

*The
Connecticut
Agricultural
Experiment
Station,
New Haven*

Row Covers
to Produce
Red or Yellow
Peppers

BY MARTIN P.N. GENT

Bulletin 870

July 1989

SUMMARY

Ripe red or yellow sweet peppers were produced up to two weeks earlier than with conventional cultivation when pepper seedlings (*Capsicum annuum* L.) were transplanted in the field on April 20 and covered for 8 weeks with spun bonded polypropylene floating row cover. Row cover applied over seedlings transplanted on May 23 did not result in early production. Several cultivars gave high early yields of ripe peppers when grown under row cover: Canape and Parks Early Thickset produced small blocky green peppers turning to red; Golden Belle produced large blocky green peppers turning to yellow; and Gypsy produced elongated yellow peppers turning red when ripe. Averaged over all cultivars, growth under row cover increased yields by 12 and 19%, in 1987 and 1988 respectively; compared to conventional cultivation. However, growth under row cover decreased the weight per pepper by 15 and 5%, in 1987 and 1988 respectively. Floating row cover does not provide frost protection, which may be needed for seedlings transplanted on April 20. However, sprinkling throughout the night or covering overnight with a second impermeable cover provided frost protection. With these precautions, Connecticut farmers could produce a crop of colorful red or yellow peppers starting as early as late July and continuing until a killing frost.

Row Covers to Produce Red or Yellow Peppers

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Ripe red or yellow sweet peppers command a high price in retail stores but to be a profitable crop for Connecticut farmers they need to be produced for a longer period than current practices allow. Two drawbacks inherent in current production practices limit availability of ripe peppers to a short period in September and October. Transplants are set late in the spring to avoid frost damage and to provide pepper seedlings the warm temperature required to grow well. The popular, large-fruited cultivars, such as Calwonder and Yolo Wonder, bred for California conditions, ripen late.

Row covers were used for earlier production of vegetables as much as 30 years ago (Hall and Bessemer 1972). Covering pepper seedlings with row cover after transplant into the field should accelerate plant development, promote earlier ripening and extend the season of production of red or yellow peppers. The early row cover, clear polyethylene sheet, was labor intensive; it had to be supported above the plants and ventilated on sunny days to prevent high temperature injury (Waggoner 1958). Recently-introduced spun-bonded floating row covers require less attention. These light and porous materials can be draped directly over the plants and left over the plants on hot sunny days. (Wells and Loy 1985).

Row cover accelerates plant development by trapping energy from solar radiation and raising the temperature under row cover above that in the open field in daytime. At night plants under row cover cool to the same temperature as those outside. Nevertheless, row cover warms plants by 5 F averaged over the daily cycle. In Connecticut the extra growing degree days should accelerate plant development up to 2 weeks in the spring.

Although early vegetative growth is promoted by covering vegetable transplants and flowers appear earlier, ripening of the fruit is advanced less. Row cover may

reduce fruit set when hot weather arrives (Splittstoesser and Gerber, 1989). If row cover is removed early, at flowering, the rate of development during the longer period from flowering to fruit ripening is the same as for plants grown in the open, and the effect of row cover on fruit ripening is negligible. If peppers were transplanted a month earlier than the conventional date, row cover would warm the plants and accelerate development during the cool part of spring. Hot weather is less likely and row cover would have less deleterious effects on flowering or fruit development. Therefore, the row cover could remain over plants after flowering and continue to accelerate development during fruit growth.

Sweet pepper cultivars may differ in their response to row cover. West and Pierce (1988) noted such differences among tomato cultivars. Those tomato cultivars that had the earliest or heaviest yield in the open field were not the best when grown under row cover. Thus, the choice of cultivar may be important to produce ripe peppers early.

During 1987 and 1988 I determined whether early planting and prolonged row cover resulted in earlier ripening of sweet peppers than normal cultural practice. In addition, I compared 18 different cultivars to see which gave the earliest and largest yields under these growth conditions.

METHODS

Sweet pepper plants (*Capsicum annuum* L.) were started from seed. The cultivar names, source of seed, and characteristics of the immature and ripe peppers are given in Table 1. For the early planting, seeds were germinated in mid February; for the late planting in late March. Seeds were planted in pots 2 x 3 x 2 inches deep filled with Promix BX, and germinated in a growth room at

70 F. After emergence, seedlings were transferred to a heated greenhouse and grown at 70 F/60 F day/night.

After hardening off for 2 weeks in a cold frame, the seedlings were transplanted into the field at Lockwood Farm in Hamden, CT. The soil was Cheshire fine sandy loam, pH 6.3, amended with N:P:K 10:10:10 at 440 lb/acre. Black polyethylene mulch was laid north-south in 4-foot wide strips separated by 2-foot aisles. The pepper seedlings were transplanted through the mulch to the original soil depth. In 1987, each plot contained nine plants spaced on 18-inch centers in a 3 x 3 array. In 1988, each plot contained six plants spaced on 18-inch centers in a 2 x 3 array.

The field was watered after transplanting and as needed later in the summer to prevent drought stress. When frost was predicted, the field was sprinkled from overhead throughout the night to prevent frost damage.

Treatments

In both 1987 and 1988, peppers were transplanted into the field either early, on April 21, or late, on May 23. The day after planting, spun-bonded polypropylene film (Kimberly Farms floating row cover, Kimberly Clark Co., Roswell, GA) was applied over half the plots. Ten-foot

wide strips of row cover, covering a double row of ground mulch or eight plots, were laid directly over the plants and fastened by burying 3 inches of each edge in the soil. The row cover remained over the plants for 5-9 weeks. Row cover was removed from the April 21 planting on June 11, 1987 and June 24, 1988 and from the May 23 planting on June 29, 1987 and July 13, 1988. There were two replicate plots of each combination of cultivar, early or late planting date, and cover or no cover treatment in a complete randomized block design.

The status of flower and fruit development was assessed on July 7, 1987 and June 27, 1988. Ripe peppers were harvested at 5-day intervals. Peppers were picked when more than three-quarters of the surface was the mature color. Fruit picked from all plants in a plot was combined. The total weight and number of fruit and the weight and number of marketable fruit were recorded. Marketable fruits were symmetrical with no blemishes, rot or insect damage and weighed more than 2 oz. Cumulative yield and number of ripe peppers were determined for each plot. The cumulative weight per pepper was obtained by dividing the cumulative yield by the cumulative number of fruit.

Each combination of early or late planting and cover or

Table 1. Characteristics and source of seed of sweet pepper cultivars grown in 1987 or 1988.

Cultivar Name (Source)	Color			Maturity	Weight Oz./ fruit
	Immature	Ripe			
Bell Captain (1)	Green	Red		Late	5.8
Canape (4)	Green	Red		Early	3.1
Earliest Red Sweet (1)	Green	Red		Early	2.5
Early Calwonder (2)	Green	Red		Late	4.2
Golden Belle (4)	Green	Yellow		Early	4.7
Golden Calwonder (2)	Green	Yellow		Late	4.0
Golden Summer (3)	Lt. Grn	Yellow		Late	5.4
Goldie (1)	Yellow	Red		Early	4.6
Gypsy (4)	Yellow	Red		Early	3.5
Lady Bell (4)	Green	Red		Mid	5.5
Lincoln Bell (1)	Green	Red		Late	4.2
Parks Early Thickset (3)	Green	Red		Early	4.4
Staddon's Select (1)	Green	Red		Late	5.1
Stokes Early Hybrid (1)	Green	Red		Early	3.2
Super Set (1)	Green	Red		Early	4.1
Super Stuff (1)	Yellow	Orange		Early	3.7
Yellow Belle (1)	Yellow	Red		Early	2.6
Yolo Wonder B (2)	Green	Red		Late	5.2

(1) Stokes Seeds Inc., POB 548, Buffalo, NY 14240

(2) Petoseed Co. Inc., POB 4206, Saticoy, CA 93004

(3) Park Seed Co., Cokesbury Rd, Greenwood, SC 29647

(4) Harris Moran Seed Co., 3670 Buffalo Rd, Rochester, NY 14624

Table 2. Fruit set of peppers on 7 July 1987.

Cultivar	Planted 21 April		Planted 23 May	
	Cover	None	Cover	None
Bell Captain	Med-Sm	Sm	Few Sm	Sm
Canape	Med	Med-Lg	Sm	Med-Sm
Earliest Red Sweet	N.A.	N.A.	N.A.	N.A.
Early Calwonder	Sm	Sm	Few Sm	Sm
Golden Belle	Med-Lg	Med-Lg	Few Sm	Sm
Golden Calwonder	Sm	Sm	None	Sm
Gypsy	Lg	Med-Lg	N.A.	N.A.
Lincoln Bell	N.A.	N.A.	N.A.	N.A.
Super Stuff	Med-Lg	Med-Sm	Few Sm	Sm
Yolo Wonder B	Sm	Med-Sm	None	Few Sm

N.A.= Not available; Sm =small; Med= medium; Lg= large

Table 3. Fruit set of peppers on 27 June 1988.

Cultivar	Planted 21 April		Planted 23 May	
	Cover	None	Cover	None
Canape	Lg	Flower	Flower	Med-Sm
Earliest Red Sweet	Med-Sm	Flower	Flower	Med
Golden Belle	Lg	Flower	None	Med-Sm
Golden Calwonder	Med-Sm	Flower	None	Few Med
Golden Summer	Sm	None	None	Flower
Goldie	Med	None	Flower	Flower
Gypsy	Med-Lg	None	Flower	Med-Sm
Lady Bell	Med	None	None	Med-Sm
Lincoln Bell	Med	Flower	Flower	Flower
Parks Early Thicket	Lg	Flower	Flower	Med-Lg
Staddon's Select	Med-Sm	None	Flower	Sm
Stokes Early Hybrid	Lg	Flower	Flower	Med-Lg
Super Set	Med-Lg	Flower	Flower	Lg
Super Stuff	Med	None	None	Sm
Yellow Belle	Med-Sm	None	Flower	Sm
Yolo Wonder B	Flower	None	None	Flower

N.A.= Not available; Sm= small; Med= Medium; Lg= large

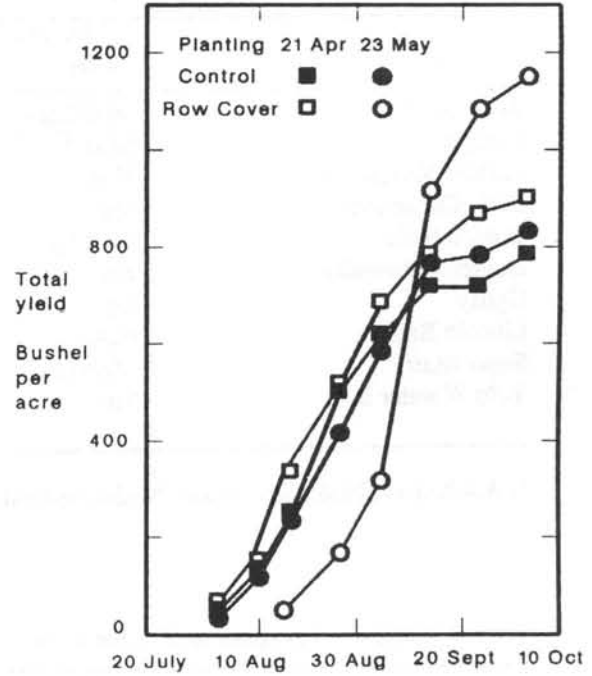
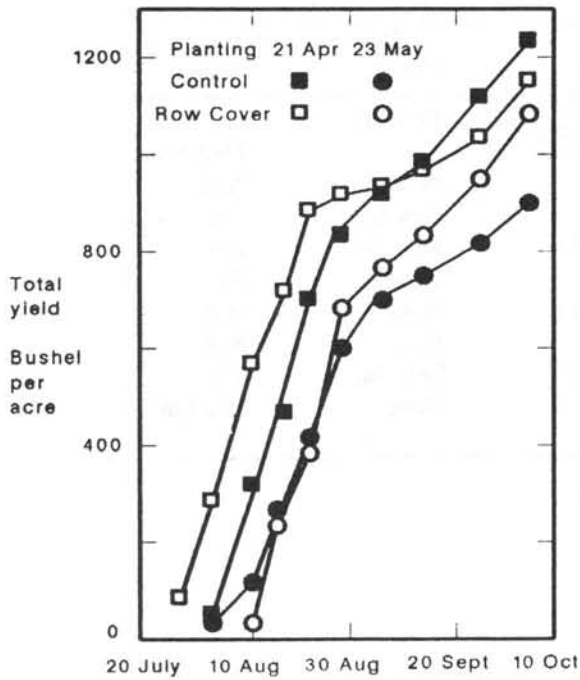


Figure 1. Accumulated yield of ripe peppers from Canape in 1987. Squares represent yield from an early planting on 21 April. Circles represent yield from a late planting on 23 May. Shaded symbols represent yield from plants grown in the open and empty symbols represent yield from plants grown under row cover for 5-9 weeks after transplant.

Figure 3. Accumulated yield of ripe peppers from Yolo Wonder B in 1987. See Figure 1 legend for description of symbols.

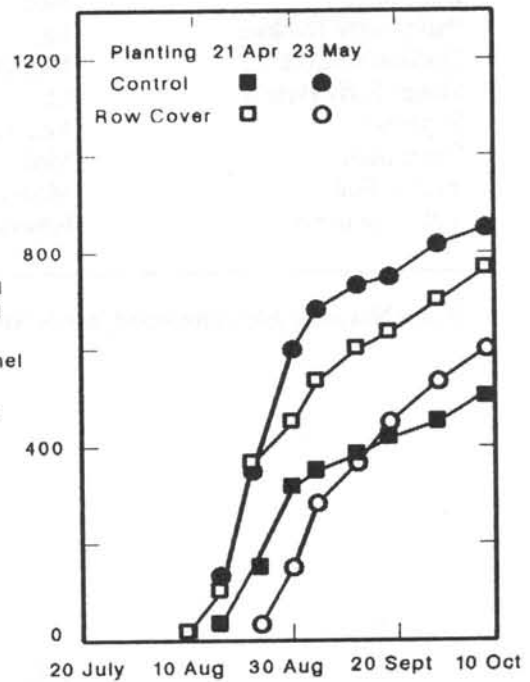
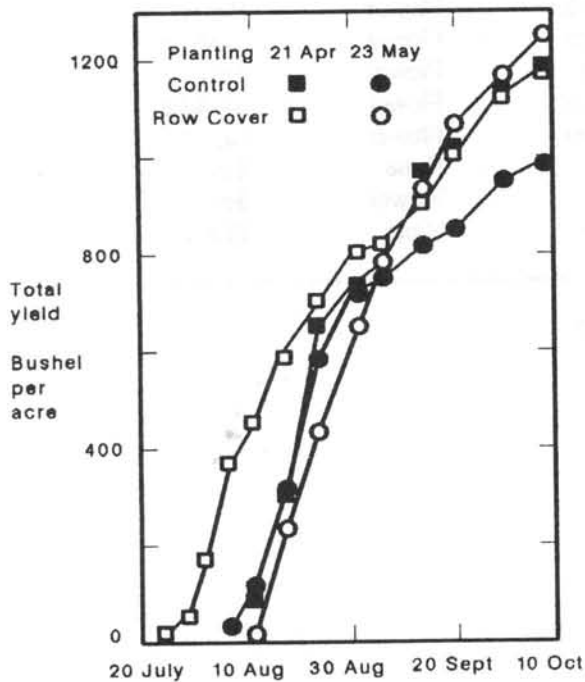


Figure 2. Accumulated yield of ripe peppers from Canape in 1988. See Figure 1 legend for description of symbols.

Figure 4. Accumulated yield of ripe peppers from Yolo Wonder B in 1988. See Figure 1 legend for description of symbols.

Table 4. Harvest date of first ripe peppers in 1987

Cultivar	Planted 21 April		Planted 23 May	
	Cover	None	Cover	None
Bell Captain	30 July	9 Aug	14 Aug	8 Aug
Canape*	27 July	4 Aug	14 Aug	5 Aug
Earliest Red Sweet	N.A.	N.A.	10 Aug	1 Aug
Early Calwonder	1 Aug	2 Aug	10 Aug	3 Aug
Golden Belle*	27 July	29 July	5 Aug	4 Aug
Golden Calwonder	3 Aug	8 Aug	11 Aug	9 Aug
Gypsy	22 July	28 July	N.A.	N.A.
Lincoln Bell	N.A.	N.A.	8 Aug	10 Aug
Super Stuff*	24 July	3 Aug	5 Aug	7 Aug
Yolo Wonder B	2 Aug	3 Aug	22 Aug	6 Aug
Average*	28 Jul	3 Aug	11 Aug	6 Aug
Pooled S.E.E.			2.0 days	

N.A. Not available.

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

Table 5. Harvest date of first ripe peppers in 1988.

Cultivar	Planted 21 April		Planted 23 May	
	Cover	None	Cover	None
Canape*	25 July	6 Aug	10 Aug	5 Aug
Earliest Red Sweet*	7 Aug	6 Aug	12 Aug	31 July
Golden Belle	22 July	4 Aug	11 Aug	29 July
Golden Calwonder	4 Aug	10 Aug	18 Aug	31 July
Golden Summer	2 Aug	20 Aug	31 July	11 Aug
Goldie*	30 July	15 Aug	12 Aug	11 Aug
Gypsy	29 July	10 Aug	9 Aug	1 Aug
Lady Bell	1 Aug	11 Aug	14 Aug	4 Aug
Lincoln Bell	3 Aug	5 Aug	15 Aug	30 July
Parks Early Thickset*	27 July	12 Aug	8 Aug	6 Aug
Staddon's Select	8 Aug	14 Aug	20 Aug	5 Aug
Stokes Early Hybrid	24 July	30 July	3 Aug	25 July
Super Set	31 July	10 Aug	15 Aug	31 July
Super Stuff	3 Aug	14 Aug	17 Aug	2 Aug
Yellow Belle	3 Aug	21 Aug	13 Aug	5 Aug
Yolo Wonder B	11 Aug	15 Aug	20 Aug	11 Aug
Average	1 Aug	10 Aug	12 Aug	3 Aug
Pooled S.E.E.			2.7 days	

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

no cover was assumed to be an independent treatment. Significant differences were determined by one-way analysis of variance. The least significant difference is reported at the 5% level based on analysis of each cultivar, individually. The pooled standard error is reported in the tables, based on analysis of variance over all cultivars and treatments.

RESULTS

Fruit set

Floating row cover accelerated vegetative growth and promoted earlier flowering for both early and late plantings and for all cultivars. Row cover applied to the early planting resulted in compact plants that set many peppers. However, beneath row cover in the late planting, the plants were taller and had set few fruit. Plants under row cover branched profusely, perhaps due to the abrasive action of the floating row cover on the stem apex.

A census of fruit set was done on July 7, 1987, shortly after row cover was removed from the late planting and about 2 weeks before the first peppers ripened, Table 2. All cultivars planted early and covered until June 24 had many attached peppers. Some of these peppers were nearly full size. However, several cultivars planted late and covered until June 29 had no peppers and the other cultivars had fewer and smaller peppers than in the early planting. Although uncovered plants of the late planting were smaller, they had many more attached peppers on July 7 than did plants grown under row cover until June 29.

A similar census of fruit set was taken on June 27, 1988, three days after removal of row cover from the early planting but 2 weeks before removal of row cover from the late planting, Table 3. In the early planting under row cover all cultivars, except Yolo Wonder, had attached fruit. None of the cultivars in the late planting under row cover had attached fruit. Results from early planting indicated that row cover, per se, did not prevent pollination and fruit set. Most likely, the combination of row cover and hot weather in June resulted in temperatures too warm for proper flower development and fruit set of the late planting under row cover. In May, temperatures were cooler and row cover did not prevent fruit set in the early planting.

Frost damage

Frost damage was more severe in 1988 than in 1987. On May 14, 1987 there was one frost of 31 F°. On April 23 and 24, 1988 there were two successive nights of 29 F° frost. Despite sprinkling throughout the night, most exposed plants later lost their leaves. The late planting in 1988 saw no frost and there was no check in growth or development after planting. On June 27, 1988 all cultivars planted late and grown in the open had set fruit while those planted early and grown in the open had not. The frost set back development of plants grown in the open more than that for plants under

row cover. In 1987 plants lost some leaves as a consequence of frost damage but no plants died. In 1988 few plants under row cover, but about 15% of the plants that were grown in the open, died as a consequence of frost. The cultivars differed in sensitivity to frost damage. Cultivars with yellow peppers turning red at maturity were more sensitive; 37% of the exposed plants of Goldie, Gypsy, Super Stuff, and Yellow Belle died. Cultivars with green immature fruit had only 5% mortality of exposed plants. Under row cover, the frost sensitive cultivars survived as well as the others.

Ripe pepper production

The first ripe red or yellow peppers were noted about July 20 in 1987 and 1988. Row cover accelerated fruit ripening of many early-planted cultivars, and in each year the first ripe peppers were picked from the early planting grown under row cover. Small-fruited cultivars benefited most from row cover; they ripened early and continued producing until a fall frost. In the open, the same cultivars started producing later and most of the fruit ripened in a shorter interval. For example, the cumulative yield of Canape is shown in Figures 1 and 2 for 1987 and 1988, respectively. Row cover accelerated fruit production only for the early planting. When planted early in 1987, peppers grown under row cover ripened 8 days earlier than those grown in the open. When planted late, peppers grown under row cover ripened 8 days later than those grown in the open. A similar interaction between the effect of planting date and row cover was seen in 1988.

Large-fruited cultivars responded differently to row cover. For example, the cumulative yield of Yolo Wonder B is shown in Figures 3 and 4 for 1987 and 1988, respectively. Row cover had little effect on ripening of early planted peppers. Unfortunately, row cover delayed ripening of late-planted Yolo Wonder B by 16 and 13 days, compared to those grown in the open, in 1987 and 1988, respectively.

Tables 4 and 5 summarize the initial dates on which ripe fruit was picked for each cultivar and treatment in 1987 and 1988. Late planting under row cover did not accelerate fruit ripening of any cultivar. When grown in the open in 1987, peppers planted early did not yield significantly earlier than those planted late. When grown in the open in 1988, peppers planted early actually ripened later than those planted late. The risk of frost and the subsequent loss of the crop or delay in development clearly outweighed any benefit of early planting without row cover. Because of this, further comparisons will be confined to the early planting grown under row cover and the late planting grown in the open, the conventional cultural practice.

Several cultivars produced ripe peppers much earlier when planted early and grown under row cover than when grown conventionally. Canape, with small blocky green peppers turning to a uniform deep red at maturity, ripened 8 and 12 days earlier in 1987 and 1988. The similar types,

Parks Early Thickset and Super Set, also yielded 10 days earlier when planted early and grown under row cover.

In 1988, Gypsy, with small elongated yellow peppers turning to orange or red at maturity, yielded ripe peppers 12 days earlier when planted early and grown under row cover. Goldie and Super Stuff, similar to Gypsy, also ripened earlier than when grown conventionally.

Golden Belle, with large blocky green peppers turning golden yellow at maturity, also produced ripe peppers early in both 1987 and 1988. This cultivar was an exception to the general rule that large fruited cultivars tended to yield later and to respond less to row cover. Stokes Early Hybrid and Parks Earliest Red Sweet were also exceptions; ripening of these small fruited cultivars was delayed when they were grown under row cover.

In general, row cover increased the total yield of ripe peppers. Over all cultivars, and compared to conventional culture, early planting and row cover increased yield 70 and 160 bu/A in 1987 and 1988, respectively. Row cover increased yields of certain cultivars substantially (Tables 6 and 7). For example, row cover increased yield of Canape by 250 bu/A in both years. In 1988, Gypsy, Lady Bell, Lincoln Bell, Stokes Early Hybrid and Super Stuff yielded more under row cover than under conventional cultivation. Canape, Golden Belle and Gypsy were among the highest yielding cultivars in both years.

The yields reported in Tables 6 and 7 were considerably higher than the average of 440 bu/A for Connecticut. The high yields were due to use of black plastic mulch, irrigation and row cover. Repeated picking at short intervals reduced fruit loss after ripening.

Quality of peppers

The marketable fraction of the total harvest varied among cultivars. The marketable fraction, as a percent by weight of the total yield, is presented in Tables 8 and 9, for 1987 and 1988, respectively. In 1987, Canape and Gypsy had the highest percentage of marketable fruit. These cultivars, as well as Super Set, had exceptional quality in 1988. For certain cultivars, such as Bell Captain in 1987 and Yellow Belle, Golden Calwonder and Goldie in 1988, the marketable fraction was less than two-thirds.

Blossom end rot and corn borer infestation followed by bacterial rot were the two principal causes of unmarketable peppers. There was no consistent pattern in blossom end rot between cultivar and treatments. Susceptibility to corn borer attack was the reason for the variable percentage of marketable fruit. In 1988, row cover increased the percentage of marketable fruit of six cultivars by 10 points. Likely, the row cover effectively prevented corn borer attack in 1988 because it covered the plants for a long period during fruit development. Incidence of fungus disease was no greater under row cover than in the open. Thus, cultivation with row cover reduced the need for pesticides.

Size of peppers

The fruit size or weight per pepper may influence marketability. In the present study, peppers weighing more than 2 oz were classified as marketable although, peppers imported to Connecticut are usually larger, 4-6 oz. Unfortunately, row cover reduced fruit size. The weight per fruit for each pick of Canape is shown in Figures 5 and 6 for 1987 and 1988, respectively. Canape peppers always weighed less than 4 oz and row cover tended to reduce the weight. This was most evident for the first peppers harvested. Yolo Wonder B peppers were more typical of the imported peppers and fruit weight varied between 4 and 8 oz. Again, fruit size was reduced by growth under row cover, as shown in Figures 7 and 8 for 1987 and 1988, respectively. The average weight per fruit, the total weight of marketable fruit divided by the total number of marketable fruit picked, is presented in Tables 10 and 11 for 1987 and 1988, respectively. Over all cultivars, row cover reduced fruit size more in 1987 than in 1988, 15% and 5%, respectively. In general, those cultivars that ripened significantly earlier when grown under row cover were either small-fruited cultivars or their fruit weight decreased when they were grown under row cover. Thus, the beneficial effect of row cover, early ripening, came at a cost, reduced fruit size.

Economic benefit

Row cover will benefit Connecticut farmers if the extra value of production exceeds the costs associated with its use. In 1988, the retail price of red or yellow peppers remained about \$2.00/pound throughout much of the season. It dropped to \$0.50-\$1.00/pound only in September when local production was at its peak. Thus, the economic benefit of row cover derived from production of ripe colored peppers in July and August when the retail price was high. An estimate of increased gross income was obtained by multiplying the difference in retail price between August and September, \$1.00/pound, by the difference in marketable yield as of mid August, between peppers planted early and grown under row cover and those grown conventionally. It was assumed that the reduction in weight per pepper caused by row cover did not reduce their value. Increased production costs were \$700/acre for the row cover and \$500/acre for labor to apply and remove it. The cost of sprinkling required for frost protection of an early planting was estimated to be \$500/A. Thus, the total increased cost of production was \$1700/A. However, material costs could be reduced if the row cover was used for more than one season.

The difference in yield by mid August of peppers planted early under row cover compared to conventional planting, and the estimated increase in gross income less additional costs of production are presented in Tables 12 and 13 for 1987 and 1988, respectively. This increased gross income

Table 6. Total yield of ripe peppers in 1987

Cultivar	Early Cover Bu/A	Late None Bu/A
Bell Captain	820	838
Canape	1152	901
Earliest Red Sweet		594
Early Calwonder	797	747
Golden Belle	1177	1091
Golden Calwonder	1015	897
Gypsy	1074	
Lincoln Bell		959
Super Stuff	794	814
Yolo Wonder B	894	825
Average	965	861
Pooled S.E.E.		128

Table 8. Marketable yield as a fraction of total yield in 1987.

Cultivar	Early Cover	Late None
Bell Captain*	0.40	0.56
Canape*	0.82	0.91
Earliest Red Sweet	N.A.	0.55
Early Calwonder	0.63	0.72
Golden Belle	0.64	0.69
Golden Calwonder	0.71	0.72
Gypsy	0.90	N.A.
Lincoln Bell	N.A.	0.78
Super Stuff	0.67	0.74
Yolo Wonder B	0.67	0.75
Average	0.68	0.72
Pooled S.E.E.		0.06

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

Table 7. Total yield of ripe peppers in 1988.

Cultivar	Early Cover Bu/A	Late None Bu/A
Canape*	1258	981
Earliest Red Sweet	821	865
Golden Belle	1121	1083
Golden Calwonder	786	769
Golden Summer	1118	880
Goldie	778	628
Gypsy*	1117	878
Lady Bell*	1156	788
Lincoln Bell*	989	700
Parks Early Thickset	1034	1050
Staddon's Select	967	880
Stokes Early Hybrid*	1115	884
Super Set	1058	1012
Super Stuff*	1002	673
Yellow Belle*	1054	650
Yolo Wonder B	762	856
Average*	1008	849
Pooled S.E.E.		108

Table 9. Marketable yield as a fraction of total yield in 1988.

Cultivar	Early Cover	Late None
Canape	0.84	0.90
Earliest Red Sweet	0.72	0.61
Golden Belle	0.71	0.71
Golden Calwonder	0.68	0.59
Golden Summer	0.64	0.69
Goldie	0.73	0.60
Gypsy	0.90	0.91
Lady Bell	0.85	0.75
Lincoln Bell	0.70	0.60
Parks Early Thickset	0.85	0.75
Staddon's Select	0.74	0.79
Stokes Early Hybrid	0.82	0.79
Super Set	0.91	0.87
Super Stuff	0.79	0.73
Yellow Belle	0.69	0.59
Yolo Wonder B	0.81	0.74
Average	0.77	0.73
Pooled S.E.E.		0.06

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

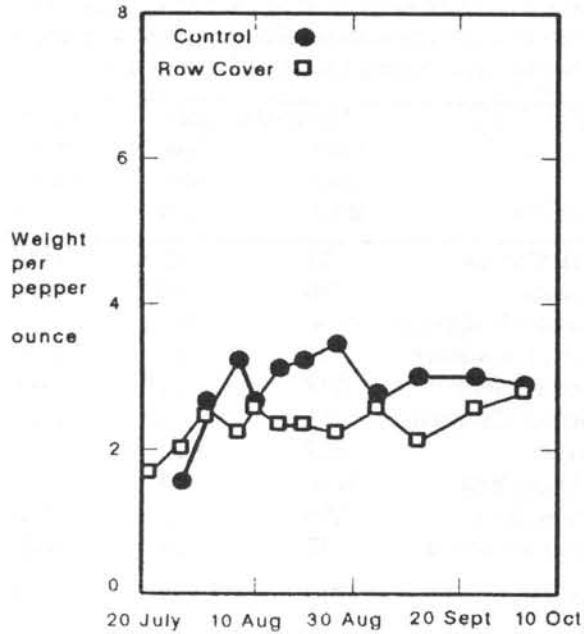


Figure 5. Weight per pepper for each pick of ripe peppers from Canape in 1987. Shaded circles represent peppers from a conventional planting on 23 May grown in the open. Empty squares represent peppers from an early planting on 21 April grown under row cover for 7-9 weeks after transplant.

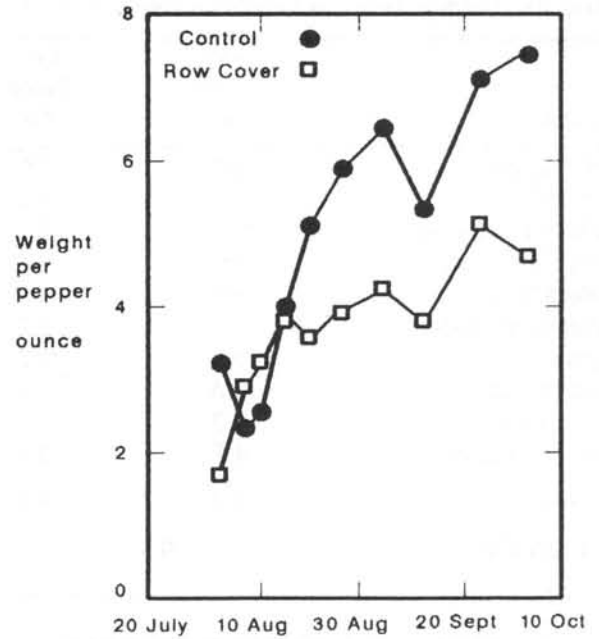


Figure 7. Weight per pepper for each pick of ripe peppers from Yolo Wonder B in 1987. See Figure 5 legend for explanation of symbols.

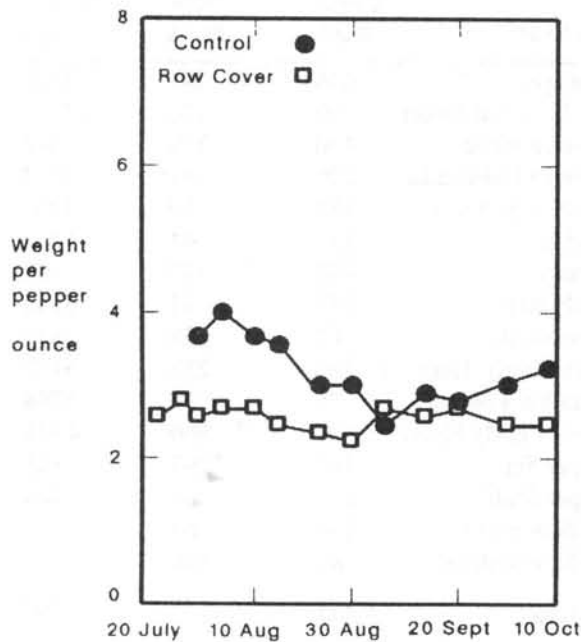


Figure 6. Weight per pepper for each pick of ripe peppers from Canape in 1988. See Figure 5 legend for explanation of symbols.

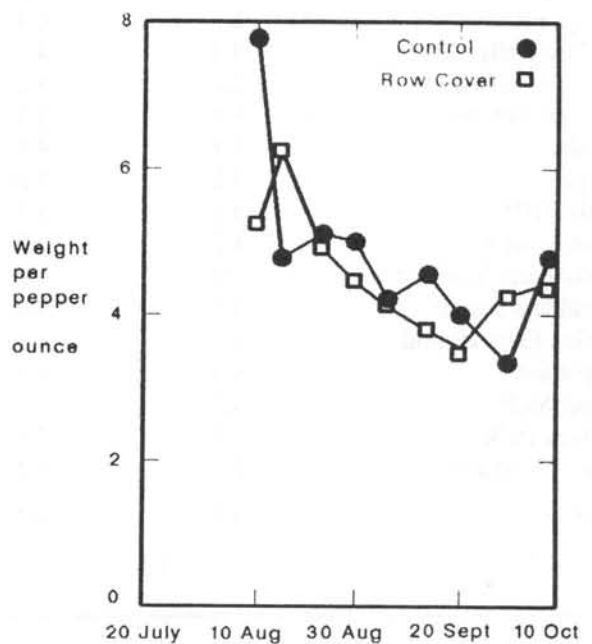


Figure 8. Weight per pepper from each pick of ripe peppers from Yolo Wonder B in 1988. See Figure 5 legend for explanation of symbols.

Table 10. Average weight per marketable fruit in 1987.

Cultivar	Early	Late
	Cover	None
	Oz	Oz
Bell Captain*	5.4	7.0
Canape*	2.6	3.1
Earliest Red Sweet	N.A.	2.7
Early Calwonder	3.9	4.3
Golden Belle	3.9	4.4
Golden Calwonder	3.4	3.7
Gypsy	3.0	N.A.
Lincoln Bell	N.A.	3.8
Super Stuff	3.0	3.0
Yolo Wonder B*	4.5	5.9
Average	3.7	4.3
Pooled S.E.E.	0.3	

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

Table 11. Average weight per marketable fruit in 1988.

Cultivar	Early	Late
	Cover	None
	Oz	Oz
Canape*	2.7	3.3
Earliest Red	2.5	2.4
Golden Belle	4.3	4.5
Golden Calwonder	3.8	4.0
Golden Summer	5.1	5.3
Goldie	4.1	4.1
Gypsy	3.2	3.0
Lady Bell*	4.9	5.4
Lincoln Bell	4.3	4.0
Parks Early Thickset	4.0	3.9
Staddon's Select*	3.7	5.0
Stokes Early Hybrid	2.7	3.1
Super Set	3.9	4.1
Super Stuff	3.7	3.8
Yellow Belle	2.6	2.5
Yolo Wonder B	5.3	5.3
Average	3.8	4.0
Pooled S.E.E.	0.3	

* Difference between early planting grown under row cover and late planting grown in the open significant at the 5% level.

Table 12. Marketable yield by 14 Aug 1987 and increase in gross return less additional cost of production resulting from an early planting grown under row cover.

Cultivar	Marketable yield		Change in net income
	Early	Late	
	Cover	None	\$/A
	Bu/A	Bu/A	
Bell Captain	21	15	-1548
Canape	486	98	8004
Earliest Red Sweet	N.A.	102	
Early Calwonder	21	15	-1539
Golden Belle	278	50	3996
Golden Calwonder	51	24	-1022
Gypsy	627	N.A.	
Lincoln Bell	N.A.	17	
Super Stuff	196	25	2576
Yolo Wonder B	72	28	-602
Average	219	39	2791

Table 13. Marketable yield by 15 Aug 1988 and increase in gross return less additional cost of production resulting from an early planting grown under row cover.

Cultivar	Marketable yield		Change in net income
	Early	Late	
	Cover	None	\$/A
	Bu/A	Bu/A	
Canape	446	291	2166
Earliest Red Sweet	70	126	-3119
Golden Belle	470	329	1844
Golden Calwonder	270	161	1032
Golden Summer	187	50	1737
Goldie	170	44	1469
Gypsy	484	417	-31
Lady Bell	293	91	3362
Lincoln Bell	62	28	-852
Parks Early Thickset	504	232	5112
Staddon's Select	75	79	-1798
Stokes Early Hybrid	231	360	-4923
Super Set	387	297	568
Super Stuff	161	64	746
Yellow Belle	216	163	-370
Yolo Wonder B	81	100	-2191
Average	257	177	300

would apply to a grower who sold his produce at retail at his own stand. A grower selling to the wholesale market would realize only about half as much extra gross income. In 1987, row cover increased gross income less additional costs of production by more than \$2000/A for Canape, Golden Belle or Super Stuff. In 1988, the greatest economic benefit of row cover was for Parks Early Thickset. Canape, Golden Belle, Golden Summer, Goldie and Lady Bell also increased gross income less additional costs of production more than \$1000/A.

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ISSN 0097-0905