THE INTRODUCTION OF EXOTIC VEGETABLES
INTO TRINIDAD, B.W.I.

AT

COLLEGE NEW FARM MARKET GARDEN

1951-52

by

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D.T.A. REPORT
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INTRODUCTION

Traditionally, agriculture in Trinidad has been similar to most of the Caribbean region. It has emphasized production of crops for export. The theory that it is more advantageous to produce locally high-priced export crops such as sugar, cocoa, and coconut products, and then buy low-priced foodstuffs in the world market, has resulted in neglect of domestic food production (31).

In 1946, the population of Trinidad was approximately 557,970. Of these, 195,747 were East Indian, 262,000 were Negro, 78,775 were mixed or coloured, 15,283 were white, and 5,641 were Chinese. This cosmopolitan population is concentrated on an island of 1,754 square miles, or approximately 1,200,000 total acres of land.

Crown Land, including Forest Reserves, now amounts to 46.6% (or 556,700 acres), of the colony's total land area. 53% of the total land area (or 636,000 acres), comprises alienated lands. A portion of these lands were given over to the East Indian labourers in lieu of their return passage to India on expiration of their indenture period. A minor portion of land in this category was sold to freed slaves living as squatters.

Of the remaining alienated land, 212,800 acres are in cocoa, 106,300 in sugar and coconuts, 37,700 in rice, 10,500 in citrus. Vegetable gardens comprise only 2,700 acres.

It is estimated that of the remaining Crown Land, less than 3% contains soils suitable for peasant agricultural development; yet this would provide an additional 16,000 acres not now in use, and validates the assumptions that Trinidad could grow more food for its own consumption. (1938 figures).

Although shortages of imported food during World War II gave impetus to local exotic vegetable production, there are
still glaring examples of its disorganized nature. Production is almost exclusively in the hands of the East Indians, who possess the agrarian heritage. Many peasants cultivate vegetables in small kitchen gardens about one-eighth of an acre in size, generally as a subsidiary part of small-scale agriculture. To many, market gardening is only a part-time vocation. Vegetable production, in general, is inadequate to supply the ever-increasing demand. The peoples of the Caribbean area are realizing that many of the nutritional diseases that have plagued them can be alleviated by increased consumption of vegetables, particularly leafy and yellow vegetables. As elsewhere, Trinidad's population is steadily increasing, and proper diet is lacking among the poorer people.

Where could a more interesting and suitable testing ground for research work in exotic vegetables be found? The rising demand for more and improved vegetables has resulted in a search for superior varieties suitable to the tropics.

Previous graduate research at the Imperial College of Tropical Agriculture has not been vigorously pursued in this field, and most of the results that have been attained previously have not yet penetrated the consciousness or stimulated the practices of the local market gardener.

For these reasons, I undertook seven months of varietal and fertilizer research on lettuce, tomatoes, and cabbage at the suggestion of the Botany and Agriculture Departments at the Imperial College of Tropical Agriculture.

The results have been encouraging and will provide a basis for continued study. Trials of spacing, fertilizer, irrigation practices, and disease and insect control can be enlarged. The experiment has been largely pioneering in scope; therefore no general economic analysis was attempted or incorporated in the trials.

For many years, crops of tomatoes, melongene, lettuce, cabbage, and other vegetables have been produced by the local
East Indian peasant farmers; yet all too often these industrious people have not had access to new, improved varieties that may be better suited to Trinidad.

Seed storage facilities are inadequate in Trinidad; hence little seed is produced locally. The peasant farmer who does use his own seed from previous crops all too often uses poor, undersized, or diseased fruit as his seed source.

Seed importation is often made by drug, department, and hardware stores. In the past, there has been no guarantee of seed viability, even that distributed by the local Department of Agriculture, for often their seed selection, distribution, and advice to local farmers has been careless. Vegetables have been relegated to a minor position, over-shadowed by estate crops of cocoa, sugar, and rice. Many vegetable varieties used are unsuited for local conditions, being low in yield, poor in quality, and susceptible to disease.

Good diet is an important factor to the progress of Trinidad, but many relationships must be taken into account when dealing with a relatively uneducated population.

"It's known that food may be closely associated with feelings of security and prestige. It has an important place in many religious observances. It is linked with countless superstitions and prejudices. Thus it can arouse many emotions: pleasure, envy, confidence, and even violent fanaticism."

The transition period requires time, tolerance, and understanding.

It would be most gratifying to researchers to see their work reach immediate conclusive results, but often the scientist feels himself rewarded if his work merely creates enough interest to be continued and broadened by others. If the writer accomplishes this, he shall deem his work of some contribution in the search for new vegetable varieties for Trinidad.

L. H. Bailey has said that "the horticulturist is the man who joins hands with the plant biologist on the one hand
and with the affairs of men on the other, and whose energies are expended in every way in which plants appeal to men. (26)

I have endeavored to keep these remarks in mind while initiating and conducting these trials, for not only are we interested in developing new vegetable varieties and aiding in their development for Trinidad, but we are hoping to find better methods of disseminating to the people the information received, via the experimental trials.

Because farmers the world over are basically conservative, changes in an agrarian society are slow in coming. The peasant farmer in Trinidad is no exception. In this lies a direct challenge. The farmer must be shown how to obtain and utilize improved vegetable varieties, and encouraged to apply new agricultural techniques.

The way is now open to raise both the peasant economy of the island and the nutritional standards of its people.
HISTORY OF THE AREA

The College New Farm comprises an area of approximately 500 acres situated north and south of the Churchill-Roosevelt Highway at its junction with the Southern Trunk Road. Previous to 1914 the site was occupied by peasant holdings and a small sugar estate. Between 1914 and 1919 it was planted to bamboo on cambered beds separated by deep drains, by the Trinidad Paper Pulp Company.

A cutting cycle of five years was planned but was unsuccessful because of insect prevalence and insufficient growth. In 1914 the estate was abandoned.

In 1946 this area was leased to the Imperial College of Tropical Agriculture for the purpose of:

A. Providing facilities for experiments in the field of market crops.

B. Giving students practical instruction in crops and animal husbandry.

Up to the present time, May, 1952, approximately 140 acres have been cleared of bamboo and brought into cultivation; the area south of the Churchill-Roosevelt Highway being still in bamboo.

In 1939, the soils in this area were investigated by the Chemistry Department of the College in order to study the conditions influencing the poor growth of bamboo. Following this, Weatherly, in 1942, made a detailed investigation of the entecology of bamboo in "good" and "bad" areas and came to the conclusion that, primarily, the differences were due to soil moisture conditions (33).

In 1951 and 1952 the market garden section has become a reality through the efforts of the College Agriculture Department. Now, in addition to producing vegetables for sale in the College Farm Shop, and providing an area for student instruction, it is planned that a certain portion of the area will be allocated for experimental trials to be conducted throughout the year.
THE AREA

A. Climate

The mean annual rainfall at the nearest meteorological station (Imperial College), is 68.5 inches, with a range of 51 to 105 inches over the island. Most of the rainfall in the wet season from June to December with a mean rainfall of 8.3 inches, in contrast to the dry season mean monthly rainfall of 2.1 inches.

If we follow Mohr's classification (17), 20% of the rain showers are torrential with an intensity of more than 0.75 inches per hour, and 60% are light showers with an intensity of 0.4 inches per hour or less. Rainfall records have been kept at the New College Farm over the last three years, and those pertinent to this thesis are shown diagrammatically in Appendix V.

The mean annual maximum air temperature is 86 F. The minimum is 70 F. (Appendix IV.)

B. Soil Parent Material

The site occupied by the College New Farm is part of the flood plain formed by the St. Joseph and San Juan Rivers. After heavy rains these rivers flood, with the result that irregular layers of alluvium have been deposited over the entire area. The rock of the adjacent part of the Northern Range is micaeous schist; weathered and unweathered particles of which form the parent material of the New Farm soils. The alluvium consists mainly of unweathered fragments of schist and fine quartz sand, with small amounts of kaolinite and muscovite. (Appendix VI.)
C. Topography

The area slopes gently to the southwest with actual slopes of one half to one per cent. Minor elevations and depressions occur as a consequence of old drainage ravines and recent road building. Map I shows the topography of the Farm and the sites of the old drainage ravines.

To the north of the New Farm is the Northern Range with its steep slopes and generally immature topography. In recent years most of the valley sides have been cleared of the natural forest and brought into cultivation. The run-off has been accelerated and therefore the lower reaches of the consequent rivers have been suffering from increased flooding (21).

D. Soils

Four soil types are found on the New College Farm. Their locations are shown on Map II. (Appendix VI)

Chenery has described the soil types as follows (6).

River Estate Loam

A free draining, permeable and highly porous sand, loam, clay or friable crumbly silt, developed on broad flats consisting of Northern Range alluviums. The top 18 inches is uniform dark yellowish brown fine sandy loam to loam, grading downwards into a paler fine sandy loam which is spotted black and orange with small soft concretions. Below five feet it passes into a bright yellowish brown loam with orange and brown stains.

St. Joseph Sandy Loam

A uniform, yellowish olive sandy loam full of small schist and mica particles, consisting of very recent
deposits of the St. Joseph and Aranguez Rivers. The soil is uniform to a depth of seven feet and has partially impeded drainage.

**Aranguez Silty Clay**

This soil occurs in the lower reaches of the Caroni and San Juan Rivers and has a similar parent material to the River Estate Loam, but it has a higher percentage of clay. The drainage is impeded.

**Pasea Clay**

This soil is prone to flooding and occurs on the north side of the middle reaches of the Caroni River. The parent material is micaceous silty clay and its low permeability is shown by the prevalent mottlings and concretions. (Appendix VI.).

According to Piggot (21), the clearance of the bamboo in 1946 was commenced on the northern part of the Farm, and this resulted in a complete change in soil conditions. Mechanical disturbances, burning, and the rains had completely destroyed the crumb structure that had been developed and maintained as long as the region was under bamboo.

Recognizing these factors, the drainage problem was rectified as soon as equipment could be placed on the soggy fields.

At present, the market garden area is laid out in a series of cambered beds running east and west, with deep ditch drains on either side. The beds are approximately 30' wide and 300' long. There are 31 beds. Between #15 and #16 lies the trace for equipment to move in and out.

The area covers 280,000 sq. feet, nearly 6½ acres. The bamboo stand on the eastern edge is an excellent windbreak. It also protects both sides of the St. Joseph River from extensive erosion.
New Farm entrance

Market Garden office and seedbeds

Pumphouse on St. Joseph River

Labor force with garden equipment
COSTS OF MARKET GARDEN EQUIPMENT AND BUILDINGS

Cost of potting shed 30' X 30' (including a look-up room), with asbestos roof, plus installation of sterilizer------------------------------------- $1,054.70

Cost of greenhouse 30' X 8', alternate aluminum and glass----------------------------------------------- 219.70

Cost of setting up of copper for water supply---------------------------------------------------------- 32.50

Value of copper-------------------------------------------------------------------------------------- 20.00

Value of boiler and sterilizer------------------------------------------------------------------------ 100.00

Cost of two J. A. P. Engines, 8 h. p. Model 55 @ $395.00------------------------------------------- 790.00

Cost of two Joseph Evans 2" X 3" S. E. B. Pumps @ $194.50------------------------------------------- 389.00

Cost of connecting two pumps and engines and installation on trolley frame, @ $75.00------------------- 150.00

Pressure gauge--------------------------------------------------------------------------------------- 12.00

Cost of Major Aluminum Irrigation Equipment
Pipe 870' X 4", 600' 3" ($924.00 Canadian)---------------------------------------------------------- 3,100.00
Pipe fittings ($986.57 Canadian)------------------------------------------------------------------------
Clifford Cultivator}--------------------------------------------------------------------------- 1,125.00
Ridger
Spraying Unit
Plough and Wheels
Rotary Gem with Cultivator-------------------------------------------------------------------------------- 1,170.00
Rotary Bantem with Cultivator}-------------------------------------------------------------------------- 480.00
Lawn Mower
Cutter Bar
Lawnsomes with Plough and Cultivator Presented to College------------------------------------------- 1,800.00

M. G. 5 Hand Rotary Duster-------------------------------------------------------------------------------- 31.20
Planet Junior Seeder Unit (500A)------------------------------------------------------------------------ 80.00

" Fertilizer Unit (219)-------------------------------------------------------------------------------- 49.00
" Hand Intercultivation Unit with tynes and discs------------------------------------------------------- 60.00

Weighing Machine---------------------------------------------------------------------------------------- 100.00

All prices quoted in British West Indian currency.
IRRIGATION EQUIPMENT

1. Pipe

870' X 4" tubing
600' X 3" "

2. Fittings

These include T type valves, couplers, end plugs, risers, sprinklers, nozzles, reducers, discharge adapters, etc.

The irrigation equipment works with a head of approximately 110' (which includes friction of pipes, lift from river to top of risers, and 35 lbs. of pressure in the pipes—82'), pumping 102 gallons per minute (U. S.), approximately 80 g.p.m. (U. K.), through 16 sprinklers, which will give 0.2" per hour over the area (diameter covered 60'—70') approximately.

The engine works at approximately 7 H. P. at 1700 R.P.M.

Actual details of entire equipment are yet to be worked out.

All irrigation equipment was obtained from the Major Aluminum Products Company of Canada Ltd.
Hauling cut-lashed weeds

Irrigation pipe
Rotary Gem cultivator
J.A.P. pump engine

Source of B.Y.M. Supply

Rotary Bantam garden cultivator

Fordson tractor with cut-out disc harrow
LETTUCE VARIETAL AND FERTILIZER TRIALS

Materials and Methods

The six varieties included in the trials were two leaf types, Grand Rapids and Black Seeded Simpson, and four head-producing varieties, Iceberg, Cornell #456, Great Lakes, and Mignonette. Mignonette was used as a check. These trials were conducted in an effort to determine if lettuce varieties other than the traditional Mignonette would produce high quality plants and high yields under Trinidad conditions.

The varieties were used in three trials at the New College Farm Market Garden area. Trial No. 1 began on December 10, 1951 and ended March 10, 1952. Trial No. 2 extended from January 10, 1952 to April 4, 1952. Trial No. 3 began on February 10, 1952 and terminated on May 16, 1952.

For each trial, seed was broadcast in seed boxes containing loam soil high in organic matter, obtained from the nearby bamboo grove. The seedlings at the 3-4 leaf stage were thinned and transplanted to additional flats, spaced at 2" X 2". The flats were shaded and watered by hand twice daily. In all varieties the percentage of germination was 95-98.

Four to five weeks after the seeds were sown, the seedlings were planted to the field beds by hand labor. The field layout for each trial consisted of nine beds, each 56" X 18'. Each of the nine beds were divided into six plots and each bed was planted at random with the six varieties. The plants were spaced 9" X 10" with 20 plants of each variety planted within each plot. There was a total of 180 plants of each variety in each of the three trials.

Shade was erected over every bed, giving 35-50% shade to the seedlings. This was provided by a bamboo frame with coconut fronds lying on top 3'-4' above the seedlings. In each trial the entire shade was removed from all nine beds 4-5 weeks after the seedlings were planted to the fields.
Three fertilizer trials were super-imposed on each of the three varietal trials in an effort to determine the optimum application of synthetic fertilizers on lettuce crops. The results were to be based on improved quality and increased yield. The three treatments were designated by N₁, N₂, and N₃.

The N₁ fertilizer treatment was applied in each trial to all of the nine beds one week before the seedlings were planted. The rate of application was 1000 lbs. per acre of 6:9:5 mixture, at the ratio of 3:5:1. The total fertilizer applied in this treatment was 18.36 lbs. or 2.04 lbs. to each of the nine beds. This mixture consisted of 6.12 lbs. Sulphate of Ammonia, 10.2 lbs. Superphosphate, and 2.04 lbs. Potassium Chloride. This was applied by hand and hoed under lightly.

The N₂ fertilizer application in each trial was applied in random manner to six of the nine beds in each trial one week after the seedlings were planted to the field. This consisted of six lbs. Sulphate of Ammonia applied as a side dressing. Each of the six beds received one lb.

The N₃ fertilizer application consisted of giving each of the three beds of the six that received the N₂ application an additional treatment of one lb. of Sulphate of Ammonia applied as a side dressing. This application was made 26 days after the seedlings were field planted.

In the three trials B.Y.M. was spread over each bed at the rate of 20 tons per acre two weeks before the seedlings were planted to the beds. Each bed received 90 lbs.

Irrigation was carried out by hand sprinkling in the early stages of Trial No. 1. When the pump and overhead sprinklers were installed, they were utilized throughout the three trials. A twice-weekly watering to the depth of 5-9" was continued efficiently during the long dry season.

Cultivation was adequately handled by hand hoeing to control the competing weeds.
The plants harvested from the three trials were cut at the ground level. The weights in ounces were taken on individual plants from each plot at the time of harvesting for the comparison of varietal yields. In addition, the varieties were compared for heading and leafing characteristics, bolting tendencies, earliness of maturity, sweetness of taste, and keeping qualities, using the Mignonette variety as the basis for comparison.

Opinions of the varietal qualities were expressed by many people to whom the lettuce was donated. The assessment of these comments is included in the varietal discussion.

**Experimental Results**

The following observations were made from the three varietal and fertilizer trials.

The mean weights for the six varieties and the three fertilizer treatments with their analysis of variance appear on Tables IA, IIA, IB, and IIIB. The large mean square by varieties shows significance on the basis of weight per plant in ounces, as illustrated in Table IIIB.

The analysis between varieties on the basis of weight per plant in ounces shows the varieties Great Lakes and Cornell #456 to be superior to the other four varieties tested. The keeping, taste, and head-forming qualities of these two varieties were also much higher.

The large mean square of experiments on Table IIIB shows a significance between the experiments which could be accounted for by the large number of plants bolting in Trials 1 and 3. Factors such as shading, watering inequalities, time of planting, soil differences, and spacing, all could contribute to this significance.

Interaction between varieties and experiments shows
significance as illustrated by the large mean square on Table IB. This could be due to the fact that strictly uniform shading, spacing, and watering, plus other cultural practices, were impossible to maintain in each trial. Mole Cricket damage on Trials No. 1 and 3 was much heavier than on No. 2; therefore the spacing balance between the three trials was upset. Trial No. 2 provided for more uniform varietal results than did the other two trials.

The Iceberg lettuce produced few heads and tended to bolt more quickly than all the other varieties, growing heavy thick stems and few leaves; therefore its high mean weight in Experiment No. 1, as shown in Table IIIA, is misleading. Mignonette never produced plants of large heads, but produced early-maturing uniform plants of marketable quality popular with Trinidadians. In all three of the trials, Grand Rapids, Black Seeded Simpson, and Iceberg tended to bolt, producing thick-stemmed plants with inferior keeping qualities.

There was no significance between the weights of the plants in the three fertilizer treatments in the three trials. The plants in beds receiving the N₂ and N₃ fertilizer treatments showed no apparent superiority over the N₁ treated beds. Bolting tendencies, leaf growth, and general quality were similar in all three fertilizer treatments.

The three statistical experiments produced some varietal results worth noting. They are as follows:

**Grand Rapids**

This early leaf producing variety tended to bolt in 40-50 days, although it did not show as great a bolting tendency as the Black Seeded Simpson variety. The earliness of maturity could be a factor in favor of this variety; yet it generally produced bitter leaves and the keeping quality was inferior to Mignonette. In three trials, the plants averaged 3.0 ounces per plant. The leaves were solid light green, large, with a broad waved and frilled margin. This variety was crisper than the Black Seeded Simpson.
Black Seeded Simpson

This is an early maturing leaf lettuce. It matured in 45-50 days and produced light green leaves. It showed a tendency to early bolting. This variety had better keeping qualities than Grand Rapids, although it was found by some to be bitter and not so crisp as the Grand Rapids variety. In three trials the lettuce averaged a mean weight of 3.3 ounces per plant.

Iceberg

This is a late maturing variety, producing heads from seed in 75-90 days. It produced large plants with broad, crisp, wavy, light-green leaves tinged with red on the margins. The few heads produced in these trials were not so large or firm as those of Cornell #456 and Great Lakes. This variety tended to bolt in all three trials. It was inferior in keeping quality and taste to all other varieties tested. The mean weight of the plants in all three trials was 4.3 ounces per plant.

Mignonette

This check variety produced small firm globular heads in 65-72 days. The lettuce was of good crisp quality with nearly white hearts. Leaves were frilled and dark green tinged with medium brown in color. The variety is good for heat resistance and has long proved its adaptability to Trinidad conditions. If it is not harvested when it is young, the taste is bitter. There is no tendency to bolting. The mean weight in these trials was approximately 4.9 ounces per plant.

Great Lakes

This is a large head-producing variety, maturing in 75-92 days. It gave excellent results on the basis of numbers of heads produced, mean weight per plant and general quality, including crispness, keeping and non-bolting qualities, sweet-
Great Lakes
Iceberg
Grand Rapids

Mignonette
Black Seeded Simpson
Cornell #456

Spreading B.Y.M. on lettuce beds

Iceberg

Great Lakes head lettuce

Great Lakes Cornell #456
ness of taste, etc. The plants were large, vigorous, resistant to tip burn, and dark green in color. The heads were firm, large and well-folded, with a crisp brittle texture. This variety is recommended for long distance shipping with controlled refrigeration. In all the trials it proved superior to the four varieties listed above. It was very popular among the natives used for unorganized sampling at the San Juan Market. A few heads weighing over two pounds were produced. The mean weight in the three trials was 11.6 ounces per plant.

**Cornell #456**

This is another heading variety, maturing in 82 days and producing heads a bit smaller than Great Lakes and of lighter green color. In all trials, many firm heads showing resistance to tip burn and early bolting were produced. There was a taste preference shown by many to this variety. It produced some heads of $\frac{1}{2}$-$\frac{1}{4}$ lbs. The general quality was slightly higher than the Great Lakes variety.

**Disease**

**Tip Burn**

This is a physiological disease causing a dead margin around tender leaves. It is a result of excessive loss of water following development of tender growth. This was controlled by proper watering.

**Damping Off**

This disease attacked some seedlings. It was controlled by not overcrowding the plants in boxes and by proper watering practices.

**Insects**

Few insects attacked the lettuce. An efficient
control was maintained by weekly dustings with Agroicide #3 dust. In addition, mixtures of DDT and Agroicide were used once mid-way in each experiment.

The following insects were found:

Lycaephia margaritosa, Variegated Cutworm
Phytometra ni Hubn., (Noctuidae), Lettuce Looper
Scapteriscus vicinus Scudd. West Indian Mole Cricket

Summary

In the statistical analysis the mean weights in ounces per plant of the six varieties tested show a significance between varieties in all three experiments. (Table IIIB) The Cornell #456 and Great Lakes varieties have been the most successful and these two should be included in any further lettuce trials. Public opinion will decide whether these head varieties can replace Mignonette as the foremost variety in Trinidad.

Both of the leaf varieties, Grand Rapids and Black Seeded Simpson, and the head-producing Iceberg variety, proved to be inferior to the cheek variety Mignonette. These three varieties tended to early bolting, producing smaller plants with heavy stems, few leaves. They were inferior in keeping and taste qualities to the Cornell #456, Great Lakes, and Mignonette varieties.

There was no significance shown between fertilizer treatments, and no interaction shown between fertilizer and varietal treatments in the three trials, as illustrated in Table IIIB.

Table IIIB shows the analysis of the three combined lettuce trials and illustrates that there was no significance shown with fertilizer treatments. No interaction was shown between fertilizers and experiments or fertilizers and varieties. In addition, there was no significant interaction
between varieties, fertilizers and experiments.

The significant interaction between varieties and experiments may have been due to the different treatments received by each of the three trials. This included various cultural practices, such as spacing, shading, weed control, watering, and the lack of uniformity in the quality of the B.Y.M. treatments.
### TABLE IA

Varieties and Treatment Means of Lettuce Yields of 6 Varieties and Combined 2 Experiments.
(Mean Wt./Plant in ounces)

<table>
<thead>
<tr>
<th>Variety</th>
<th>N₁ (Mean Wt.)</th>
<th>N₂ (Mean Wt.)</th>
<th>N₃ (Mean Wt.)</th>
<th>Combined Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand Rapids</td>
<td>3.1</td>
<td>3.4</td>
<td>2.6</td>
<td>3.04</td>
</tr>
<tr>
<td>Black Seeded Simpson</td>
<td>3.7</td>
<td>3.02</td>
<td>3.4</td>
<td>3.39</td>
</tr>
<tr>
<td>Mignonette</td>
<td>4.8</td>
<td>5.2</td>
<td>4.6</td>
<td>4.87</td>
</tr>
<tr>
<td>Iceberg</td>
<td>4.3</td>
<td>4.7</td>
<td>3.9</td>
<td>4.33</td>
</tr>
<tr>
<td>Cornell 455</td>
<td>9.04</td>
<td>10.1</td>
<td>9.3</td>
<td>9.45</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>10.8</td>
<td>12.1</td>
<td>11.9</td>
<td>11.6</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>5.96</strong></td>
<td><strong>6.41</strong></td>
<td><strong>5.98</strong></td>
<td><strong>6.11</strong></td>
</tr>
</tbody>
</table>

* Significant at .05 level of probability
*+ Significant at .10 level of probability

N.D. Degrees of Freedom
### TABLE IB

**Analysis of Variance of Combined Three Lettuce Trials.**

*(Mt. ounces/plant)*

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>D/F</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>161</td>
<td>14.445</td>
<td></td>
</tr>
<tr>
<td>Fertilizers</td>
<td>2</td>
<td>3.59</td>
<td>1.83</td>
</tr>
<tr>
<td>Experiments</td>
<td>2</td>
<td>23.47**</td>
<td>12.29</td>
</tr>
<tr>
<td>Fertilizers x Experiments</td>
<td>4</td>
<td>2.47</td>
<td>1.29</td>
</tr>
<tr>
<td>Varieties</td>
<td>5</td>
<td>339.596**</td>
<td>177.79</td>
</tr>
<tr>
<td>Fertilizers x Varieties</td>
<td>10</td>
<td>1.609</td>
<td>0.243</td>
</tr>
<tr>
<td>Varieties x Experiments</td>
<td>10</td>
<td>30.509**</td>
<td>15.97</td>
</tr>
<tr>
<td>Varieties x Fertilizers x</td>
<td>20</td>
<td>1.818</td>
<td>0.952</td>
</tr>
<tr>
<td>Experiments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>108</td>
<td>1.909</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 5% level of probability

** Significant at 1% level of probability

D/F: Degrees of Freedom
### TABLE IIIA

Varieties and Experiment Means for 3 Lettuce Trials

(Cont. in ounces/plant)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Exp. I</th>
<th>Exp. II</th>
<th>Exp. III</th>
<th>Mean of All Experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand Rapids</td>
<td>3.6</td>
<td>2.2</td>
<td>3.2</td>
<td>3.04</td>
</tr>
<tr>
<td>Black Seeded Simpson</td>
<td>3.6</td>
<td>2.8</td>
<td>3.8</td>
<td>3.39</td>
</tr>
<tr>
<td>Mignonette</td>
<td>4.2</td>
<td>5.2</td>
<td>5.3</td>
<td>4.87</td>
</tr>
<tr>
<td>Iceberg</td>
<td>6.4</td>
<td>2.2</td>
<td>4.4</td>
<td>4.33</td>
</tr>
<tr>
<td>* Cornell 456</td>
<td>9.6</td>
<td>10.8</td>
<td>8.0</td>
<td>9.46</td>
</tr>
<tr>
<td>* Great Lakes</td>
<td>12.9</td>
<td>14.2</td>
<td>7.7</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Experiment Mean Totals:

<table>
<thead>
<tr>
<th></th>
<th>Exp. I</th>
<th>Exp. II</th>
<th>Exp. III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.71</td>
<td>5.22</td>
<td>5.41</td>
</tr>
</tbody>
</table>

Standard Error

|                | .593   | .379    | .376     |

S.E. of Diff.

|                | .839   | .536    | .532     |

* Promising Varieties
# TABLE III

Analysis of Variance for each of Three Lettuce Trials.
(Mt. ounces/plant)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>D/F</th>
<th>Mean Square Exp.I</th>
<th>Exp.II</th>
<th>Exp.III</th>
<th>F Exp.I</th>
<th>Exp.II</th>
<th>Exp.III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>53</td>
<td>15.4</td>
<td>23.06</td>
<td>4.53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizers</td>
<td>2</td>
<td>5.48</td>
<td>.765</td>
<td>2.26</td>
<td>1.73</td>
<td>.593</td>
<td>1.78</td>
</tr>
<tr>
<td>Varieties</td>
<td>5</td>
<td>131.17**</td>
<td>232.62**</td>
<td>36.51**</td>
<td>41.51</td>
<td>180.55</td>
<td>28.75</td>
</tr>
<tr>
<td>Fertilizers x Varieties</td>
<td>10</td>
<td>3.57</td>
<td>.968</td>
<td>.72</td>
<td>1.13</td>
<td>.750</td>
<td>.567</td>
</tr>
<tr>
<td>Error</td>
<td>36</td>
<td>3.16</td>
<td>1.29</td>
<td>1.27</td>
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<td></td>
</tr>
</tbody>
</table>

* Significant at 5% of Probability
** Significant at 1% level of Probability
BUSH TOMATO VARIETAL TRIALS

**Methods and Materials**

The seed for the six tested varieties in each of the two varietal trials was obtained from the United States. The varieties were: Victor (Bounty), J. Moran, Pearl Harbor, #5142P₁, #5142P₂, and G. S. 5.

These determinate tomato varieties are characterized by being bushy and low-growing, with branches ending in flower clusters and new shoots appearing laterally on the stems. Generally the flowers and fruits develop earlier and in a shorter period than do the indeterminate tomato varieties.

These varietal trials were conducted in an effort to find superior bush tomato varieties adaptable to Trinidad's market garden agriculture. The observational results were to be based on plant and fruit qualities and the statistical results were to be based on varietal yields per plot.

The two trials were conducted at the New College Farm Market Garden area. In the first trial the seed was sown Dec. 22, 1951, and the plants were transplanted to the unshaded field plots on Jan. 18, 1952, when they were 7-10" in height. The first harvest was March 20, 1952 and the 17th and final harvest was on May 5, 1952.

The seed was sown Jan. 22, 1952 in the second trial, and on Feb. 29, when the seedlings were 6-11" in height, they were transplanted to unshaded field plots. The first harvest was made on April 20, 1952, and the 9th and final harvest was made on May 19, 1952.

In each trial the seed was sown at the rate of 2-4 seeds per hole to the shaded seedbeds containing high humic soil. The hole spacings were 2" X 2". When the plants were 2-4" in height they were thinned, and the transplanted seedlings were spaced singly 2" X 2" in adjoining seedbeds. The seeds and seedlings were well watered by hand sprinkling once daily.
The seed germination percentage for the six varieties in both trials was 86-93.

The field layout for each trial consisted of three replicated blocks totaling 1035 sq.ft (1/42 acre). Within each block there were six randomized plots made up of six ridge rows each 1 1/2' wide and 1' high, to allow excessive rainfall drainage.

The plants were spaced 3 1/2' apart in the plot row, and the plots were 2' apart from center to center. In both trials there were ten plants per variety in each of the three blocks. The varieties were planted in plots at random within the blocks. There was a total of thirty plants of each variety in each of the trials.

For the two trials, B.Y.M. was applied to the total area at the rate of twenty tons per acre one week before the seedlings were planted to the field. This was turned under lightly with rotary hoe along the hand built row plots.

In both trials two fertilizer applications were made. The first was applied around each planting hole three days before the seedlings were field planted. The mixture was 4:7:5 and the ratio was 2:4:1, applied at the rate of 700 lbs. per acre. This totalled 16 lbs., consisting of 4 1/3 lbs. Sulphate of Ammonia, 9 1/3 lbs. Superphosphate, and 2 1/3 lbs. Potassium Chloride.

Twenty-eight days after the seedlings were planted to the field plots, the second fertilizer application was made as a side dressing around every plant. A total of nine lbs. of Sulphate of Ammonia was applied to the three blocks in each trial.

Irrigation for both trials was efficiently handled by hand watering in the shaded seedbeds and with overhead sprinkling every 8-12 days with pumped and piped St. Joseph River water. The time of water application was erratic for Trial #1 and could not always be applied at the optimum time.
of day (e.g. morning). This may have been one of the contributing factors to the prevalence of leaf mould on several of the varieties.

Cultivation was adequately carried out by hand hoeing, to control competing weeds. The weeds and additional twigs were banked under the mature sagging plants to cut down losses resulting from fruit lying on the soil and rotting.

Fruit was determined mature for harvesting when the color turned from green to light red at the blossom end. Fruit stems were removed before the fruit was weighed in lbs. per varietal plot.

The varieties were compared on the basis of plant vigor, size, taste, texture, keeping quality, disease resistance, as well as the mean weight of the fruits produced per varietal plot.

Opinions on the varietal qualities were expressed by many local people to whom the mature fruit was donated. The assessment of these observations is included in the varietal discussion and summary.

Experimental Results

The following observations were made from the two bush tomato varietal trials:

The three replicated blocks of each trial showed no significant difference in the final statistical analysis. The mean weights for the six varieties in both trials and their analysis of variance for yields appear on Table III and IIIB respectively. There was no significance shown in the two trials between the six varieties tested on the basis of total mean yield in lbs. per varietal plot.

A covariance analysis between the number of plants per varietal plot and the total yield per varietal plot was conducted for Trials 1 and 2. This analysis determined that the
total number of plants differed within the varieties, but the total yields per plot were not affected by the significant difference in plant number. This is indicated by the same varietal difference shown between varieties for the adjusted and unadjusted mean yields. (Appendix Table II)

On the basis of mean yields per varietal plot, no varieties showed significant superiority; yet the three varieties, G. S. 5, J. Moran, and Victor (Bounty) were the most promising of the six tested varieties. These were compared on the basis of plant vigor, comparative resistance to disease, fruit size and uniformity, taste, and texture. These varieties should be included in further varietal trials for more conclusive testing. The varietal observations are included in the following discussion of each bush variety tested.

**G.S.5**

This variety was recently in Greenleaf, Alabama, and donated for these varietal trials. It developed a low-growing vigorous plant, highly resistant to both Curly Top Virus and Bacterial Wilt. Some Gladosporium Leaf-Mould was evident. The first harvest was 65-75 days after the plants were set out, and the fruit produced was medium-sized, ripened to red, of excellent taste and firm texture, possessing good keeping qualities. Few of the fruits were affected by Blossom End Rot.

On the basis of numbers of uniformly sized, marketable fruit of high quality, this variety proved to be one of the superior ones tested. The average fruit size was 2.4" in diameter.

**#5142P1, and #5143P2**

These two varieties were recently developed in Greenleaf, Alabama and donated for these varietal trials. Both varieties produced low-growing plants, with the P2 variety showing more plant vigor in both trials. The two varieties
were attacked by Curly Top virus and Bacterial Wilt, and Cladosporium Mould was more extensive on the plants of variety P₁. Blossom End Rot was common to the fruits of P₁.

Fruit was produced in 60-70 days by both varieties and was small to medium in size, light red in color, of good taste and firm texture, although the fruit of both varieties did not attain the high quality of the C.3.5, Victor (Bounty), and J. Moran varieties. The keeping quality of the P₂ variety was superior to that of P₁.

The average fruit size of these varieties was 2.0" in diameter for #5142P₁, and 2.5" in diameter for #5142P₂.

Pearl Harbor

An early maturing variety that produced fruit in 60-65 days, the Pearl Harbor plants were short-lived. The plants in both trials were attacked with Cladosporium Leaf-Mould, Bacterial Wilt, and Curly Top virus in varying degrees, but were resistant to Heart Rot and Spotted Wilt virus.

The many fruits produced were consistently small, and there were heavy losses from Blossom End Rot. The fruit taste, texture, ripening and keeping qualities were inferior to all other varieties tested. The average fruit size was 1.6" in diameter.

Victor (Bounty)

This variety produced marketable fruit in 60-70 days. The plants were vigorous and highly resistant to Curly Top virus. Some plants were killed in both trials by Bacterial Wilt, and the plants were extensively infected with Cladosporium Leaf-Mould.

The fruit was medium sized, flattened and globe-shaped, deep scarlet when ripe, of a firm texture and excellent taste.
Sowing bush tomato seeds in shaded seedbed

PEARL HARBOR GS5

#5142 P₁ #5142 P₂

J. MORAN VICTOR
The keeping quality was good. The average sized fruit was 2.6" in diameter. This variety proved outstanding in both trials.

**J. Moran**

This is a late maturing variety, producing mature fruit 83-98 days after the setting out of the plants. The vigorous plants were mildly resistant to **Bacterial Wilt** and **Curly Top virus** in both trials. The fruit was highly resistant to **Blossom End Rot** but **Cladosporium Leaf-Mould** was present in both trials. The plants produced medium sized fruit, flattened in shape, of excellent taste and firm texture. The fruit was free from puffs and cracking, showed a high degree of size uniformity, and had excellent keeping qualities. The average fruit size was 2.6" in diameter. This variety produced outstanding fruit in both trials.

**Disease (1)**

**Cladosporium fulvum** Cke. **Leaf-Mould**

This was not as prevalent on the bush varieties as it was generally throughout the stake varieties. The wide spacing between the plants may have been a deterrent factor. It was scattered through the three plots of both trials. Varieties #5142F₁, Pearl Harbor, and Victor (Bounty) were more heavily infected than were the remaining three varieties.

**Bacterium solanacearum** Smith. **Bacterial Wilt**

The varieties Victor (Bounty), Pearl Harbor, and #5142F₁ and F₂ possessed varying degrees of susceptibility to this disease. There were more wilt losses in Trial I than in Trial II, which may be accounted for by inadequate, or irregular watering.
Curly Top Virus

This disease was not as widespread on the bush varieties as it was on the stake tomatoes. In both trials, J. Moran and Pearl Harbor showed more infection than did the other four varieties. This disease presumably accounted for no plant deaths, although it may have affected the yield analysis of all the varieties slightly.

Blossom End Rot

This is a physiological trouble affecting the fruit, and apparently is due to the inability of the plant to obtain sufficient water. Exposure of the plant to drying winds and irregular watering contributes to this disease. Experience indicates that inattention to watering, and allowing plants to begin to wilt even once during dry weather, may bring on this disease. (1)

Apparent varietal susceptibility has been noted in these trials. The fruit of the Pearl Harbor and #5142P_2 varieties was susceptible to this disease. The G.S.5, #5142P_1, and Victor (Bounty) and J. Moran varieties showed varying degrees of resistance during the two trials.

Insects

Listed below are the insects that attacked the tomato plants and fruit:

- Scapteriscus vicinus Scudd. West Indian Mole Cricket
- Systema s-littera (L.)
- Laphygma frugiperda S. and A. (Noctuidae), Corn Leaf Worm
- Heliothis armigera (Hubn.), (Noctuidae), Corn Ear-Worm
- Prodenia ornithogalli (Go.), (Noctuidae)
- Xylomiga eridania (Cram.), (Noctuidae)
- Phytometra oo (Cram.), (Noctuidae)
Adequate control was maintained in both trials by the use of either DDT dust or Agrocide #3 Dust, applied at weekly intervals.

Control of mole crickets in Trial #1 was attempted by the use of bamboo collars placed in the soil around each young plant. It was an effective control although not economically feasible. The mole cricket damage was less in Trial #2, which may be attributed to the better distribution of the B.Y.M. In Trial #1, the B.Y.M. was concentrated around each plant hole and the undecayed fiber provided an insect haven.

Summary

The assessment of varietal difference in the statistical analysis of the tested six determinate tomato varieties in the two trials was based on varietal yield in pounds per randomized varietal plot. There was no significant difference shown between varieties in both trials and there was no significance shown between the replicated blocks in the two trials.

In the covariance analysis between the total number of plants and total yields per varietal plot, it was illustrated that the number of plants within the varieties differed significantly. The number of plants per plot in each trial depended on the variety; so the differences between the six varieties were the same after adjusting for variation in the number of plants. The same varietal difference was shown between the varieties for the adjusted and unadjusted mean yields. Because the statistical analysis showed no varietal significance on the basis of varietal yield per plot, it was necessary to utilize public preferences and opinions, and field and market observational analysis to form a basis for judging the varieties. Using high standards of plant and fruit quality, the G.S.5, Victor (Bounty), and J. Moran varieties were judged to be superior to the other three varieties tested in both trials.
Trial varieties in contrast to local varieties at San Juan Market

Preparing field beds

J. Moran, G.S. 5, and Victor (Bounty) varieties at San Juan Market

Bush tomato plant broken down as result of row being too narrow
TABLE III A

Varietal Mean Yields and Number of Plants/Replication for Two Trials of Bush Tomatoes.

(Mean Yields in Pounds)

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Mean Yields (lbs)</th>
<th>Mean No. Plants /Trial</th>
<th>Mean Yields(1bs) of 2 Trials</th>
<th>Mean No. Plants for 2 Trials.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial I</td>
<td>Trial II</td>
<td>Trial I</td>
<td>Trial II</td>
</tr>
<tr>
<td>* C.8.5</td>
<td>49.7</td>
<td>14.0</td>
<td>7.0</td>
<td>9.3</td>
</tr>
<tr>
<td>5142 P2</td>
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<td>11.0</td>
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</tr>
<tr>
<td>5142 P1</td>
<td>22.0</td>
<td>20.3</td>
<td>4.0</td>
<td>9.7</td>
</tr>
<tr>
<td>* Victor (Bounty)</td>
<td>32.7</td>
<td>15.7</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>* J. Moran</td>
<td>15.3</td>
<td>13.3</td>
<td>3.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Pearl Harbor</td>
<td>32.7</td>
<td>17.0</td>
<td>5.3</td>
<td>9.0</td>
</tr>
</tbody>
</table>

Mean Totals     30.6    15.2     5.2     9.1      22.9                           7.1                           
Std. Error      7.70    2.34     
Std. Error of Difference 10.88 3.31

* Promising Varieties.
TABLE III B

Analysis of Variance for Two Trials of Bush Tomatoes.
(Total Mean Yields in Pounds)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>D/F</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
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<td></td>
<td>Trial I</td>
<td>Trial II</td>
<td>Trial I</td>
</tr>
<tr>
<td>Replications</td>
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<td>2</td>
<td>39.1</td>
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<tr>
<td>Varieties</td>
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<td>5</td>
<td>407.8</td>
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<tr>
<td>Error</td>
<td>10</td>
<td>10</td>
<td>177.7</td>
</tr>
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</table>

D/F: Degrees of Freedom
STAKE TOMATO VARIETAL TRIALS

Methods and Materials

The seed for the eight undeterminate tomato varieties tested in each of the two varietal trials was obtained from the United States. The varieties were: Stokesdale, Manahill, Manasota, Rutgers, Pan American, Bonny Best, Grothen's Globe, and Southland. Bonny Best was used for the check variety as a basis of varietal comparison.

These varietal trials were conducted in an effort to find superior stake tomato varieties adaptable to Trinidad's market garden agriculture. The market garden observational and public preference results were to be based on high standards of fruit and plant quality, and the statistical results were to be based on the varietal yields per plot.

The two trials were conducted at the College New Farm Market Garden area. In the first trial the seed was sown December 10, 1951, and the stocky plants were transplanted to the unshaded field plots on January 7, 1952, when they were 8-12" in height. The first harvest was on March 13, 1952, and the 24th and final harvest was on May 5, 1952.

In the second trial the seed was sown on January 11, 1952, and on February 15, when the seedlings were 8-10" in height, they were transplanted to the unshaded field plots. The first harvest was made on April 29, 1952, and the fifth and final harvest was made on May 16, 1952.

In each trial, the seed was sown at the rate of 2-4 seeds per hole to the shaded seedbeds containing humic loam soils obtained from the nearby bamboo grove. The hole spacings were 2" X 2". The plants were thinned when they reached a height of 2-4", and the transplanted seedlings were spaced singly 2" X 2" in adjoining seedbeds. The seeds and seedlings were watered by hand sprinkling once daily. The seed germination percentage for the eight varieties in both trials was 91-97.
The field layout for each trial consisted of three replicated blocks covering an area of 726 sq. ft. (1/6 acre). Within each block there were eight randomized plots made up of eight ridge rows each 1\(\frac{1}{2}\) wide and 1' high, to permit excessive rainfall drainage.

The plants were spaced 18" apart in the plot row, and the plots were 3' apart from center to center. In both trials there were fifty plants per variety in each of the three replicated blocks. The eight varieties were planted in random manner in the plots within the three blocks.

For both trials, B.Y.M. was applied to the total area at the rate of twenty tons per acre, 2\(\frac{1}{2}\) weeks before the seedlings were planted to the field. This was turned under lightly with the rotary hoe cultivator. The plot rows were built up by hand hoeing one week later.

Two fertilizer applications were made in each of the two trials. The first was applied on the plot rows and lightly turned under six days before the seedlings were field planted. The mixture was 4:7:5, and the ratio was 2:4:1, applied at the rate of 1400 lbs. per acre. The total amount applied was 240 lbs., consisting of 70 lbs. of Sulphate of Ammonia, 140 lbs. Superphosphate, and 35 lbs. of Potassium Chloride.

Four weeks after the seedlings were set out in the field, the second fertilizer application was made as a side dressing around every plant. The mixture was 4:12:8, and the ratio was 1:3:1, applied at the rate of 270 lbs. per acre. This totalled 44 lbs., consisting of 7 1/3 lbs. Sulphate of Ammonia, 29 1/3 lbs. Superphosphate, and 7 1/3 lbs. Potassium Chloride.

Irrigation for both trials was efficiently handled by hand watering in the shaded seedbeds and with overhead sprinkling every 6-12 days with pumped river water. As with the bush tomato Trial #1, the time of water application was erratic and could not always be made at the optimum time of
Building ridges for stake tomatoes

Seedlings in shaded seedbed

Stake Tomato Field Layout

Overhead irrigation on stake tomato

Blossom End Rot on stake tomato
day (e.g. morning). Again, the high incidence of *Cladosporium* 
Leaf-Mould may have been due to these watering difficulties.
In both trials, the plant losses due to *Bacterial Wilt* were
greater in the small, depressed, poor-draining pockets.

Cultivation was adequately carried out by hand hoeing,
to control competing weeds. The cleared weeds were removed from
the trial area.

The plants were pruned by continued pinching out of
all but one or two of the laterals. The plants were trained
upright and each was tied to a 6-6' bamboo stake. This per-
mitted closer spacing of the plants within the plots and facili-
tated weeding, plant dusting, and harvesting of the fruit.

The fruit was determined mature for harvesting when
the color turned from green to pale orange or light red at the
blossom end. Fruit stems were removed before the fruit was
weighed in pounds per varietal plot.

As with the bush tomatoes, opinions on the varietal
fruit qualities were expressed by local people to whom the
fruit was donated. The assessment of these observations is
included in the varietal discussion and summary.

**Experimental Results**

The following observations were made from the two
stake tomato varietal trials:

There was a large difference between the replication
means in both Trials 1 and 2, as illustrated in the large mean
squares for replications in the analysis of variance for the
yields of stake tomatoes in Table IVB.

In Trial 1, the yields for replication three were
nearly as large as for the yields of replications 1 and 2 com-
bined. The large differences in the number of plants in repli-
cation 3 probably accounted for the increased yields compared
to replications 1 and 2.
The higher plant losses from Bacterial Wilt in replications 1 and 2 of Trial 1, possibly contributed to the large differences in total yields. Blossom and Rot damaged more fruit in replications 1 and 2 than in replication 3. Soil variations between plots could have contributed to these differences.

In Trial 2, the significant difference between the three replications was at the 5% level. This may be accounted for by excess plant and fruit losses caused by insect and disease damage, as well as the possibility of soil variations between the replications, faulty irrigation, and erratic insect control between the replicated blocks.

There was no significance shown between the eight varieties tested in Trial 1, although the F value approached the 5% level. The differences were large between the varieties in Trial 2, as shown by the large mean square on Table IV B.

Analysis of covariance between the number of plants per variety and total yields per variety was calculated as shown on Appendix Table III. A significant error of regression coefficient of 2.33 lbs. per plant was obtained in Trial 1, and that for Trial 2 was negligible.

The low regression coefficient in Trial 2 appeared to be due to the low varietal yields, as compared to the high varietal yields in Trial 1.

Although there was no significance shown between the unadjusted varietal means in Trial 1, the ranks of the adjusted means were somewhat different from the unadjusted means; but the differences in plant numbers had no effect on the overall comparison between the varieties. In Trial 2, the F value for the adjusted varietal mean square compared to the error mean square was equal to the expected value at the 5% level of significance.

Certain varieties were ranked differently after adjustments.

In Trials 1 and 2, the Pan American variety was the lowest in rank before and after adjustment. It was low in
plant numbers, which could be the result of poor plant vigor under local conditions.

Grothen's Glebe ranked on top in both trials before and after adjusting for regression.

Manahill variety maintained its middle position in rank before and after adjustment took place.

In Trial 1, Manasota moved from fourth rank to first, after adjustment for plant number. In Trial 2, it maintained third position before and after adjustment.

Stokesdale ranked third in Trial 1 and 2 before and after adjustment. This variety produced high yields but fruit of poor quality.

Rutgers ranked midway in Trial 1, but low in Trial 2. In both trials it produced fruit of poor quality.

Southland and Bonny Best varieties were the same in rank before and after adjustments were made. The former ranked low in Trial 1 and high in Trial 2; yet produced poor quality fruit in both trials. The latter variety ranked sixth in both trials; yet produced high quality fruit throughout.

Further detailed varietal descriptions are discussed below.

**Stokesdale**

This variety produced mature fruit in 60-65 days. It developed a vigorous plant quite resistant to Bacterial Wilt but highly susceptible to Curly Top virus and Cladosporium Leaf-Mould in both trials.

The fruits were well-coloured, large, smooth, and globe or sub-globe shaped. Texture was firm and the taste was good although below standards of the check variety. Few of the fruits were infected by Blossom End Rot. Keeping qualities were good. The average fruit size was 2.7" in diameter.
Manchill

This was a late maturing variety, producing fruit in 70-80 days. It showed resistance to Fusarium Wilt and to Stemphylium Blight, but some Cladosporium Leaf-Mould was evident. Plants were large, vigorous, and highly resistant to Curly Top virus and Bacterial Wilt. The round fruits produced were medium sized, firm in texture, and uniform in size. The fruit ripened to deep scarlet and possessed excellent taste and keeping qualities. Very few of the fruits were affected by Blossom End Rot.

On the basis of high quality fruit and plant standards, this variety proved to be one of the superior ones tested. The average fruit size was 2.5" in diameter.

Manasota

This late maturing variety produced fruit in 75 days. It showed resistance to Fusarium Wilt and partially to Stemphylium Blight. There was less Cladosporium Leaf-Mould on this variety than on any of the others tested. A few plants were infected with Curly Top virus, but plant losses from Bacterial Wilt were small.

The plants were large, vigorous, and somewhat more open than the Manchill variety. The fruits were medium sized, deep scarlet in color, globular in shape, with firm texture and excellent taste and keeping qualities. Few of the fruits were affected by Blossom End Rot. This was one of the most promising varieties tested, ranking with Manchill for excellence. The average fruit was 2.7" in diameter.

Rutgers

Marketable fruit was produced by this variety in 60-65 days after the plants were set out in the field. In both trials it was slow-growing in the seedbeds and suffered more
losses in the field after transplanting. It appeared to be more sensitive to irregular or faulty watering in the early stages than did the other varieties. Bacterial Wilt, Curly Top virus, and Cladosporium Leaf-Mould attacked this variety, although it was partially resistant to Fusarium Wilt. The plants were not too vigorous in either trial. Bright red, large, globular shaped, smooth and thick-walled fruits were produced. Production was good, but the fruit was not as firm in texture or as good in taste or keeping quality as the other varieties. Many of the fruits were affected by Blossom End Rot. The average fruit size was 2.10" in diameter.

**Pan American**

This variety produced marketable fruit in 70-75 days. The plants possessed a high degree of resistance to Fusarium Wilt, and were quite resistant to Bacterial Wilt, but they were susceptible to Curly Top virus and Cladosporium Leaf-Mould. The seedlings were slow growing and the field plants were not too vigorous. Losses were high in transplanting to the field. The fruit produced was small to medium in size, smooth, globe-shaped, and scarlet in color. Fruit taste, texture, and keeping qualities were good although far below the standard of the four promising varieties. The average fruit was 2.5" in diameter.

**Benny Best**

The Benny Best variety produced mature fruit in 60-70 days. The vigorous plants were quite resistant to Bacterial Wilt although they were infected with Curly Top Virus and Cladosporium Leaf-Mould in both trials. The fruit was heavily infected with Blossom End Rot in the low, poor-draining areas in Trial 1. Fruits were medium-large to large and bright red. Although the fruit was not free from cracking around the stem, the size uniformity was fair, texture was good and taste excellent. The average fruit was 3.3" in diameter.
Grothem's Globe

The fruit of this early maturing variety was produced in 60 days. The plants were the most vigorous of all the tested varieties. They were Fusarium Wilt resistant and showed resistance to Bacterial Wilt and Curly Top virus. Cladosporium Leaf-Mould was prevalent in both trials. The fruits were the largest of any variety tested, scarlet-red in color, and globose-shaped. Texture was firm and the taste qualities were excellent. This was one of the promising varieties. The average fruit size was 3.4" in diameter.

Southland

This was a late maturing variety producing mature fruit in 73-80 days. The plants were vigorous and resistant to Fusarium Wilt, although highly susceptible to Curly Top virus and Bacterial Wilt in both trials. There was a high incidence of Cladosporium Leaf-Mould on many of the plants.

The fruit produced was medium-red, medium to large in size, oblate shaped and smooth. The texture, taste and keeping qualities of the fruit were below the standards of the four seemingly superior varieties tested. The average fruit size was 2.11" in diameter.

Diseases

No additional diseases were found on the stake tomato trials. All diseases listed in the bush tomato discussion were also present in the stake tomato trials. The appraisal of apparent varietal susceptibility or resistance is discussed under the preceding varietal descriptions.
Insects

Listed below are the insects that attacked the tomato plants and fruits:

- *Pachyzanthe peruisalis* (Walk.) Tobacco Leaf Roller
- *Arvelius albopunctatus* (De Geer), (Pentatomidae) White Speckled Stink-Bug
- *Xylococes cridania* (Germ.), (Noctuidae)
- *Phytometra co* (Germ.), (Noctuidae)
- *Prodenia ornithosalli* (Gn.), (Noctuidae)
- *Heliothis armigera* (Hubn.), (Noctuidae) Corn Ear-Worm
- *Laphygma frugiperda* (S. and A.) (Noctuidae) Corn Leaf Worm
- *Syntema a-littera* (L.)
- *Scapteriscus vicinus* Scudd. West Indian Mole Cricket

Adequate control was maintained in both trials by the use of either DDT dust or Agroicide #3 Dust, applied at weekly intervals.

Control of mole crickets in both trials was maintained in the same manner as in the bush tomato trials.

Summary

The assessment of varietal difference in the statistical analysis of the eight tested indeterminate (stake) tomato varieties in the two trials was based on varietal yields in pounds per randomized varietal plot.

In both trials, there was significant difference shown between the replications. This was attributed to heavy plant and fruit losses of certain varieties from insects and disease. The uneven yields produced between the three replications of each trial was possibly caused by soil variations between the replications, erratic watering, and insect dusting techniques.
In Trial 1, there was no significance between the eight varieties in the unadjusted means, but varietal rankings of the adjusted means determined by the covariance analysis were somewhat different.

In Trial 2, varietal differences were significant at the 1% level. This was probably due to the large losses of plants of certain varieties. Only five harvests were made in nineteen days in this trial, as compared to twenty-four harvests in fifty-three days in Trial 1. In Trial 1 the plants were in the field 119 days, as compared to 93 days in the field in Trial 2.

The high night temperatures may have contributed to the reduced sugar translocation in the plants of all the varieties, resulting in the poor leaf growth, legginess, and low fruit set and yields. This hypothesis led to the termination of Trial 2 for varietal study and the introduction on May 17, 1952 of the sucrose and hormone experiment described in this paper.

It is interesting to note that the high vigor and good yields produced by the six bush tomato varieties in the adjoining bed were maintained during this same period of higher night temperatures; yet the trial stake tomatoes were all low in vigor and yields.

In order to give more conclusive varietal results, it was necessary to utilize public preferences and opinions, field and market observational analyses for judging the varieties. Using high standards of plant and fruit quality, the Grothen's Globe, Manasota, Manahill, and Bonny Best varieties were judged to be superior to the other four tested varieties in both trials.
<table>
<thead>
<tr>
<th>Varieties</th>
<th>Mean Yields (lbs)</th>
<th>Mean No. Plants /Trial</th>
<th>Mean Yields (lbs)</th>
<th>Mean No. Plants for 2 Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial I</td>
<td>Trial II</td>
<td>Trial I</td>
<td>Trial II</td>
</tr>
<tr>
<td>Stokesdale</td>
<td>115.7</td>
<td>4.3</td>
<td>45.0</td>
<td>29.3</td>
</tr>
<tr>
<td>* Manahill</td>
<td>104.3</td>
<td>3.0</td>
<td>40.7</td>
<td>42.0</td>
</tr>
<tr>
<td>* Manasota</td>
<td>112.3</td>
<td>4.3</td>
<td>37.3</td>
<td>31.0</td>
</tr>
<tr>
<td>Rutgers</td>
<td>119.3</td>
<td>1.0</td>
<td>50.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Pan American</td>
<td>52.0</td>
<td>67</td>
<td>25.0</td>
<td>11.7</td>
</tr>
<tr>
<td>* Bonny Best</td>
<td>103.3</td>
<td>1.3</td>
<td>43.0</td>
<td>12.7</td>
</tr>
<tr>
<td>* Grothen's Globe</td>
<td>121.7</td>
<td>6.7</td>
<td>51.3</td>
<td>33.3</td>
</tr>
<tr>
<td>Southland</td>
<td>104.7</td>
<td>5.3</td>
<td>52.0</td>
<td>45.0</td>
</tr>
</tbody>
</table>

| Mean Totals      | 104.2   | 3.3      | 43.2    | 27.1     | 53.3       | 35.1 |
| Std. Error       | 14.49   | 1.37     |         |          |            |     |
| Std. Error of Difference | 20.49  | 1.18     |         |          |            |     |

* Promising Varieties
<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>D/F</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Trial I</td>
<td>Trial II</td>
</tr>
<tr>
<td>Replications</td>
<td>2</td>
<td>2</td>
<td>854.3**</td>
</tr>
<tr>
<td>Varieties</td>
<td>7</td>
<td>7</td>
<td>1431.8</td>
</tr>
<tr>
<td>Error</td>
<td>14</td>
<td>14</td>
<td>529.6</td>
</tr>
</tbody>
</table>

* Significant at 5% level of probability
** Significant at 1% level of probability

D/F: Degrees of Freedom
Introduction

Because of poor yields, scant leaf growth, and excessive blossom drop, the second stake tomato varietal trial was terminated on May 15, 1952, ninety days after the seedlings had been planted to the field plots.

The yields of the total number and weight of fruit in pounds per varietal plot were exceedingly poor in comparison to Trial #1, and further valid varietal comparison studies in Trial #2 were impossible.

It was observed in Trial #2 that there were fewer plant losses from Bacterial Wilt and less plants were infected with the Tomato Mosaic Virus disease than in Varietal Trial #1; yet these plants were producing few new leaves, setting less fruit, and were generally leggy. Some plants grew as high as 7-8 feet, with sparse foliage and few developing fruits.

According to Went, "As the plants grow taller, translocation of the sugars become more limiting and the optimum temperature level for stem elongation shifts to a lower level."

(36)

In an effort to analyze the probable cause of this apparent insufficient translocation of sugar from the leaves, this writer used the working hypothesis of high night temperature relationships on tomato plant growth, as determined by Went and Carter (35,36).

On May 16, 1952, a 10% sucrose and hormone treatment experiment was initiated on all the eight varieties in the randomized block #1 of the concluded stake tomato varietal trial #2.
Methods and Materials

Twenty plants of each of the eight varieties in the first randomized block were included in the experiment. All the fruit over 3/8" in diameter was removed from the twenty plants of each variety. Five plants of each variety, chosen at random, received no treatment and were marked with white yarn and left as the control plants for a basis of comparison within and between each variety.

Five additional plants of each variety were selected at random, tagged with blue yarn, and the top/undersides of leaves were sprayed with a 10% sucrose solution in each of three treatments.

Five more plants of each variety were selected at random and tagged with red yarn. On these plants only the open blossoms were sprayed with the hormone B Naphthoxyacetic acid, (100 mgm./liter HgO). This was applied in one treatment only.

The remaining five plants of each variety were selected at random and tagged with red and blue yarn. Each of these plants were given three treatments of combined 10% sucrose solution sprayed on the top and underside of the leaves. In addition, one spray treatment of hormone solution was applied to all the open fruit blossoms.

Shirlan A. G. Fungicide was mixed with the 10% sucrose solution at the rate of 1 teaspoon per gallon of HgO, to retard fungal infection on the plants treated with the sucrose spray. Agraf, a wetting agent, was added to this solution at the rate of 1-2 ounces per 40 gallons of HgO.

The first treatment was applied on May 16, 1952, and included the single hormone spray and the combined hormone plus the 10% sucrose spray. In the second treatment on May 20, 1952, only sucrose solution was applied. At the third and final treatment on May 23, 1952, sucrose only was applied. Before the first combined treatment on May 16, 1952, a blossom and fruit count was taken on all plants, shown on Table V-A.
Experimental Results

These sucrose and hormone treatments were conducted under field conditions and therefore no attempt was made to interpret the results on the basis of root and top growth weights, or by measuring stem growth before and after the treatments. The results were to be based on total increase of the blossom and fruit set, as well as on increased vigor and added leaf growth of the mature plants treated, using the five untreated control plants of each variety as the basis for comparison.

The trial was terminated on June 5, 1952, and a final blossom and set fruit count was taken as illustrated on Table VII. Two plants of the Southland variety were dead from Bacterial Wilt, one located in the control plot and one in the combined hormone and sucrose treated plot.

The treated plants showed little increase in vigorous stem and leaf growth and the apparent lack of response of all the plants of the eight varieties could be due primarily to their late stage maturity when the test was initiated. In addition, the lack of control over spraying techniques and temperature conditions contributed to the lack of positive plant response.

Throughout these experiments the mean night temperatures remained well above 17 -18 C., the critical maximum temperature for tomato plant sugar translocation, according to Went (36). (Appendix IV)

It can be assumed that treatment experiments should be carried out with younger plants under controlled conditions for day and night temperatures, wind and humidity, and with facilities for measuring stem elongation and taking root and top weights before and after treatments.

Table VII illustrates that the gain in growth response of plants in the sucrose treated plots, and the blossom set on
those plants treated with hormone spray was insignificant. The non-treated control plots in every variety showed as much or more plant vigor and as many blossom and fruit sets as did those plants in the treated plots.
## Table V A
Pre-Treatment Count of Total Tomato Blossoms and Fruit Set. Taken on May 16, 1952.

<table>
<thead>
<tr>
<th>Variety</th>
<th>CONTROL</th>
<th>HORMONE ONLY</th>
<th>SUROSE ONLY</th>
<th>SUROSE &amp; HORMONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. Plants</td>
<td>Blossoms</td>
<td>Fruit</td>
<td>Total No. Plants</td>
</tr>
<tr>
<td>Grothen's Globe</td>
<td>5</td>
<td>47</td>
<td>9</td>
<td>56</td>
</tr>
<tr>
<td>Manasota</td>
<td>5</td>
<td>33</td>
<td>16</td>
<td>54</td>
</tr>
<tr>
<td>Pan American</td>
<td>5</td>
<td>12</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Manahill</td>
<td>5</td>
<td>22</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Rutgers</td>
<td>5</td>
<td>14</td>
<td>18</td>
<td>32</td>
</tr>
<tr>
<td>Southland</td>
<td>5</td>
<td>26</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>Stokesdale</td>
<td>5</td>
<td>18</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Bonny Best</td>
<td>5</td>
<td>18</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>40</td>
<td>195</td>
<td>76</td>
<td>271</td>
</tr>
</tbody>
</table>
### TABLE V B

Post Treatment Count of Total Tomato Blossoms and Fruit Set. Taken June 5, 1952.

<table>
<thead>
<tr>
<th>Variety</th>
<th>CONTROL</th>
<th>HORMONE ONLY</th>
<th>SUGROSE ONLY</th>
<th>SUGROSE &amp; HORMONE</th>
<th>4 Treatments blossoms &amp; fruit totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. Plants</td>
<td>Blossoms</td>
<td>Fruit</td>
<td>Total No. Plants</td>
<td>Blossoms</td>
</tr>
<tr>
<td>Grothen's Globe</td>
<td>5</td>
<td>18</td>
<td>16</td>
<td>34</td>
<td>5</td>
</tr>
<tr>
<td>Mansota</td>
<td>5</td>
<td>22</td>
<td>19</td>
<td>41</td>
<td>5</td>
</tr>
<tr>
<td>Pan American</td>
<td>5</td>
<td>17</td>
<td>13</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Manahill</td>
<td>5</td>
<td>15</td>
<td>14</td>
<td>29</td>
<td>5</td>
</tr>
<tr>
<td>Rutgers</td>
<td>5</td>
<td>14</td>
<td>11</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Southland</td>
<td>4</td>
<td>24</td>
<td>15</td>
<td>39</td>
<td>5</td>
</tr>
<tr>
<td>Stokesdale</td>
<td>5</td>
<td>17</td>
<td>10</td>
<td>27</td>
<td>5</td>
</tr>
<tr>
<td>Sonny Best</td>
<td>5</td>
<td>14</td>
<td>10</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTALS:</strong></td>
<td>39</td>
<td>141</td>
<td>108</td>
<td>249</td>
<td>40</td>
</tr>
</tbody>
</table>
CABBAGE VARIETAL TRIALS

Materials and Methods

Ten varieties, Golden Acre, Sutton's Pride of India, Resistant Glory, Glory of Enkhuizen, Ferry's Round Dutch, Stein's Flat Dutch, Copenhagen Market, Savoy Chieftain, Mid-season Market, and Marion Market, were grown and tested in the two varietal trials at the New College Market Garden.

Both trials were laid out statistically, each trial having two randomized block treatments. The varieties were to be evaluated for heading qualities, weight per head in pounds, as well as for their adaptability to Trinidad conditions.

Copenhagen Market was included in both trials as the check variety. The seeds were sown in shaded seedbeds at a spacing of 2" X 2" in soil high in humic content. The soil was obtained from the nearby bamboo grove.

At the 4-6 leaf stage (5-6 weeks), the seedlings were transplanted directly to the field. There was no shading provided for these field plants and all varieties were spaced 2' X 2' in each trial.

The seed for Trial No. I was sown December 11, 1951, and the plants were harvested from March 19, 1952 to April 15, 1952. The second trial commenced on January 16, 1952, and was concluded in one harvest on May 20, 1952.

Each replicated trial utilized an area of approximately 3000 sq. ft. (1/14 acre) each on flat 30' beds.

In each trial B.Y.M. was applied at rate of 20 tons per acre one month prior to the seedlings being planted to the field, and then it was turned under lightly by hand hoeing. In addition, each trial was given two fertilizer treatments. The first treatment was applied five days before the field was planted with a 4:7:5 mixture at the rate of 1500 lbs. per acre.
The ratio was 2:4:1, giving 50 pounds of Ammonium Sulphate, 60 pounds of Superphosphate, and 15 pounds of Potassium Chloride. The second treatment was a side dressing at rate of 6 pounds of Ammonium Sulphate per randomized block, applied four weeks after the seedlings were planted to the field.

Irrigation of both trials was normally furnished by overhead sprinkling once every 3-12 days, which provided for a 5-9 inch depth of watering.

Cultivation for both trials was carried out by hand hoeing to control competing weeds.

Experimental Results

The mean weights per plant in pounds, and the total number of excellent heads are shown on Table VI. The results of this trial were intended to provide statistical analysis, but due to organizational problems at the market garden, plus the lack of control over cultural practices, the losses of plants were too heavy in both trials to permit other than an observational analysis. This is illustrated on Table VII showing the losses out of the total planted for each variety.

Some of the varietal responses during these trials are shown on Table VI, and the significance of the varietal observations are noted as follows:

Golden Acre

This variety matured in 60-70 days and produced small to medium firm, flattened, globular heads. The plants had short stems and the interior was clear and white. This variety showed a tendency to produce small side shoots when over-watered. The largest head weighed 2.6 lbs. and was 5" in diameter.
Sutton's Pride of India
This variety matured in 60-70 days and produced small, firm and oval heads. It tended to produce heavy leaf when over-watered. The largest head weighed 3.2 lbs. and was 4½" in diameter.

Resistent Glory
Taking 55-65 days to mature, this variety produced medium-large firm oval heads with white clear interior. It was superior in head quality and production. Where excess water was applied, a heavy leaf growth without head formation was produced. The largest head weighed 4½ lbs. with a diameter of 6½".

Glory of Enkhuisen
This variety matured in 60-70 days and produced medium to large firm oval heads. Head production was poor in these trials. The largest head weighed 3.8 lbs. with a diameter of 5".

Ferry's Round Dutch
This short-stemmed variety matured in 65-72 days, producing medium firm ball-shaped heads. This was one of the better varieties on the basis of quality and size of head, although the number of heads produced was small. The largest head was 6½" in diameter, weighing approximately 4½ lbs.

Stein's Flat Dutch
This flat-headed variety matured in 70-80 days, producing medium sized heads of high quality and sweetness. The largest head was 5" in diameter and weighed 3.3 lbs.

Copenhagen Market
This short-stemmed variety maturing in 60-65 days, produced grey-green leaves and medium to large firm round heads with clear white interiors. This variety was used as
Golden Acre  Sutton's Pride of India  Stein's Flat Dutch

Copenhagen Market  Ferry's Round Dutch  Glory of Enkhuizen

Marion Mkt.  Savoy Chieftain  Resistant Glory

Rotary Gem on cabbage beds
the check and produced many excellent heads as shown in Table 2. The largest head was 4.5 lbs. in weight, with a 5" diameter.

**Savoy Chieftain**

A variety non-resistant to *Fusarium Yellows*, this matured in 70-90 days and produced heads of medium drumhead type, rounded on top and flat at the base with broad leaves. It was rounded and uniformly savoyed, dark olive-green in color. The heads were not too firm and few heads were produced in the two trials. The largest head was 6.5" in diameter and weighed 3 1/2 lbs. This was one of the poorest varieties planted on the basis of heads produced, quality, and weight of heads.

**Midseason Market**

This variety matured in 60-70 days, and produced no heads in Trials 1 or 2. In temperate regions this variety produces large globular, very hard heads, but here all plants were heavy in leaf.

**Marion Market**

This variety maturing in 60-65 days and resistant to *Fusarium Yellows*, produced medium heads oblong in shape and very firm. When the plants were over-watered there was a production of heavy leaf growth with no head formation. The largest head was 4" in diameter, weighing 5.5 lbs. This variety was one of the superior ones tested.

**Disease**

There was no disease in either trial.

**Insects**

The following were detected and identified (12):

*Scape teriscus vicinus* Scudd. (West Indian Mole Cricket)
*Heliothis phidilealis*, Wlk., (Pyralididae), (Cabbage Bud-worm)

*Ascias monuste* (L.), (Cabbage White Butterfly)

*Plutella maculipennis* (Curt.), (Diamond-Back Moth)

Effective control of the above insects was maintained by weekly applications of Agroicide #3 dust, alternating D. D. T. dust. Then a combination of the two dusts was used once monthly.

**Summary**

Since the results of this trial could not be analyzed statistically, the results were observational. The five varieties designated by asterisks on Table VI are promising. This writer feels that further tests of all ten varieties should be carried out with increased numbers of randomized blocks, in order to obtain more precise and conclusive varietal information.
<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Seedlings Planted in Both Blocks</th>
<th>Total Harvested No. Plants</th>
<th>Total Wts. of all Plants Harvested (lbs)</th>
<th>Mean Wts./plant Harvested (lbs)</th>
<th>Total Excellent Heads No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trial I</td>
<td>Trial II</td>
<td>Trial I</td>
<td>Trial II</td>
<td>Trial I</td>
</tr>
<tr>
<td>Golden Acre</td>
<td>21</td>
<td>30</td>
<td>14</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Sutton’s Pride of India</td>
<td>20</td>
<td>15</td>
<td>9</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>* Resistant Glory</td>
<td>26</td>
<td>16</td>
<td>14</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Glory of Enkhuizen</td>
<td>21</td>
<td>35</td>
<td>8</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>* Ferry’s Round Dutch</td>
<td>20</td>
<td>16</td>
<td>10</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>* Stein’s Flat Dutch</td>
<td>10</td>
<td>40</td>
<td>8</td>
<td>40</td>
<td>17</td>
</tr>
<tr>
<td>* Copenhagen Market</td>
<td>33</td>
<td>24</td>
<td>25</td>
<td>21</td>
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<td>Midseason Market</td>
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<td>11</td>
<td>15</td>
</tr>
<tr>
<td>* Marion Market</td>
<td>21</td>
<td>15</td>
<td>12</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>210</td>
<td>213</td>
<td>123</td>
<td>161</td>
<td>212</td>
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</tbody>
</table>

* Promising Varieties
POLE BEAN EXPERIMENT

Trial—Method of planting

Date—Initiated on October 20, 1951

Location—Old College Farm

Purpose—To obtain data for improved spacing, staking, and cultivation methods. The results were to be based on the yield per acre basis.

Trial Area—Approximately 5712 square feet. (1/8 acre)

Previous Crop—Vigna sinensis (Cowpea)

Crop:

Family: Leguminosae
Genus: Phaseolus
Species: vulgaris
Variety: Kentucky Wonder

Types: Brown Seeded Rust Resistant
        White Seeded Non-rust Resistant

Seed Source: Burpee Seed Company, U. S. A.

Manuring: Applied well-rotted B. Y. M. at rate of 30 tons per acre. (Total—3.7 tons)

Cultivation: Fordson tractor, Rotary Hoe worked under the spread B. Y. M. manure. The area was then hoed, and blocks, plots, and rows were built by hand labor.

Layout—12 plots @ 28' X 17', 3 blocks with 4 randomized plot treatments in each block (A B C D).

Staking—Bamboo poles 7-8 feet in length with side branches.

Planting Procedure and Treatment—Three replications of each of the following treatments:

Plot (A) Single Rows 36" X 6" Single pole 9 rows 4" apart

Plot (B) Double " 36" X 12"X6" " 7 dbl.rows 36"apart

Plot (C) " " Double pole 7 " " "

Plot (D) Single Rows 24" X 6" Double pole 14 rows 1½ "

Irrigation—Rainfall adequate. No use made of nearby farm reservoir.
Fertilizers—NPK fertilizer applied around base of seedlings on November 27, 1951, when blossoms began to open.

Ratio 1:2:1 @ 280 lbs./acre

93 lbs. Ammonium Sulphate
17½ lbs. Superphosphate
33 lbs. Muriate of Potash

Total: 35 lbs. applied to all 18 blocks. Every row in each plot received 3.5 oz.

Growth and Work Schedule

Oct. 30—Seedlings emerged, 90-98% germination.

Nov. 5—Seedlings attacked by fungus at ground level.
Identified as Sclerotium rolfsii Sacc. (I) Block reseeded.

Nov. 9—Appraisal of seedling losses due to initial Sclerotium rolfsii attack.

Block I (Brown Seeded) - Block II (Brn. Seeded) - Block III (wh. S.)

<table>
<thead>
<tr>
<th></th>
<th>Block I</th>
<th>Block II</th>
<th>Block III</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>50% loss</td>
<td>(A) 72% loss</td>
<td>(A) 61% loss</td>
</tr>
<tr>
<td>(B)</td>
<td>55% &quot;</td>
<td>(B) 12% &quot;</td>
<td>(B) 6% &quot;</td>
</tr>
<tr>
<td>(C)</td>
<td>87% &quot;</td>
<td>(C) 52% &quot;</td>
<td>(C) 10% &quot;</td>
</tr>
<tr>
<td>(D)</td>
<td>26% &quot;</td>
<td>(D) 6% &quot;</td>
<td>(D) 12% &quot;</td>
</tr>
</tbody>
</table>

Insects

Ceratoma ruficornis (Oliv.), Galarucidae
Diabrotica plumella Baly, (Galarucidae)
Hemorrhina equinociliaris (F.)
Scapteriscus virgatus Scudder, Mole cricket
Leptotes cassius (Lucas), (Lycaenidae)
Conatus pectoralis (L), "Bean Leaf Roller"
Helicoverpa virescens (F.), (Noctuidae)

Control was maintained by Agroside DDT dusts and sprays.

Chlordane controlled mole cricket.

Diseases

Sclerotium rolfsii Sacc.
Corticium microsclerotia—"Web Blight"

Conclusion—After the appraisal of losses, several attempts were made to re-establish the crop by reseeding, but subsequent crippling losses due to Sclerotium rolfsii occurred. The project was abandoned on January 2, 1952. Several small harvests were made and tabulated, but the amounts recorded were insufficient to warrant scientific statistical appraisal of results based on weights / treatment. The brown seeded and white seeded varieties showed equal susceptibility to the fungus, and yields were similar.
POLE BEAN EXPERIMENT

Trial—Time of planting

Date—Initiated on October 29, 1951

Location—Old College Farm

Purpose—To determine the residual effects of 2,4-D on time of planting, spacing, and cultivation practices to ascertain the number of weedings that could be eliminated. The results were to be based on the yield / acre.

Trial Area—Approximately 1440 square feet. (1/30 acre)

Crop

Family: Leguminosae
Genus: Phaseolus
Species: vulgaris
Variety: Kentucky Wonder
Type: Brown Seeded Rust Resistant

Seed Source—The Burpee Seed Company, U. S. A.

Manuring—Two cwt. of well-rotted B. Y. M. was applied to the beds.

Cultivation—The manure was hoed under and the beds and drainage ditches built by hand labor.

Layout—The six beds were planted east and west 2'6" X 40'.

Staking—The bamboo poles used were 7-8 feet in length.

Treatment—On October 29, 1951, the five beds were sprayed with 2, 4D herbicide at the rate of six pounds per acre. The control bed (X) was not sprayed. The total 2,4-D used on the plot was 2½ oz.

Planting Procedure

(X) Bed, Control—D day—Seed planted 29/10/51
(A) " " + 4 " " 2/11/51
(B) " " + 6 " " 4/11/51
(C) " " + 9 " " 7/11/51
(D) " " + 11 " " 9/11/51
(E) " " + 13 " " 11/11/51

Note: Beds A-E sprayed with 2,4-D on 29/10/51.
Irrigation—Rainfall was adequate. No use was made of near-by farm reservoir.

Fertilizers—None applied.

Insects—Same as in Pole Bean Method of Planting trial.

Diseases—

Sclerotium rolfsii, fungus

Corticium microsclerotia, "web blight".

Summary

A sudden attack by Sclerotium rolfsii fungi destroyed the statistical layout of the trial and made conclusive results unobtainable. The experiment was continued with hopes of obtaining some worthwhile information. The area was reseeded after the initial fungus losses, but the new seedlings were soon destroyed and the trial was abandoned on January 5, 1952, without conclusive results. Additional trials to determine the optimum time of planting after the use of herbicides for weed control should be included in the research program at the New College Farm.

Conclusion

Weed incidence and the relative growth of bean seedlings prior to the severe losses from fungus attack tentatively indicate that the optimum time for planting after a pre-emergence 2,4-D spray is approximately 8-10 days.
Rotary hoeing the bean beds

Laying out pole bean Method-of-Planting trial

DDT dusting pole bean seedlings

2-4,D Pre-emergence spraying of pole bean plots

Sowing pole bean seeds to field
Weighing B. Y. M.

Building beds for pole bean spacing trial

Dibbling in pole bean seeds

Sclerotium rolfsii fungus damage to pole bean seedlings
CONCLUSION

As the result of eight months of experiments on exotic vegetables, and an informal survey of local vegetable production economy, the author is convinced that statistical varietal trials of vegetables for Trinidad could profitably be continued.

Improved nutrition, more efficient vegetable production, and reduction in the need for vegetable imports are a few of the many values to be gained by the introduction of improved vegetable varieties suitable to Trinidad.

As the College New Farm is in the early stages of development, there were organizational problems and operational difficulties that should never confront the research worker in the execution of experimental trials. In general, however, the trial results were encouraging and will provide a basis for continued study.

Several of the stake and bush tomato varieties as well as some lettuce and cabbage varieties proved to be quite well adapted for Trinidad conditions during the dry season. Another challenge will come when these same trials are carried out through the wet season.

These trials have illustrated that many of the experiments can be improved and broadened in scope. The stake and bush tomato varietal trials could be continued in the replicated block layout, but the number of stake tomato plants of each variety per replication could be cut from 50 to 25, and the number of replications at least doubled. Pruning versus non-pruning, fertilizer, and plant spacing trials could be superimposed on the varietal trials.

Future cabbage varietal trials would provide accurate data for statistical analysis if the seedbed watering and insect control were rigidly maintained. The optimum time of planting seedlings to the field should be determined and the
field beds prepared in advance. Spacing, fertilizer, and shading trials could be superimposed on the varietal trials. Layout should be in at least six randomized blocks, using 15-20 plants of each variety in each replication.

The layout of the lettuce varietal trials with fertilizer trials superimposed provided an excellent basis for statistical analysis. Shading and plant spacing trials could be incorporated, continuing through the wet season.

There are many new successfully tested varieties of exotic vegetables available from government experiment stations in Hawaii, Puerto Rico, and Florida. It would be advantageous for these to be made available to the market garden manager.

To achieve conclusive statistical results in future experiments, a distinct area should be provided for vegetable crop research within the market garden area, where cultural practices could be strictly controlled.

In a vegetable improvement breeding program could be intensified, utilizing the most promising and rare varieties.

2. Intensify the farm laboratories of the various stations, and especially the experimental plots, would increase their interest and pride in the trials.

3. Better control over cultural practices in the experimental trials should be enforced.

4. To take advantage, in the dry season, of the cool hours in the dry season for transplanting, cultivating, etc., it may be advantageous to take the whole time of the laborers down well in the morning and 2-3 in the afternoon.

5. The market garden secretary should be instructed in the maintenance of certain equipment so that emergency repairs could be handled without delay.
RECOMMENDATIONS

Following are some of the writer's recommendations for broadening the scope of experimental work at the College New Farm Market Garden. These include suggestions for general organization and administrative problems, as well as for improving layout and treatments of the specific crops with which the author is familiar.

1. A closer liaison between the local Department of Agriculture and the College may prevent needless overlapping of experimental work.

2. The encouragement of visits from local farmers might foster better understanding about the purpose of the experimental work. This could include guided tours of the Farm on one Saturday per month and the donation of seed from promising new crop varieties to the visitors for trial.

3. A vegetable improvement breeding program could be introduced, utilizing the most promising new crop varieties.

4. Informing the farm labourers of the purposes of the garden, and especially the experimental plots, would increase their interest and pride in the trials.

5. Better control over cultural practices in the experimental trials should be enforced.

6. To take advantage, in the dry season, of the cool hours of the day needed for transplanting, watering, etc., it may be advantageous to make the working hours of the labourers from 7-12 in the morning and 3-6 in the afternoon.

7. The market garden overseer should be instructed in the maintenance of garden equipment so that emergency repairs could be handled without delay.
8. The farm storekeeper should be requested to keep a stock of fertilizers, insecticides, etc., in amounts ahead of the needs. A small supply could be kept at hand at the Market Garden field house.

9. To save labor time, a 100 gallon drum of gasoline could be stored in the garden area storeroom.

10. A large water cooler should be installed in the vegetable shed for the convenience of the workers.

11. Adequate transportation should be provided daily during the vegetable production season to carry crops to the Farm Shop, and to prevent unnecessary spoilage, Farm Shop hours could be regulated to fit the production schedule.

12. Adequate storage facilities for perishable vegetables should be made available. This could be of value in future storage experimental studies.

13. A telephone in the Market Garden office would facilitate administration.

14. To promote accuracy, scales should be readily available at all times for experimental trials.

15. Beds for experimental crops should be a distinct unit in the Market Garden area, so that the watering, spraying, and dusting operations on non-experimental plots will not overlap and upset the trial plots.

16. This writer believes that future varietal trials should be carried out statistically and that many could be broadened in the following ways:

Field shading and spacing trials could be included in future lettuce and cabbage trials laid out in Latin Square or in randomized blocks; the varietal yield results to be based on ounces or pounds per plant and heading or leafing
The stake tomato varietal trials in randomized blocks could be enlarged to include spacing, shading, and pruning versus non-pruning trials, with superimposed fertilizer treatments.

The statistical results would be based on varietal yields in total pounds per plot, and also on plant vigor, disease resistance, and fruit taste and texture.

All of the above-mentioned trials would provide more conclusive data if conducted throughout at least one wet season.
SUMMARY

I. Three lettuce varietal trials, superimposed with three fertilizer treatments, were conducted for statistical analysis. The trial layout consisted of nine beds, each divided into six plots, each plot receiving twenty plants per variety. The three superimposed fertilizer treatments were designated N_1, N_2, and N_3. The varietal results and treatment responses were analyzed on the basis of weight per plant in ounces.

There was no statistical significance shown among the three fertilizer treatments in each of the three trials. Of the six varieties, Mignonette (check), Grand Rapids, Black Seeded Simpson, Iceberg, Cornell #456, and Great Lakes, significant difference was shown in each of the three trials on the basis of weight in ounces per plant. In addition to the statistical analysis, the varieties Cornell #456 and Great Lakes were judged to be superior by standards of leaf and head quality, taste, and non-bolting tendencies.

II. Each of the bush tomato varietal trials were laid out in three replicated blocks. Each replication contained six blocks, planted at random to the six varieties, G.S.5, #5142F_1, #5142F_2, Pearl Harbor, Victor (Bounty), and J. Moran, with ten plants per variety in each replication.

There was no statistical difference shown between varieties on the basis of yields in pounds per varietal plot. Based on standards of plant vigor, taste, texture, and keeping qualities, the most promising varieties in both trials were G.S.5, Victor (Bounty), and J. Moran, as judged by field and market observation and public opinion.
III. Each of the two stake tomato varietal trials were laid out in three replicated blocks. Each replication contained eight plots planted at random to the eight varieties, Grothen's Globe, Manasota, Manahill, Bonny Best (check), Rutgers, Pan American, Southland, and Stokesdale.

On the basis of statistical analysis the varieties Grothen's Globe, Manasota, Manahill, and Bonny Best appeared to be superior. Observations at the Market Garden and public opinion supported these findings.

IV. Because of poor fruit yields, scanty leaf growth, and excessive blossom drop of all eight varieties in the stake tomato varietal trial #2, a sucrose and hormone treatment experiment was initiated ninety-three days after the plants were set out in the field.

Working on the assumption that the high night temperatures were reducing sugar translocation from the leaves, a 10% sucrose solution was sprayed to the leaves and hormone spray was applied to the open blossoms, in the hope that there would be a plant response of greater vigor and improved blossom set.

Twenty plants of each of the eight varieties were selected and treated. Results were analyzed from comparisons of pre and post treatment counts of blossoms and fruits set. Results showed as much or more plant vigor and as many or more blossoms and fruits set in the untreated plots as in the treated plot. Lack of plant response to these treatments was probably due to the late maturity of the tested plants and lack of control over the spray applications under field conditions.

V. The two cabbage varietal trials were laid out for statistical analysis in two replicated blocks. Each replication consisted of ten plots, each plot planted to one variety. The
varietal results were based on the weight per plant in pounds.

Due to lack of control over cultural practices, the plant losses were too great to permit other than public, field, and market observational analyses, based on standards of varietal heading qualities, taste, and disease resistance.

Out of the varieties Golden Acre, Sutton's Pride of India, Stein's Flat Dutch, Ferry's Round Dutch, Copenhagen Market, Glory of Enkhuizen, Resistant Glory, Midseason Market, Marion Market, and Savoy Chieftain, the most promising were Resistant Glory, Ferry's Round Dutch, Stein's Flat Dutch, Copenhagen Market (check), and Marion Market.

VI. The pole bean Method-of-Planting experiment, using the Kentucky Wonder variety, was laid out in three replicated blocks. Each replication contained four randomized plant spacing treatments. The statistical analysis of the results of spacing treatments was to be based on treatment yield per acre.

Subsequent crippling losses due to Sclerotium rolfsii fungus led to abandonment of this trial before conclusive results could be obtained.

VII. The pole bean Time-of-Planting experiment, using the Kentucky Wonder variety, was conducted to determine the optimum time of planting pole beans after a pre-emergence spray was applied to the prepared beds. There was an attempt to determine the necessary number of weedings, with the results to be based on treatment yields per acre.

Due to heavy plant losses from Sclerotium rolfsii fungus, results were inconclusive, but there were indications that the optimum time for planting was approximately 8-10 days after a pre-emergence spray of 2,4-D was applied at the rate of six pounds per acre.
ACKNOWLEDGMENTS

The writer wishes to extend his gratitude to Mr. John Campbell, Mr. John Mayne, and Professor A. B. Killick, of the College Agriculture Department, with whose cooperation and generous assistance these trials were conducted.

The author is also indebted to Dr. A. L. Jolly and Dr. Basil Bartley for their valuable suggestions and guidance with the statistical layout and analysis of the trials.

Thanks are due to the Ferry-Morse Seed Company of California, U. S. A., for the donation of vegetable seeds used in the experiments, and to the Trinidad Department of Agriculture for the information generously supplied.

In addition, my thanks go to Professor R. E. D. Baker, Department of Mycology, Mr. J. Wilson, Botany Department, and Professor F. Hardy, Soils Department, for their helpful advice and loan of departmental laboratory materials.

I am grateful to members of the New and Old Farm Senior and Junior Staff, as well as field workers at the market garden, for their cooperation.

The keen interest and conscientious field labor of Murray Chate greatly aided the successful execution of the trials.
REFERENCES


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29. "Vegetable Gardening in the Tropics", Puerto Rico Federal Experiment Station Circular #33, USDA, (Oct., 1940)

30. "Vegetable Varieties", Ferry-Morse Seed Co. (1950)


### TABLE

#### APPENDIX I.

**Varieties and Treatments Means of Lettuce Yields of Six Varieties and Three Experiments.**

* (Average Wt./plant in ounces)

<table>
<thead>
<tr>
<th></th>
<th>N₁ 1</th>
<th>N₁ 2</th>
<th>N₁ 3</th>
<th>Mean Total</th>
<th>N₂ 1</th>
<th>N₂ 2</th>
<th>N₂ 3</th>
<th>Mean Total</th>
<th>N₃ 1</th>
<th>N₃ 2</th>
<th>N₃ 3</th>
<th>Mean Total</th>
<th>Mean Weights</th>
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<tbody>
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<td>Grand Rapids</td>
<td>3.7</td>
<td>2.2</td>
<td>3.3</td>
<td>3.1</td>
<td>4.3</td>
<td>2.4</td>
<td>3.4</td>
<td>3.3</td>
<td>2.96</td>
<td>2.2</td>
<td>2.7</td>
<td>2.6</td>
<td>3.04</td>
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<td>3.7</td>
<td>3.4</td>
<td>2.1</td>
<td>3.6</td>
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<td>3.3</td>
<td>3.3</td>
<td>3.7</td>
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<td>3.39</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Mignonette</td>
<td>3.7</td>
<td>5.6</td>
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<td>4.8</td>
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<td>5.1</td>
<td>4.2</td>
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<td>11.1</td>
<td>8.2</td>
<td>9.04</td>
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<td>11.0</td>
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### APPENDIX TABLE II

Analysis of Covariance of Number of Plants per Plot ($X$) and Total Yield (lbs) per Plot ($Y$), of each of Two Trials of Six Bush Tomato Varieties.

<table>
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<th>Source of Variation</th>
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<th>$XY$</th>
<th>$Y$</th>
<th>D/F</th>
<th>Sums of Squares</th>
<th>D/F</th>
<th>Mean Square</th>
<th>F</th>
<th>Regression Coefficient ($b_{y,x}$)</th>
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<tr>
<td><strong>B. Bush Tomatoes</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trial I:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Total</td>
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<td>3894.3</td>
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<td>Error</td>
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<td>1777.2</td>
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<tr>
<td>Total</td>
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<td>Error</td>
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### APPENDIX TABLE III

Analysis of Covariance of Number of Plants per Plot (X) and Total Yield (lbs) per Plot (Y), of each of Two Trials of Eight Stake Tomato Varieties.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sums of Squares and Products</th>
<th>Analysis of Covariance Errors of Estimate of Y</th>
<th>Regression Coefficient (b ( \times ) y)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Sums of Squares</td>
<td>D/F</td>
</tr>
<tr>
<td>Source of Variation</td>
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<td>XX</td>
<td>Y</td>
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<td>Total</td>
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<td>Error</td>
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<td>Difference for Testing Adjusted Mean</td>
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<td>7</td>
<td>6.59</td>
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</tbody>
</table>

#### Trial I

#### Trial II

### A. Stake Tomatoes

LEGEND:
- N: DAY TEMP.
- G: NIGHT TEMP.

LATITUDE: N° 38° 15' N.
LONGITUDE: E° 23° 50' W.