destructiva grown on them before hanging one of them above each tomato plant).

Fungicides were sprayed every week and once more if a rainfall superior to 20 mm occured (April 23rd, 30th. May 5th, 8th, 14th, - 19th, 21th, 26th, 29th, June 8th). The mean frequency was every 5th or 6th day between inoculum introduction and the last fruit harvest (June 15th).

10 plants in each plot were chosen for notations. The severity of the disease on leaves was evaluated on each plant on the 3 leaves inmediately above the 3 first fruit trusses and on the last well developed leaf with the following scale: 0-no spot, 1- 1 to 10 spots, 2- more than 10 spots, 3- yellowing of the whole leaf, and 4-drying of the leaf.

We evaluated also the yield of fruits per plant, the number of the fruits/plant, the mean weight of the one fruit (for this criterium the last harvest was left out of the calculation, since little green fruits were harvested together with mature ones). Then mean weight of leaves and stem for one plant after the last harvest was also evaluated.

These results can be seen on Table I.

| Table I | Check | Benomyl | Daconil | Mancozeb | Methylzineb |
|---|---|---|---|---|---|
| Disease severity on leaves on May 25th | 3.47 a | 2.44 b | 2.32 b | 2.03 bc | 1.94 c |
| Yield kg. fruits/ plant. | 0.57 a | 0.83 b | 0.84 bc | 0.80 b | 0.90 c |
| Number of fruits/ plant. | 8.37 a | 11.38 bc | 11.40 bc | 10.80 b | 11.70 c |
| Mean weight of fruits (g.) | 68.5 a | 80.8 c | 78.5 b | 80.8 bc | 83.0 c |
| Mean weight of stem and leaves kg/plant | 0.027*a | 0.160 b | 0.75 bc | 0.180 bc | 0.190 c |

* Complete drying of plants.

The best fungicide is therefore Methylzineb (Anthracol). For most of the criteria, Mancozeb, Daconil and Benomyl are similar - (accidental degradation of the Maneb fungicide used in the 1969 experiment accounted probably for its inferior performance compared - to Daconil).

It can also be observed that the disease severity is higher and the fruit yield inferior compared to the 1969 trial. It may be caused by the use of a different tomato variety, and also be the rainy season during the experiment which surely enhanced the virulence of Phoma destructiva.

## R E S U M E N

El Phoma destructiva es un importante patógeno, que ataca las - hojas del Tomate, sobre todo en las zonas lluviosas de Guadalupe; - la humedad del aire favorece todas las faces de la enfermedad. Cuando los ataques son graves, las pérdidas en la cosecha resultan muy importantes.

Una prueba en el campo demostró que el Methylzineb (Anthracol) resultó más efectivo para contener el P. destructiva que el Benomyl el Daconil y el Mancozeb; esos tres fungicidas son equivalentes.