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PATHOLOGICAL PROBLEMS ASSOCIATED WITH VEGETABLE GROWING AT ORANGE RIVER AGRICULTURAL STATION

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INTRODUCTION

A Vegetable Research Programme was started at Orange River Agricultural Station in Jamaica on 1972 to determine the major pathological problems associated with vegetable growing under the particular climatic and ecological conditions and to find effective control measures. After eighteen months of research work on many different types of vegetables, we have found that some of the major diseases are late blight (Phytophthora infestans) and bacterial wilt (Pseudomonas solanacearum) of tomatoes, downy mildew (Pseudoperonospora cubensis) of cucurbits and black rot (Xanthomonas campestris) of cabbages. Since then we have been testing new varieties of these vegetables for disease resistance and searching for other control methods. This paper attempts to report and assess the results of variety trials carried out on 23 tomato, 9 cucumber and 5 cabbage varieties.

The objects of the exercise were to:

1) test all available varieties of important vegetables
2) observe what diseases occurred and at what time
3) assess their severity and relationship to climatic conditions (where possible), and
4) find effective control measures.

The first four tomato varieties tested were Manalucie, Oxheart, Tropi-Gro and Walter. We found that all four varieties were extremely susceptible to late blight, during the rainy season (October-January), crop loss was sometimes as high as 90% and it was almost impossible to effectively control this disease at this time even though a wide range of fungicides were tested. More than 95% of the Manalucie crop was lost to bacterial wilt when grown in areas where the causal organism was present.

Tests on cucumber varieties Straight Eight, Poinsett and Cherokee Hybrid indicated that the former was susceptible to downy mildew throughout the life of the plant. Over 80% of the Straight Eight crop was lost in the rainy season when plants were left lying on the ground and sprayed with different fungicides. However, good control was obtained by trellising the plants and spraying with Manzate D-Benlate or Daconil-Benlate. On the other hand, Cherokee Hybrid and Poinsett have exhibited resistance to the disease.

In late October of 1973 the following cabbage varieties were treated:- Japanese Succession, K-K, Express Cross 60, K-Y Cross, Hybrid 906, Early Jersey Wakefield, Jet-Pak, N-S Japan, Danish Ballhead and Copenhagen Market. After heavy rains in December (9 inches in 36 hours), black rot symptoms became evident. The disease was most severe in the Early Jersey variety, where 90% of the crop was lost. In all other cabbage varieties there were varying degrees of susceptibility, but all heads reaped were free of the disease.

The economic importance of these vegetable crops, the high losses resulting from the diseases mentioned and the limited success of the combination of good cultural practices and pesticide treatment, all point to a need for more intensive work on obtaining and testing resistant varieties in Jamaica.

MATERIALS AND METHODS

Tomato

Fourteen new varieties of tomato are presently being compared to the standard Manalucie for resistance to late blight. Seeds of 13 varieties were obtained from the Regional Plant Introduction Station at Ames, Iowa, and the other variety from Guadeloupe. For late blight resistance tests, seeds of all the varieties were germinated in peat pots. When the seedlings were four weeks old some were placed in an atmosphere conducive to disease build-up (cool, damp, shady conditions), the others were transplanted to the field for observations. Records are being kept of resistance and yield. Prior to obtaining seeds of these 14 varieties, we had obtained seeds of West Virginia 63, a late blight resistant variety, from the United States. The seeds of this variety and Manalucie were grown in peat pots and transplanted to the field when the seedlings were one month old. Records have been kept of resistance and yield.

Eight new varieties of tomato are being tested at present for resistance to bacterial wilt, together with the standard Manalucie. Two varieties were obtained from the University of North Carolina, five from the University of Hawaii and one from the Petit-Bourg Research Station in Guadeloupe. For bacterial wilt tests, one-month old seedlings of the new varieties and Manalucie were transplanted to the field in two areas:

a) known from previous experiments to be infested with Pseudomonas solanacearum,

b) free of this disease organism.

Records are being kept of performance under wilt and wilt-free conditions.

Cucumber

Six new cucumber varieties are now being tested along with three commercial varieties. The new varieties were obtained from the Plant Introduction Station at Ames. Records are being kept of resistance and yield.

Cabbage

Five varieties of cabbage, together with the standard Early Jersey Wakefield, are being field-tested in an area known from a previous experiment to be infested with Xanthomonas campestris. Seeds of the new varieties were obtained from the University of Wisconsin's X. campestris and Fusarium Yellows resistant breeding lines. Records are being kept of resistance and yield.

RESULTS AND DISCUSSION

Tomato-Bacterial Wilt

The results in Table I indicate that Venus and Saturn perform well under bacterial wilt conditions. Although favourable reports have been obtained from tests in Guadeloupe with INRA #74,

it does not react favourably under bacterial wilt conditions at Orange River. All plants of the variety Hawaii 7755 reported tolerant in Hawaii were killed by the bacterial disease. BWN4 reported resistant in Hawaii displays some tolerance, all plants wilt but remain alive. Although there is some fruit-set, it is apparent that the maturation and size of the fruits will be affected by the state of the plants. All Manalucie plants except three, were killed by the disease. The yield obtained for this variety came from the three plants which apparently "escaped" infection and from those few where the disease symptoms were not evident until sometime after fruit-set. For the other bacterial wilt resistant variety BW N10 and the two tolerant varieties, Hawaii #7958 and 7845 (all from the University of Hawaii), complete results are not available at this time, however, wilting had just commenced in #7845 and Manalucie when the paper was written.

It should be mentioned that the area where these tomato varieties are grown was treated with Nemagon prior to planting, to prevent any adverse effects of nematodes on the bacterial wilt resistance performance of the varieties. In correspondence with Dr. Gilbert of the University of Hawaii, it was stated that the bacterial wilt resistance of the Hawaiian varieties is less effective under hot tropical conditions. This could possibly explain the disappointing performance of the Hawaiian varieties tested so far. No attempt has yet been made to sort out the strains of P. solanacearum that exist in Jamaica.

In terms of ability to do well as new varieties under Orange River conditions, when the yields of varieties Saturn, Venus and INRA #74 are compared with Manalucie (TABLE II), INRA #74 is almost as good, Venus is quite good and Saturn is fair. The fruit quality of all three varieties is good. We did not determine the yielding ability of Hawaii #7755 and BW.N4 because of the limited supply of seedlings.

Late Blight

Seeds of West Virginia 63 were obtained from the United States as this variety has resistance to late blight. Seedlings of West Virginia 63 and Manalucie were transplanted after about four weeks. Seedlings of both varieties had slight late blight symptoms before transplanting. After transplanting, there were thirteen days of cloudy, rainy weather. All of the Manalucie plants were lost to late blight whereas all of the West Virginia 63 seedlings survived. We had to replant the Manalucie stand. The quantity and quality of the fruits of the West Virginia 63 compare favourably with the Manalucie variety (TABLE III).

One-month old seedlings from seeds of other Late Blight resistant varieties obtained from the Plant Introduction Station all exhibited Late Blight symptoms before either transplanting to the field or transferring to artificial conditions (to induce disease build-up). Severe infection did occur on some of the plants kept under artificial conditions; however, it was difficult to assess resistance even though an attempt was made (TABLE IV). For those transplanted to the field, several days of cloudy, rainy weather resulted in an increase of the disease. Evaluation of varietal differences is also difficult in the field, since the onset of dry, hot weather conditions has stopped the spread of the disease. It seems, however, that those varieties which were less severely infected in the artificial environment have also been less severely infected in the field:- 263716 (Puerto Rico), 114038 (Honduras), 110946 (Colombia), 118790 (Venezuela), 224675 (New York) (TABLE IV). We are evaluating all of the varieties as to fruit quality and

quantity. In the rainy season we plan to repeat the blight resistant test when weather conditions will be more uniform and conducive to disease build-up.

From the results in TABLE V of the new cucumber varieties, only #255936 from Holland appears promising when compared with the most resistant variety commercially grown - Poinsett. No data can be given on yields for these varieties in this paper as harvesting was not completed. Poinsett, Ashley and Straight-8 are all high-yielding commercial varieties. However, Poinsett is the only variety commercially grown at the present time, which exhibits very good resistance to downy mildew.

Cabbage - Black Rot

The five new varieties of cabbage are No. 291-296, 284-287, 268-274, 275-281, 250-256. These varieties now in the field with the standard Early Jersey have not yet reached maturity. Little data is available at this time. However, it is of interest to note that 30% of the Early Jersey plants are already exhibiting black rot symptoms.

CONCLUSION

1. The tomato varieties Venus and Saturn exhibit good resistance to bacterial wilt when tested in the field. The performance of INRA #74, Hawaii 7755 and BJN4 was disappointing. The yielding ability of Venus and INRA #74 is comparable with the standard Manalucie. That of Saturn is a bit low.

2. The variety of tomato West Virginia 63 shows resistance to late blight. Thirteen other varieties were being tested for late blight resistance.

3. Of the nine varieties of cucumbers tested for downy mildew resistance, the commercially grown Poinsett exhibits good resistance, a new variety from Holland is promising.

4. Five new varieties of cabbage are being tested for resistance to black rot, no results are available at this time.

TABLE I. Results of Performance of six varieties of tomato grown in soil infested with P. solanacearum.

Variety[1]	Avg. No. fruits/plant	Avg. size of fruits (oz.)	Avg. yield/ plant (lb/oz)	% Wilt
Venus	25	3.5	5.5	0
Saturn	15	3.2	2.9	0
Manalucie	3	1.4	0.3	98 (All wilted plants have died).
INRA #74	20	2.5	3.1	30 (All wilted plants have died).
Hawaii #7755	0	0	0	100 (All wilted plants have died)
BJN4	0	0	0	100 (All wilted plants are still alive)

Key

1 Manalucie - grown commercially
Venus, Saturn - seeds obtained from the University of North Carolina
INRA #74 - seeds obtained from Petit Bourg Research Station in Guadeloupe
Hawaii #7755 and BJ N4 - seeds obtained from the University of Hawaii.

TABLE II. Results of Yield of four varieties of tomato grown in soil free of P. solanacearum.

Variety[1]	Avg. No. of fruits/plant	Avg. size of fruits (ozs)	Avg. yield/plant (lb/oz)
Venus	15	4.8	4.8
Saturn	11	4.2	3.0
INRA #74	16	5.1	5.0
Manalucie	10	9.0	5.10

1 No results are available for Hawaii #7755 and BN 14 because limited seed supply prevented yield studies.

TABLE III. Results of yield performance of West Virginia 63 - a late blight resistant variety of tomato and Manalucie - a commercially grown variety.

Variety	Avg. No. of fruits/plant	Avg. size of fruits (ozs)	Avg. yield/plant (lb/oz)
Manalucie	10	9	5.1
West Virginia 63	17	6	6.6

TABLE IV. Results of Resistance of tomato varieties to P. infestans both under artificial conditions and in the field.

Variety	Disease rating[1]	%Survival[2]	Survival Index[2]
91913 - Bulgaria	2	67	2
95584 - Manchuria	3	25	4
108245 - Germany	2	0	5
110946 - Colombia	1	50	3
114038 - Honduras	1	56	2
118790 - Venezuela	1 - 2	50	3
126408 - Panama	2	60	2
126907 - Peru	2	33	3
198674 - Mexico	0 - 1	0	5
204994 - U.S. (A. Va.)	2	0	5
224675 - U.S. (New York)	1 - 2	47	3
263716 - Puerto Rico	1 - 2	50	3
273446 - Philippines	2	25	4
Manalucie	2 - 3	25	4
Pieraline INRA 1970 Guadeloupe	Too young	-	-

1 Infection in the field

Disease Index

1 - slight
2 - moderate
3 - severe

2 Index of survival of seedlings in peat pots

1 - 76-100%
2 - 51-75%
3 - 26-50%
4 - 1-25%
5 - dead due to disease

Cucumber - Downy Mildew

TABLE V. Results of resistance, fruit size, colour and eating quality of six new cucumber varieties compared with commercial varieties.

Variety	Disease[1] rating	Size of fruits (cm length)	Diam.	Colour and eating quality
# 173889 (India)	3	8.3	4.3	Yellow, bitter
# 197087 (India)	2 - 3	fruits not mature enough for any assessment		
# 175120 (India)	4	9.6	4.3	Green, good
# 234517 (U.S.)	3	fruits not mature enough for any assessment		
# 255936 (Holland)	1	15	5	Green, good
# 227208 (Japan)	1 - 2	29.3	4.5	Green, good
Straight-8 (commercially grown)	2 - 3	20	5	Green, good
Ashley (commercially grown)	2 - 3	18.75	5	Green, good
Poinsett (commercially grown)	0 - 1	21.25	6.25	Green, good

[1] Key

1 - slight
2 - moderate
3 - fairly heavy
4 - severe
5 - dead