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EXTENDING THE TOMATO SEASON IN PUERTO RICO: PROBLEMS OF SUMMER PRODUCTION

L. Wessel-Beaver, G. Fornaris, A. Armstrong, E. Caraballo, and L. Velázquez

University of Puerto Rico
Mayaguez, Puerto Rico 00708

ABSTRACT

Commercial varieties and breeding lines of tomato were evaluated over three planting dates (April, May, June) in 1988 and 1989 at Juana Díaz, Puerto Rico in order to study the effects of planting date, variety, and planting date by variety interaction of summer tomato production. In addition, the 1989 plantings included sprayed and nonsprayed plots at every planting date to evaluate the importance of insect pests particularly pinworm. While average yield over all varieties decreased markedly with later planting dates, heat tolerant varieties 'Heatwave' and 'Capitan' maintained excellent yields (up to 70,000 kg/ha) in the April and May planting dates and good yields (45,000 kg/ha) in the June planting. Tomato pinworm populations and damage were high at the beginning of the summer, decreased and then increased again. Use of a heat tolerant variety is essential for successful summer tomato production.

INTRODUCTION

Almost all commercial tomato production in Puerto Rico is found on the south coast during the relatively cool and dry winter months of November through April. Nevertheless, there is a strong interest on the part of tomato producers to extend their growing season into the summer months. A strong export market may not be available during the summer, but a local demand exists which is currently satisfied by imports because of little or no local summer production.

Almost all varieties currently planted on the south coast during the winter months exhibit low fruit set when planted during the summer. Average day/night temperatures above 32C/21C result in poor fruit set in most tomato genotypes (Abdalla and Verkerk, 1968; Went, 1944). Summer temperatures on the south coast of Puerto Rico regularly reach those limits. In addition to high temperatures, summer tomatoes are subjected to a high incidence of insect pests and diseases. High rainfall, humidity, and temperatures, as well as continuous tomato plantings over many months, contribute to the incidence of these problems.

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Similar problems are encountered in other areas of the Caribbean (Anais and Dali, 1985; Suah, 1986).

The objective of our study was to determine the effect of the following factors on tomato production, fruit quality, and incidence of diseases and pests (especially tomato pinworm):(1) planting date (April, May, June), (2) variety, (3) date by variety interaction, and (4) insecticide sprayed vs. non-sprayed treatments.

MATERIALS AND METHODS

A total of 22 genotypes were planted in the summer of 1988 and 1989. These included commercial varieties and advanced breeding lines from the University of Florida and University of Puerto Rico breeding programs. This paper deals chiefly with 12 commercial varieties planted in both years. Seed companies were requested to supply their most heat tolerant materials. Flora-Dade and Flora-Del were included as heat susceptible checks. Seed sources and variety codes used appear in Table 1. Month-old seedlings were transplanted into single 6.9 m rows. At each planting date (19 April 1988, 24 May 1988, 22 June 1988, 24 April 1989, 25 May 1989 and 22 June 1989) genotypes were planted in a randomized complete block design with 2 replicates. In 1989 two trials were planted at each of three planting dates: one trial was sprayed with a rotation of various insecticides and the other was unsprayed. Cultural practices typical of the Puerto Rican south coast tomato production areas (drip irrigation, plastic mulch, fertigation, and staking) were used. Depending on the planting date, 2 to 4 harvests were made of mature green to red fruit. Total weight of each plot was measured and a random 50-fruit sample was taken to determine weight and number of culls, small/medium fruit and large/extra large fruit (small, medium, large, extra large as defined by US grading system).

RESULTS AND DISCUSSION

In general we observed a very strong negative effect of later planting dates on yield (Figure 1). The average yield (over two years) of the April planting date was about 35 MT/Ha, fell to about 23 Mt/Ha in the May plantings and finally dropped to about 14 Mt/Ha at the June planting date. Nevertheless there were certain varieties that produced very well in the April and May planting dates, particularly Heatwave (PSR) and Capitan (AP). In the April planting many varieties did well, including including Sunny, Duke, Flora-Dade and Flora-Del which are not considered heat tolerant (Figure 2). Heatwave (PSR) and Whirlaway (WHL) had excellent yields of large and extra large fruit. In the May planting overall yields were reduced by about a third compared to April but again Heatwave and Capitan maintained good yields (although Capitan had smaller fruit)

(Figure 3). The June plantings (harvested in September) averaged about a third of the yield of the April plantings (Figure 4). Capitan was the most heat tolerant variety at this planting date but its yield was also severely affected by high temperatures common in late summer. In general we observed a decrease in yield of about a third at each later planting date. Figure 5 summarizes our results over 3 summer planting dates in each of two years. Heatwave (PSR) and Capitan had the highest average yields although Capitan tends to have smaller fruit (generally U.S. medium) than other heat tolerant varieties. Other good summer varieties were Whirlaway, Flash, and Bingo.

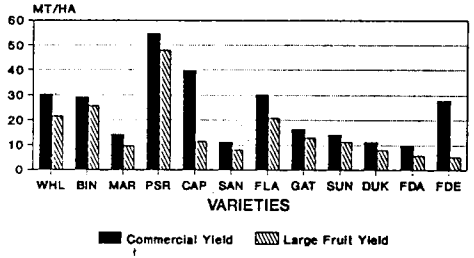
Besides fruit set, insect pests and disease can be a problem during summer tomato production, although we found poor fruit set to be the most limiting problem. However, if a heat tolerant variety is used, then insects, particularly tomato pinworm (*Keiferia lycopersicella* Walsingham), become limiting. Populations of this insect can increase dramatically especially with continuous production of tomatoes through two seasons (winter and summer). Spraying was not very effective against tomato pinworm although it did control most other insect pests. Sprayed plantings yielded better than unsprayed although there is no statistical test to compare these means since plantings were not replicated (Figure 6). Along with tomato pinworm, red spider mite was also difficult to control.

In general diseases were a minor problem compared to poor fruit set and insects, particularly in the April and May planting dates. Early blight (*Alternaria solani*) and Gray leaf mold (*Cladosporium fulvum*) became more severe in the June planting dates. High humidity and rainfall are particularly common in the months of August and September and contribute to high disease incidence. Finally it should be noted that many of the varieties tested were severely affected by radial cracking.

CONCLUSIONS

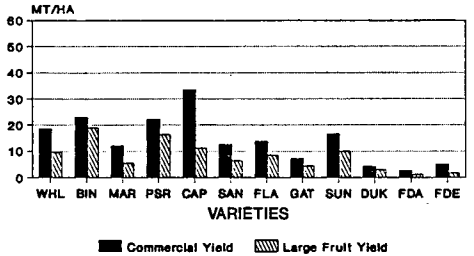
In summary we found that tomato production was highest at the April planting date and decreased by one third at each later date. Some varieties (Heatwave, Capitan, Whirlaway, and Bingo) showed little yield reduction in the May compared with April planting date. All varieties had severely reduced fruit set and yield in the June planting but Capitan was the least affected. Reduced fruit set due high temperatures limits summer tomato production in Puerto Rico more than insect pests or disease. When a heat tolerant variety is used tomato pinworm may become a limiting factor in summer tomato production. Red spider mite can also be severe under conditions of high temperatures and reduced rainfall. Diseases are the least limiting problem in summer tomato production in Puerto Rico.

Figure 3. Tomato yields* averaged over 1988 and 1989 late May plantings at Juana Diaz, Puerto Rico



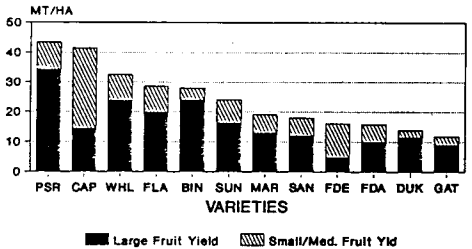
*not including fruit damaged and/or sized less than 2 4/32" (U.S. 7x7)

Figure 4. Tomato yields* averaged over 1988 and 1989 late June plantings at Juana Diaz, Puerto Rico



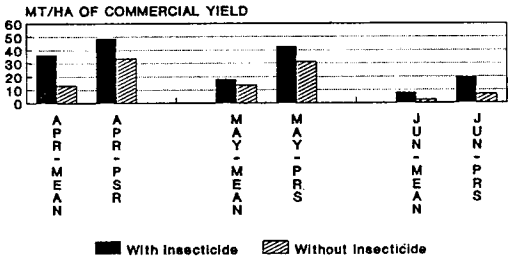
*not including fruit damaged and/or sized less than 2 3/32" (U.S. 7x7)

Figure 5. Tomato yields* at Juana Diaz, Puerto Rico averaged over April, May and June planting dates in 1988 and 1989.



*not including damaged and/or fruit less than 2 4/32" -- U.S. 7x7

Figure 6. 1989 tomato yields* over three summer planting dates at Juana Diaz, PR with and without insecticides.

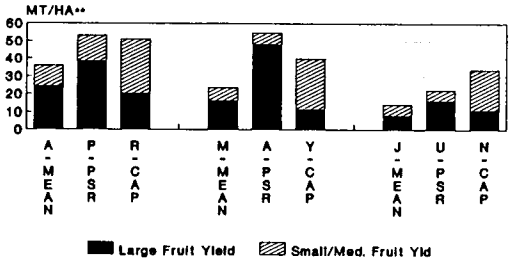


*Averaged over 13 genotypes in 1989.

Table 1. Variety code names used in figures 1 - 6 and seed source:

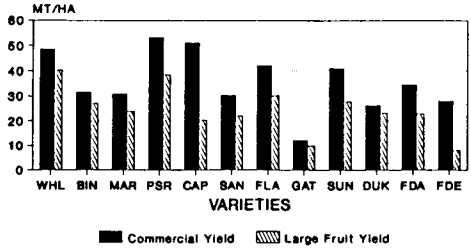
WHL	Whirlaway	Ferry-Morse
BIN	Bingo	Ferry-Morse
MAR	Marquis	Harris-Moran
PSR	PSR-39686	Petoseed
	(released in 1989 as 'Heatwave')	
CAP	Capitan	Petoseed
SAN	San Quintan	Asgrow
GAT	Gator	Asgrow
FLA	Flash	Asgrow
SUN	Sunny	Asgrow
DUK	Duke	Petoseed
FDA	Flora-Dade	Asgrow
FDE	Flora-Del	Asgrow

Figure 1. Planting date* effect on average tomato yields and yields of variety 'Capitan' and 'Heatwave (PSR)'.



*Averaged over 1988 and 1989.
**Not including fruit damaged and/or sized less than 2 4/32" (U.S. 7x7).

Figure 2. Tomato yields* averaged over 1988 and 1989 late April plantings at Juana Diaz, Puerto Rico



*not including fruit damaged and/or sized less than 2 4/32" (U.S. 7x7)

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