The covered trench (CT) planting system was evaluated for increasing early row covers, depressional planting, polyethylene mulches, mid-bed trench, and a type bed shaper and a conventional plastic mulch applicator. The slitted clear polyethylene material over wire hoops spaced 1.5 to 2 m apart over a row (8). Systems such as these enable crop protection from adverse environments for 1 to 2 months after planting seeds or transplants. Although effective, these systems are both labor-intensive and costly (6). The depressional planting technique has been reported to improve seed germination, earliness, and yield through its influence on seed zone microclimate (7, 10). Previous work with a mid-bed trench (M-BT) planting technique indicated that earliness and yield were increased in muskmelons and long green chile peppers (2, 4). Another study showed that polyethylene row covers further enhanced the effectiveness of the M-BT technique for increasing early yield of long green chile (3). The objective of this study was to develop a low-cost mechanized row cover system for increasing early yield of bell pepper.

Trenches covered with either of three types of polyethylene material over wire hoops spaced 1.5 to 2 m apart over a row (8). Systems such as these enable crop protection from adverse environments for 1 to 2 months after planting seeds or transplants. Although effective, these systems are both labor-intensive and costly (6). The depressional planting technique has been reported to improve seed germination, earliness, and yield through its influence on seed zone microclimate (7, 10). Previous work with a mid-bed trench (M-BT) planting technique indicated that earliness and yield were increased in muskmelons and long green chile peppers (2, 4). Another study showed that polyethylene row covers further enhanced the effectiveness of the M-BT technique for increasing early yield of long green chile (3). The objective of this study was to develop a low-cost mechanized row cover system for increasing early yield of bell pepper.

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clear) were compared to the standard practice of direct-seeding bell peppers into raised flat-topped beds. The treatments were evaluated in a 2-year study using a randomized complete block design having four replicates. Plots were established on 15 Mar. 1984 and 15 Feb. 1985. Each plot consisted of a single raised bed 1.9 × 12 m bed with double seed rows placed 58 cm apart. The trenches were constructed with a tractor-drawn slit-type bed shaper modified to produce a trench 12.5 cm deep × 7.5 cm wide at the bottom and 25 cm wide at the top (Fig. 1). The beds were shaped, biaxial drip irrigation lines were buried ≈15 cm deep between the double trenches or seed rows, and the pepper cultivar Grande Rio 66 was planted in one operation. Row covers were applied immediately after planting over the appropriate trenched plots using a conventional plastic mulch applicator. Covers consisted of 1.8-m-wide solid clear, 1.8-m-wide slitted clear, or 1.2-m-wide black polyethylene. Precut slitted areas of the slitted polyethylene were aligned to cover each trench. Five-centimeter-diameter holes were burned into the black polyethylene at 30-cm increments using the first evidence of seedling emergence under the solid clear polyethylene as a reference. Temperatures and soil moisture tensions were read daily at 8:30 AM and 3:30 PM from thermometers placed in the seed zone and 5 cm above the seed row. Seed zone tensiometers were placed 0.6 cm below the surface of drill row, and standard tensiometers at 15.2 and 30.5 cm below the seed zone. The solid clear polyethylene covers were vented by cutting 7-cm x-shaped slits spaced 0.6 m apart over the trenches when temperatures first exceeded 37°C. The slitted and solid clear vented polyethylene were removed when seedling terminal growth came in contact with the covers. Seedlings were thinned to single plants at 30-cm spacings. One seedling per hole was encouraged to grow through the holes in the black polyethylene. Standard cultural practices used for pepper production in southern Texas were employed to produce the crop.

Interactions between treatment effects and season were not significant. Hence, the results presented in this study were averages of two seasons. The slitted clear polyethylene cover significantly increased (P < 0.05) early and total marketable yields over the check (Table 1). Early marketable yield obtained with the slitted polyethylene CT treatment was 2964 kg·ha⁻¹ as compared to 1312 kg·ha⁻¹ by the standard raised-bed plots. Total season marketable yield increased by 2000 kg·ha⁻¹. These results compare favorably with previous reports by others for bell peppers and long green/red chile produced under row covers (11,17). In a previous investigation by Dainello and Heineman (3), the M-BT was shown to increase total yield significantly of long green chile peppers. However, early yield was significantly increased only when solid clear plastic covers were applied over the M-BT. In this study, no significant yield differences were detected among all other CT treatments and the check. The lack of yield response to the solid clear and black polyethylene coverings is attributed to observed seedling injury. Wells (13) speculated that outside air temperatures in excess of 32°C raised the inside tunnel temperature above optimum for growth of most vegetables. Southern Texas is characterized by fluctuating temperatures during late winter and early spring. Consequently, considerable difficulty was encountered in determining the correct time to vent the solid clear polyethylene cover. This method also created other problems: excessive weed buildup within the trenches and water ponding in the trenched areas following heavy rainfall received prior to venting. Montes and Cotter (11) also observed problems with weeds and nonsignificant yield response when using solid clear polyethylene trench covers. They suggest that these problems become more severe the later that the plantings were established. The slits in the slitted row covers provide for ventilation on sunny days, which reduces the potential for heat injury to seedlings (14,17). In this study, covers with slits and/or holes were found to prevent the ponding of water in the trench areas and did not result in excessive weed buildup. Subsequent tests have shown that two applications of the herbicide Devrinol at 4.6 liters/ha per application (preplant incorporated, and post-plant precovers) provided good weed control in the CT plots (unpublished data).

Black polyethylene was allowed to remain in the field for the duration of the study each year to obtain the added advantages of conventionally used mulches. Although seedlings readily grew through the holes in the black polyethylene, they were etiolated and weak due to the low light intensity available to them prior to emergence through the covers. These seedlings also experienced considerable abrasion as they grew through the holes in the plastic. The abrasion appeared to be the result of the bellowing action of the row covers caused by the prevailing winds. Although no significant stand differences were detected among treatments, plant counts were consistently lower in the black polyethylene CT plots.

The increased seedling growth under row covers noted by others (11,15,16) was also seen in this study. Only seedlings grown under the black polyethylene covers were less vigorous than those from the check plots (Table 1).

Air temperatures underneath the trench covers were 1° to 4°C higher at 3:30 PM than ambient. Although the warmer temperatures were noted under the solid clear plastic cover and the coolest under the black plastic cover.

Table 1. Influence of trench covering on growth, earliness, and yield of ‘Grande Rio 66’ bell pepper.†

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Seeding dry wt† (g)</th>
<th>Marketable yield (kg·ha⁻¹)</th>
<th>Early harvest (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check, uncovered raised bed</td>
<td>5.1</td>
<td>1312</td>
<td>4572</td>
</tr>
<tr>
<td>Black polyethylene covered trench</td>
<td>8.2</td>
<td>1244</td>
<td>3935</td>
</tr>
<tr>
<td>Solid clear polyethylene covered</td>
<td>7.8</td>
<td>1202</td>
<td>4852</td>
</tr>
<tr>
<td>Slitted clear polyethylene covered trench</td>
<td>7.3</td>
<td>2964</td>
<td>6568</td>
</tr>
<tr>
<td>LSD (P = 0.05)</td>
<td>1.3</td>
<td>1539</td>
<td>1532</td>
</tr>
</tbody>
</table>

†Results are presented as pooled means for both seasons.
‡Based on 10 largest seedlings sampled/treatment at cover removal.
§Early yield—fruit obtained from initial harvest (20 July 1984; 12 June 1985).
¶Total yield based on four harvests in 1984 and three harvests in 1985.

Table 2. Influence of trench covering on soil moisture tension.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean tension (centibars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed zone (0.6 cm)</td>
</tr>
<tr>
<td>Check, uncovered raised bed</td>
<td>24.2</td>
</tr>
<tr>
<td>Black polyethylene covered trench</td>
<td>9.4</td>
</tr>
<tr>
<td>Solid clear polyethylene covered</td>
<td>12.7</td>
</tr>
<tr>
<td>Slitted clear polyethylene covered trench</td>
<td>14.4</td>
</tr>
<tr>
<td>LSD (P = 0.05)</td>
<td>6.3</td>
</tr>
</tbody>
</table>

*Moisture tension read on a daily basis at 8:30 AM are presented as a 2-year average. Moisture tension measurements were monitored in the seed zone from planting through the four-true leaf stage, after which the measurements were obtained from the 15.2- and 30.5-cm depths.
Literature Cited


VARIABILITY OF FRUIT QUALITY CHARACTERISTICS WITHIN SWEET CHERRY TREES IN CENTRAL WASHINGTON

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Additional index words. Prunus avium, color, soluble solids, firmness

Abstract. The variability of color, soluble solids, weight, and firmness of individual sweet cherries (Prunus avium L.) on trees from 15 locations throughout the central Washington production district was measured at weekly intervals. Between the first and third harvest, the cv for color decreased from 24% to 9%, for soluble solids from 16% to 13%, was a constant 14% for weight, and increased from 19% to 24% for firmness. Within groups of cherries of similar color, the cv was 13% for soluble solids, 14% for weight, and 19% to 24% for firmness. Firmness measured by durometer or shear press was not correlated with bruising induced by a standardized bruising test. It was concluded that color picking could solve only partially the problem of variability in sweet cherry quality.

Two principal quality problems with fresh cherries are nonuniform fruit color in the package and losses to bruising and rot. (1)

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