Row Cover Vegetable Production Techniques

Guide H-251

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Protected agriculture is any technique used to modify a plant's natural environment in order to optimize plant growth (Jensen and Malter, 1995). Such techniques are often used to protect plants from frost in order to extend the growing season of a crop. Through earlier crop production, growers are able to capitalize on early markets and higher prices.

One of the more popular techniques used by commercial growers to extend the growing season of a crop is the use of row covers. Row covers are generally made of flexible transparent to semitransparent materials and are used to enclose one or more rows of plants in order to enhance crop growth and production by increasing both air and soil temperatures and reducing wind damage (Hochmuth, Kostewicz, and Stall, 2000).

ADVANTAGES

Frost Protection. Depending on the material, the frost protection factor associated with a row cover can vary from 2˚ to 7˚ F. Generally the heavier materials (spunbonded polypropylene) give greater frost protection but tend to exclude more light. Row covers can also be used with some crops in the fall for late frost protection.

Early Yields. The greenhouse effect of most row covers will not only warm air surrounding the plant but will also result in warmer soil temperatures, enhancing seed germination, root growth, shoot growth and maturity. Early crop production generally results in higher crop prices at local markets. When combined with black plastic mulch, many crops may mature one to three weeks earlier than under normal cropping practices. Increased costs, however, generally limit use to high-value horticultural crops.

Increased Yields. Many cucurbits (squash, cucumbers, melons) respond well under row covers with increased yields of as much as 25 percent (Helbacka, 2002). Earlier production of cool season crops like spinach and leaf lettuce will also increase total yields. Earlier cane growth of everbearing red raspberries in the spring will result in earlier production in late summer to early fall and increased total yields for short-growing season production areas of New Mexico. Other crops that have responded well to row covers include tomatoes, peppers, eggplant, cauliflower, strawberries, sweet corn, cole crops and peas.

Wind Protection. Row covers supported with wire hoops will protect crops from wind and blowing sand. This will result in less plant stress and re-

duces desiccation of delicate early growth. Row covers will also protect crops from hail and pounding rain. Unsupported floating row covers can, however, rub on plants, damaging leaves, stems or flowers.

Pest Control. Lightweight floating row covers are often used to cover some crops in the spring to protect them from insects. Edges of the cover must be covered with soil to ensure exclusion of insects. This will result in less use of insecticides and less frequency of insect-borne diseases. Floating and supported row covers can also be used to protect plants from birds.

Water Conservation. Less irrigation may be required under row covers since water collects as condensation on the inside of the cover and returns to the soil. Less crusting occurs since wind movement and water evaporation is reduced. Overall water use, however, may increase since crop growth is greater, earlier and over a longer period of time.

DISADVANTAGES

Cost. Costs associated with growing crops under row covers are dependent on the type of crop, row spacing and type of row cover. Crops requiring a supported row cover will incur greater costs associated with wire hoops required for support versus using a floating row cover. Rows with closer spacing will require more material for supported tunnels. There is also a big difference in the cost of materials. Heavier materials tend to be more expensive. Additional labor costs can also be quite significant. Costs can be reduced with the use of protective coatings and ultraviolet light inhibitors incorporated into the row cover so that such materials can be reused.

Pests. Although row covers are often used to exclude insects, any insects that do enter the covered area can multiply very quickly in such a favorable environment. Weeds can also flourish, especially if the area has not been treated with an herbicide or covered with a plastic mulch. The row cover may have to be pulled back to allow for hand weeding. The row cover may also have to be pulled back during bloom (cucurbits, strawberries) to allow bees to pollinate the plants.

Labor. Use of row covers, especially the supported tunnels, require considerably more labor input earlier in the season than traditional production techniques. This is particularly true if the row cover has to be occasionally removed to weed, apply insecticides or allow for pollination. Machines are available for establishing hoop-supported row covers.

ROW COVER TYPES

The three most popular row cover techniques are plastic-covered trenches, floating row covers, and hoop-supported row covers or low tunnels. Row covers are generally made of polyethylene (poly), polyester or polypropylene. Polyethylene may be clear or pigmented and either stretched across a trench or supported by wire hoops. It may also be vented or unvented. Fabric-like polyester or polypropylene materials are generally spunbonded or nonwoven. Both may be left to float on the surface of the soil or can be supported by wire hoops.

PLASTIC-COVERED TRENCH

Plastic-covered trenches permit early seeding, early plant growth and some frost protection (Jensen and Malter, 1995). Polyethylene is generally stretched across a trench about 7 in. deep. A mechanical mulch layer can be used to apply the plastic, mounding soil along the edges of the bed to keep the plastic taut. The application of a pre-emergence herbicide is important to control weeds.

Periodic holes can be made in the plastic as temperatures rise in the trench. The plastic should be removed when plants first come in contact with the bottom of the row cover.

FLOATING ROW COVERS

Floating row covers are often used to protect both cool-season and warm-season crops. Made of spunbonded polyester or polypropylene, covers may range in width from 5 to 50 ft. and up to 800 ft. long. In the manufacturing process, the polyester or polypropylene is extruded or spun in a web onto a collection belt. The small-diameter filaments are then heat and pressure treated to form a thin, whitish sheet of porous fabric (Vaughn, 1992). Covers may range in weight from 0.3 to 2.0 oz/sq yd. Row covers from 0.5 to 1.25 oz/sq yd will give 2° to 6° F frost protection in the spring. More frost protection may be realized during the fall due to warmer soils. Row covers weighing 1.25 oz/sq yd will generally transmit enough light (70 percent) for optimum plant growth with good frost protection. Lighter-weight materials, that provide minimal frost protection, are generally used to protect crops from insects and birds.

Floating row covers are generally applied loosely over the top of the crop and secured along the edges with fabric pins and/or soil. Insect control is more effective when the sides are completely sealed with soil. Covers should be applied when there is minimum wind. Allow the cover to drape over the crop, leaving room for crop expansion. Floating row covers should not be applied over one-stemmed crops like peppers, tomatoes, eggplant or even squash, since stems can be broken on windy days.

Spunbonded polyester and polypropylene have the advantage over polyethylene in that they don't usually have to be vented. Air and water will pass relatively freely through spunbonded covers.

HOOP-SUPPORTED ROW COVERS

Unlike floating row covers, hoop-supported row covers or low tunnels are supported by wire hoops, eliminating abrasive damage to the crop associated with floating row covers. Hoops are generally made from 9- to 10-gauge galvanized wire, 48 to 60 in. long, spaced 4 to 5 ft. apart in the row. Wires are generally shaped to form an arch. Wider tunnels will generally result in greater warming but are more vulnerable to wind damage (Jensen and Malter, 1995). Crops are often irrigated with drip irrigation to help conserve moisture and reduce weed populations.

California System. The California System of hoop-supported row covers involves two sheets of 36-in. wide, 1.5 ml clear polyethylene supported by wire hoops spaced 5 to 7 ft. apart. Edges of the plastic are secured with soil. Wooden stakes approximately 30 in. long and one in. in diameter are spaced at 10- to 25-ft. intervals in the bed. A 16-gauge wire is stapled to the top of the stakes and edges of the plastic are clipped together at the wire with clothespins. Covers are closed and opened manually (Hochmuth, Kostewicz, and Stall, 2000). Hoops are generally attached to the wooden stakes and wire for greater stability under windy conditions. A second set of wire hoops may be placed over the top of the tunnel allowing the plastic to slide down between the hoops when venting (Jensen, and Malter, 1995).

Perforated Plastic Tunnels. Solid plastic tunnels must be vented in some way to prevent heat damage to plants. Venting can be very time consuming and a major problem in windy weather.

Perforated plastic allows for ventilation without removing the plastic and reduces damage from wind. Perforations are generally 3/8-in. in diameter (74 holes/sq ft) but may vary with manufacturer. Slit row covers have the same effect. Very little water condensation occurs under perforated plastic covers. There is generally less frost protection under perforated and slitted row covers than under a solid cover.

Spunbonded Fabric Tunnels. Spunbonded polyester and spunbonded polypropylene fabric tunnels are two of the more popular row cover tunnels since they don't have to be vented and don't tear as easily as polyethylene. Edges are secured with fabric pins and/or soil.

ROW COVER REMOVAL

Row covers are often applied three to four weeks before crops are normally planted to encourage growth enhancement or for frost prevention. Row covers must be removed at bloom for fruiting crops to encourage bee or wind pollination. Higher temperatures later in the season may reduce quality for cool-season crops, necessitating the removal of the row covers. Extremely high temperatures that develop later in the season under row covers can also reduce production of crops like tomatoes and peppers.

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