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THE EFFECT OF TOBACCO ETCH VIRUS ON THE GROWTH AND YIELD OF TWO *Capsicum chinense* PEPPER VARIETIES

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ABSTRACT

The effect of tobacco etch virus (TEV) on the growth and yield of two hot pepper (*Capsicum chinense)* varieties, Scotch Bonnet and West Indian Red pepper was investigated in a field trial under natural virus/vector pressure. Four treatments comprising covered and uncovered treatments were investigated.

The effect of TEV on plant height and foliage cover was not significant in covered and uncovered Scotch Bonnet and West Indian Red treatments. This was due to the delay in virus introduction within treatments. When virus was first detected maximum vegetative growth was already attained.

Despite the delay in virus onset there was a 52.5% yield reduction in uncovered Scotch Bonnet treatments. Virus infected uncovered West Indian Red treatments on the other hand showed only a 14% yield reduction in the presence of virus. Due to the relatively high temperature and humidity under covered treatments, little or no yield data were obtained for analysis.

A negative correlation was found between total marketable yield, after eight weekly harvests and virus disease incidence at 91, 98 and 106 DAT for uncovered Scotch Bonnet pepper treatments. This correlation was even greater between the latter four weekly harvests and virus disease incidence at the same dates. No correlation existed between these variables in uncovered West Indian Red pepper treatments.

It was concluded that host genotype, the time of infection and virus incidence were factors which influenced the effect the virus had on growth and yield.

INTRODUCTION

Tobacco etch virus (TEV) is widespread in pepper growing areas in Jamaica and has been reported as a limiting factor to hot pepper production (McGlashan, 1994; Myers, 1996; Myers and Prasad, 1997). The virus has been linked to reductions in yield and overall productivity of the crop (McGlashan, 1994; Myers, 1996; Myers and Prasad, 1997). However no quantifiable information exists on the effect of this virus on hot pepper growth and yield in Jamaica.

This study was undertaken to determine the effect of this virus in uncovered and covered treatments on the growth and yield of two hot pepper varieties: Scotch Bonnet pepper a local pepper which fetches a high price on the export market and West Indian Red pepper which is new to the Jamaican environment but has been noted for its high level of productivity.

MATERIALS AND METHODS

Field study

Research was conducted at the Bodles Research Station in St. Catherine in summer 1997. Scotch Bonnet pepper and West Indian Red pepper seeds were sown in steam sterilized soil in seedling trays. At the second-true-leaf stage, the seedlings were transferred to potting bags and kept in an insect proof glasshouse for eight weeks.

Pepper seedlings were transplanted in the field on July 8.

Each experimental plot consisted of a single pepper genotype. Four treatments comprising of covered and uncovered Scotch Bonnet and West Indian Red pepper were arranged in a randomized incomplete block (RCB) design. The blocks ran parallel to each other. Typar®, a spun bound polyester material was used in covered treatments. Uncovered treatments were replicated nine times while covered treatments were replicated three times.

Plot size was 3.0 x 6.0 m. Plots consisted of two double row beds with seven plants per row. Distance between plots was 3.0 m. Plant to plant distance was 1.0 m and between rows was 0.9 m.

Sprinkler irrigation was provided once a week. Cultural practices were done according to standard farmer practice. No chemicals were applied to treatments with the exception of covered treatments, to control very high aphid populations. In that instant plants were sprayed with soap and dimethoate applications.

The inner two rows consisting of five plants in each row were monitored and the following assessments made. The end row plants were not included to minimize edge effects.

Virus incidence

Both primary and secondary virus spread within treatments occurred by natural means. Leaves from the top middle and lower levels of each plant were collected and pooled and assayed for TEV and potato virus Y (PVY) by dot blot immunobinding assay (DIBA) according to Tolin (personal communication from Sue Tolin who is a Pathology professor at Virginia Polytech Institute). PVY often occurs in mixed infections with TEV.

Disease severity

Symptoms were scored weekly using the following scale: 0 = no symptoms, 1 = vein-clearing, 2 = vein-clearing and mosaic, 3 = mosaic and leaf deformation 4 = severe leaf deformation, mosaic and stunting.

Yield parameters

Fruit harvesting commenced 70 DAT. Marketable yield and fruit number were recorded weekly. A total of eight harvests was conducted. Marketable fruit were selected on the following criteria:(1) A minimum diameter or length of 2.5 cm,(2) fresh and turgid, (3)green stem and calyx, (4)free from skin breaks, mechanical injuries, bruises or decay, (5)no discoloration nor insect or bird damage and (6) no distortion due to virus infection.

RESULTS

Virus incidence

Fruit set had already occurred when virus was first detected in uncovered treatments. Tobacco etch virus was confirmed by DIBA in plants manifesting virus-like symptoms. TEV was detected as early as 49 and 56 DAT in uncovered West Indian Red (WIR) and Scotch Bonnet plots respectively. TEV incidence reached 100% in virus infected uncovered treatments by 98 DAT. Two periods of virus spread were observed in uncovered treatments. Primary spread occurred 49-70 DAT and secondary spread 70-98 DAT. The time of onset of virus disease and the rate of virus spread varied within uncovered treatments. It must be noted that uncovered treatments in blocks 1-3 were not infected with virus, while uncovered treatments in blocks 4-6 were infected with virus during the course of the experiment. No virus was detected in covered treatments.

Relationship between virus disease severity and yield

There was a significant ($P<0.05$) negative correlation between virus disease severity and Scotch Bonnet yield. There was no correlation between these variables in uncovered West Indian Red treatments.

Relationship between virus incidence and yield

Highest marketable yields were obtained from uncovered treatments with no virus disease (Table 1). West Indian Red pepper and Scotch Bonnet healthy uncovered treatments showed similar levels of productivity (Fig. 1a), however West Indian Red pepper gave higher yields.
Virus disease had a marked effect on the productivity and yield of uncovered Scotch Bonnet treatments (Table 1 and Fig. 1b). The productivity of West Indian Red uncovered treatments was not as adversely affected by the presence of virus (Table 1 and Fig. 1b).

Table 1. Marketable yield parameters of healthy and virus infected Scotch Bonnet(SB) and West Indian Red (WIR)pepper uncovered treatments.

	Harvests 1-4 Fruit no.	Yield(g)	Harvests 5-8 Fruit no.	Yield(g)	Total fruit no.	Total yield(g)
Healthy SB	127	1289.07	227	1752.6	354	3041.67
Healthy WIR	181	1437.10	246	2087.81	427	3524.91
Virus infected SB	112	1084.86	56	453.65	168	1538.51
Virus Infected WIR	161	1539.3	198	1494.26	359	3033.56

Little fruit was harvested from covered Scotch Bonnet treatments as only one of three replicates produced fruit. There was little or no flowering in these treatments. Covered West Indian Red treatments produced fruit but the quantities were insufficient for analysis. High temperature and humidity under the covers may have inhibited fruit set.

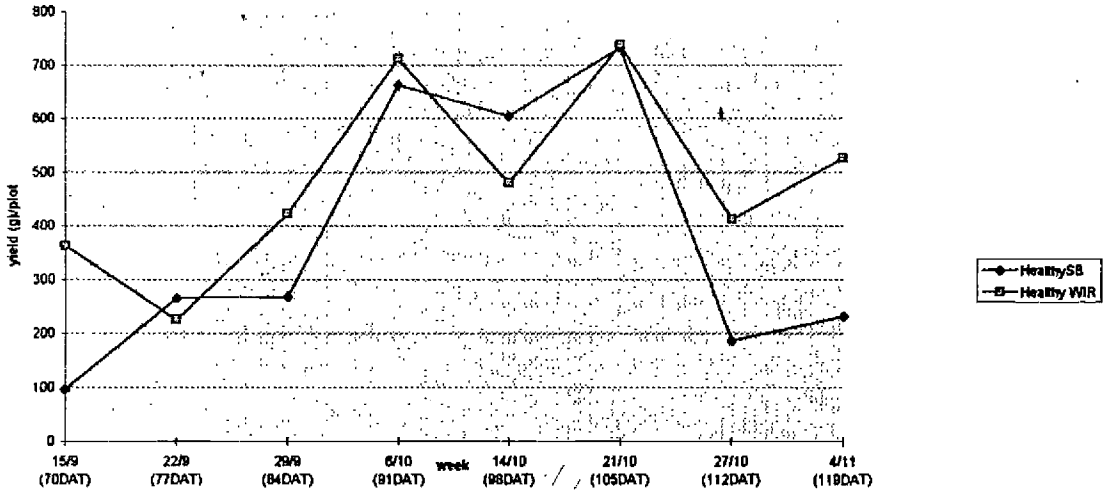

Figure 1a. Mean marketable yield of uncovered healthy Scotch Bonnet and West Indian Red Pepper treatments against time

There was a negative correlation between total yield and virus disease incidence at 84, 91, 98, and 106 DAT in uncovered Scotch Bonnet treatments. There was an even higher negative correlation between the last four harvests and virus disease incidence on these dates (Fig. 1b). The highest correlation occurred with virus disease incidence 84 DAT ($r=-0.765$; $p=0.07$). There was no correlation between the first four harvests and virus disease incidence (Fig. 1b).

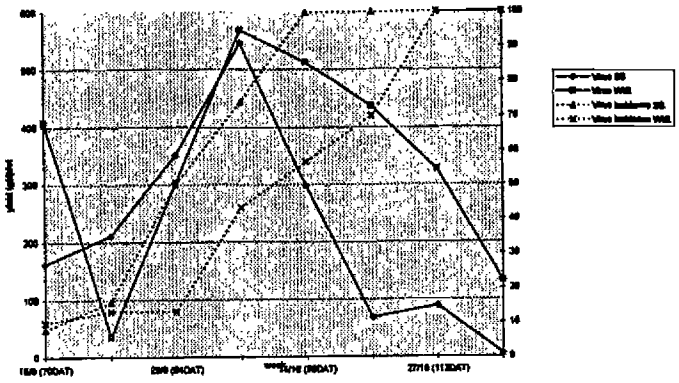

Figure 1b. Mean marketable yield and virus incidence of uncovered virus infected Scotch Bonnet and West Indian Red Pepper treatments against time

There was no correlation between yield parameters and virus disease incidence in uncovered West Indian Red pepper treatments.

DISCUSSION

It was always the belief that the late appearance of virus disease would have a low impact on yield (Bos 1981). However in this study, Scotch Bonnet pepper was found to be more susceptible to tobacco etch virus disease, although virus disease came in after the vegetative growth period. West Indian Red on the other hand appeared more tolerant to the disease. This may have important implications in efforts to develop virus control measures, that delay the introduction of the virus unto plants. This study showed that yields were comparably high in Scotch Bonnet and West Indian Red treatments up to the fourth harvest but dropped drastically in the case of Scotch Bonnet treatments. This occured as the virus disease incidence increased rapidly in Scotch Bonnet plots after the fourth harvest. Villalon (1981) investigated the effects of TEV on yields of eight bell pepper types. Yield reductions varied from 4.6% in resistant cultivars to as high as 58.7% in susceptible cultivars (Villalon, 1981). In this study there was a 52.5 % reduction in Scotch Bonnet yield and a 14% reduction in West Indian Red yield in the presence of TEV. Comparatively higher levels of virus incidence during early harvest may have negatively impacted on the level of productivity of Scotch Bonnet pepper later on in the season. The interaction of varying parameters such as host genotype, virus disease incidence and disease severity contributed to the impact of the virus on yield. Hence measures which act in controlling any of these parameters will go a long way in affording proper management of the disease.

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