Rowcovers Improve Early Season Tomato Production

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Summary. 'Pilgrim' tomatoes (*Lycopersicon esculentum*) grown under slitted clear polyethylene or spunbonded polypropylene rowcovers were compared to those with no protection for the effect on yield. Both covers significantly increased early yield in terms of fruit numbers and weight, but no differences were observed in total yields. In addition, no difference was observed in yield between two tomato transplant sizes- 4- to 5-leaf stage and 6- to 7-leaf stage---grown in the same-sized containers. The results from this study indicate that early tomato yield may be enhanced with the use of rowcovers.

In an effort to maximize farm profitability, vegetable growers attempt to bring crops to market earlier. Early harvests may result in price premiums two to three times that received just a few weeks later. Plastic mulches have been used by growers to enhance earliness for many years. In addition, the past decade has seen an increase in the use of rowcovers to enhance early yield further. The protected conditions under the cover have resulted in early yield enhancement for muskmelons (Hemphill and Mansour, 1986; Wells and Loy, 1985) and other cucurbits (Hemphill and Crabtree, 1988), but has had a mixed effect on peppers (Gent, 1989) and tomatoes. Perry and Sanders (1986) demonstrated that early yield of tomatoes was reduced, possibly due to high temperatures under the covers. Wolfe et al. (1988) estimated that temperatures

exceeding 35C can result in detrimental effects on tomato yield. Peterson and Taber (1991) found a correlation between early yield loss and a sustained high temperature exceeding 40C for 3 consecutive hours or more. Apparently this may be related to insufficient pollination at high temperatures (Shelby et al., 1978), blossom drop (Sugiyama et al., 1966), or fruit abortion (Peterson and Taber, 1991).

Tomato transplants grown in large cell sizes have resulted in an increase in early yield as compared to those produced in smaller cells (Weston and Zandstra, 1986). Perry and Sanders (1986) also looked at tomato transplant size when grown with and without covers. Transplants grown in 7.5-cm square peat pots under rowcovers resulted in significantly greater early marketable yield than from plants grown in 5-cm pots. The effect of rowcovers on the growth and yield of tomatoes grown in the same cell size, but transplanted at different sizes, has not been evaluated. Growers may find that, if weather conditions are poor, they may be forced to wait 7 to 10 days before planting, resulting in plants that may be larger than preferred. The objective of this study was to compare the effect of plant protection systems on two different-sized tomato transplants for their effect on early and total yield.

'Pilgrim' tomato was seeded in plastic cell packs (48 cells per flat, each cell 130 cm³) containing a 1 peat : 1 vermiculite mix (v/v). There were two seeding dates (8 and 22 Mar. 1989) to obtain two different transplant sizes. Plants were irrigated weekly with 0.6 g (15N-6.5P-12.4K) fertilizer/liter. Plants were also watered to runoff as needed and were grown in a glass greenhouse with air temperatures ranging from 18 to 24C. Fields were prepared at the Vegetable Research Farm in New Brunswick, N. J. The soil was a Colt's Neck loam (fine loamy mixed mesic, Typic Hapludults) with 56N-28P-28K (kg·ha⁻¹) broadcast and incorporated by discing. Black polyethylene mulch and trickle irrigation was applied on 1.5-m centers. Tomatoes were set into plastic at a 0.6-m spacing on 28 Apr. Plant protection systems were installed immediately following planting. Rowcover treatments included 1) slitted clear polyethylene (Agway, Elizabethtown, Pa.), 2) spunbonded polypropylene (20 g·m⁻², Kimberly Farms, Roswell, Ga.), and 3)

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no plant protection system. Both rowcovers were supported by wire hoops spaced over every other plant. The two transplant sizes were 1) 4- to 5-leaf stage and, 2) 6- to 7-leaf stage. Pesticides and trickle irrigation were applied according to the New Jersey Commercial Vegetable Production Recommendations (Garrison and Reiners, 1989). Rowcovers were removed 22 May, when the plants began to touch the tops of the covers. Temperatures were recorded in each plot using a 21-X micrologger (Campbell Scientific, Logan, Utah) with thermocouples placed 7.5 cm above the plastic mulch. Harvest of breaker-stage fruit began on 6 July and continued twice weekly until 5 Sept. Fruit harvested during the first 18 days were considered early. Fruits were divided into marketable and unmarketable (fruit diameters <6.4 cm, rotted, cracked, misshapened), counted, and weighed.

A randomized complete block was used in this 2 × 3 factorial with four replications. The experimental unit consisted of 6.1 m of row. Data were subjected to analysis of variance and means separated by the protected least significant difference (LSD).

Interactions were not significant, so only main effects are addressed. Early yield of tomatoes was increased significantly by the use of either spunbonded or slitted clear plastic rowcovers as compared to no protection system (Table 1). These results differ from some earlier studies (Perry and Sanders, 1986; Peterson and Taber, 1991; Wolfe et al., 1989), which showed no early yield enhancement, but a decrease in early marketable yield. Wolfe et al. (1989) attributed this to the frequency and duration of temperatures exceeding 35°C under rowcovers;

Fig. 1. Maximum daily temperatures with spunbonded (solid circle), clear (open triangle), and no rowcovers (open circle).

Peterson and Taber (1991) found a correlation between early yield loss and a sustained high temperature exceeding 40°C for 3 consecutive hours or more. Others (Shelby et al., 1978) have found poor pollination and yield at temperatures exceeding 30°C. In our study, temperatures exceeded 30°C 7 and 10 of the 24 days that rowcovers were present in the spunbonded and clear rowcover treatments, respectively (Fig. 1). Temperatures exceeding 35°C occurred on 4 of the 24 days in both rowcover treatments. In addition, high temperatures under the slitted clear plastic were consistently 1 to 3°C higher than spunbonded covers, yet there was no significant difference in yield between these treatments.

Early yield of tomatoes may not have been affected adversely in this study for a number of reasons. Temperatures under covers exceeded 30°C on less than half the days that rowcovers were present. In addition, information

is not available as to the duration of the maximum temperature each day. Longer durations may result in a significant decrease in early yield enhancement. In addition, tomato varieties differ in their abilities to set fruit under temperature extremes (Shelby et al., 1978). More work is needed comparing the yield of different varieties under rowcovers.

Plant size had no effect on either early or total yield (Table 1). It was hypothesized previously that larger, root-bound plants may be stressed more severely by the high temperatures under the covers. This was not the case in this study, however, and may again be due to the limited duration of the high temperatures. No differences were observed in total yield or average fruit weight with either plant protection system. Apparently, the growth of unprotected plants eventually equals those under covers as the season progresses.

Work with peppers has demonstrated that there is an optimum period for rowcovers to enhance early yield (Gant, 1989). Early transplanted peppers covered from late April until mid-June resulted in early yield increases of 12% to 19% compared to no cover treatments. Later plantings covered from late May through early July resulted in decreased early season production. This indicates that, in peppers, rowcovers left on past the optimal season will result in a detrimental effect on early yield, probably due to higher temperatures later in the season. Work by others has indicated that a similar effect on yield is also true with

Table 1. The effect of rowcovers and plant size on early and total yield of tomatoes.

Treatment	Early			Total		
	Marketable		Cull	Marketable		Cull
	Total (lb/acre)	Per fruit (oz)		Total (lb/acre)	Per fruit (oz)	
No cover	5,760	6.3	1589	26,020	6.4	8,065
Spunbonded	8,833	5.7	2497	23,235	6.1	8,833
Clear	11,810	6.1	3360	29,284	6.2	9,601
LSD ²	3,003	NS	1635	NS	NS	NS
4- to 5-leaf	8,642	6.0	2208	22,563	6.1	7,586
6- to 7-leaf	8,930	6.0	2785	29,764	6.4	10,081
LSD ²	NS	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS	NS

²Protected LSD at the 5% level of significance.

tomatoes. This may help explain differences between this study and others examining tomatoes and rowcovers. To maximize this early yield enhancement, growers need to use covers early in the season before consistently high temperatures may decrease yield.

This study indicates that rowcovers may be used to increase early season yield of tomatoes. Growers need to examine spring temperature data for their areas to optimize planting times under covers and also determine average prices for early season tomatoes in their area to ascertain whether rowcovers are a cost-effective system for them.

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