

**Season Extension: New Techniques and Covers for
Extending the Growing Season**

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Since many vegetable crops in general and Solanaceous and Cucurbitaceae (S & C crops) specifically love warm temperatures, production of these crops in much of Pennsylvania is a challenge both from the standpoint of temperature and moisture. Cucurbit and Solanaceous plants stop growing below 45°F and have a difficult time maturing fruit when average night temperature drops below 50°F. Optimum growth of Cucurbit and Solanaceous plants is between 75° and 85°F daytime temperature. For the average grower in Pennsylvania growing on bare soil, the planting date for S & C crops is generally between May 10 and June 10, assuming that there will be no extremes in day and night temperatures. While mature S & C crop plants are somewhat drought tolerant, they require consistent soil moisture levels (80% of available soil moisture) after transplanting and until they reach the initial flowering stage of growth. On the other hand, excessive rainfall 2 weeks prior to fruit harvest will dramatically reduce fruit quality and increase the potential for fruit cracking. The use of plasticulture will help eliminate/prevent these environmental stresses on S & C crop plants during the growing season.

For the production of high quality S & C crops, the use of raised beds, plastic mulch, drip irrigation row covers and/or high tunnels will insure successful and consistent marketable yields. The use of plasticulture in the production of S & C crops will: 1) increase soil temperature 8° to 12°F warmer than bare soil, 2) increase/maintain soil water holding capacity, 3) reduce/eliminate weeds, 4) maintain/increase soil tilth and 5) reduce/eliminate fertilizer and pesticide leaching under the bed. I will discuss the individual components of plasticulture in the following sections below.

Raised Beds – Making a 6 to 8 inch raised bed prior to applying plastic mulch in the field helps to; a) increase soil temperature, b) produce a tight fit of plastic on the soil surface, c) prevent plant/fruit damage from excessive water (heavy thundershowers), d) reduce soil erosion when beds follow soil contour and e) helps to produce a higher quality, cleaner fruit. Many equipment manufacturers sell a multi-function machine that will make a raised, pressed bed, lay the agricultural plastic film snugly on top of the bed and also place drip tape at a desired depth in the bed at one pass. In addition, a fertilizer applicator can be placed on top of the bed maker/mulch applicator to add nutrients into the bed.

Plastic Mulch – Since plastic mulch increases soil temperature, soil moisture and maintains soil tilth, transplanting S & C crop plants within 2 to 5 days after application of the plastic in the field is recommended. Plastic film can be purchased at a thickness of 0.3 to 1.5 mil, embossed or smooth and colors of clear, white, black, blue, IRT green, IRT brown, red and metalized silver. The plastic film you purchase can be tailored to your needs based on crop being grown, number

of crops to be grown on the film, length of time to be left in the field and pest elimination requirements. The thicker the film, the longer it can be left in the field; 1.5 mil plastic will last two years/multiple crops in the field. However, in general, the thicker the film, the higher the cost; unless the purchase is an ultra-thin plastic film 0.3 mil or less. Embossing imparts more elasticity/stretchability compared to the smooth plastic film. Pepper plants will produce higher early and marketable yields on IRT green or silver mulch compared to the standard black film. Metalized silver mulch will maintain cooler soil temperatures compared to the standard dull silver mulch, but metalized silver mulch has the potential to repel more insects than the dull silver mulch. Tomato/eggplant plants will produce higher early and marketable yields on red mulch compared to the standard black film, especially if the growing season is very stressful. The silver mulch also repels aphids so that aphid vectored viruses are eliminated in the field.

Drip Irrigation – Water comprises 93% of S & C fruit when mature emphasizing the importance of water in the growth and development of both S & C plants and fruit. When transplanting S & C plants, application of water is extremely important to maintain soil capacity for the regeneration of root and shoot growth of the transplants and eliminate plant mortality of the vegetable transplants. Drip irrigation is very efficient in; 1) directing water to the crop and not the weeds, 2) reducing/eliminating foliar diseases, and 3) injection of fertilizers and/or pesticides. Since many soils in Pennsylvania are silt loams to clay loams and generally have between 1.5% to 2.5% organic matter, they tend to have relatively high cation exchange capacity (CEC), low to moderate water infiltration rates, and moderate to high water holding capacity. Because of these characteristics, growing S & C crops on these soils and raised beds/plastic mulch is more effective when at least 40% of the fertilizer requirement is added preplant rather than totally through the drip irrigation system. Fertigation of nitrogen (approx. 7 to 10 lbs/A) after crown set of fruit are pollinated does help to increase fruit production and maintain plant health and vigor. Scheduling water application on measurement of actual soil moisture levels (irrometer or tensiometer) will help to maintain active plant growth throughout the growing season and high quality fruit. Maintaining uniform soil moisture (minimizing fluctuations) will help reduce/eliminate blossom end rot in both tomato/pepper/eggplant fruit.

Row Covers – Since S & C crops return a relatively high gross per acre and require warm temperatures both day and night, use of polypropylene row covers is both economical and productive. Applying row covers on the raised bed/plastic mulch after transplanting S & C crops will; 1) increase both ambient and soil temperatures resulting in increased plant growth, 2) reduce/eliminate plant dessication, 3) maintain higher soil moisture levels, and 4) exclude insect feeding on young plants. However, once plants begin to flower, removal of the row cover is suggested to allow for successful pollination of flowers. While polyester row covers are available, the stiffness of the material compared to polypropylene will cause leaf abrasion and potential delays in fruit maturity.

Low Tunnels – In locations that are rather windy in the spring of the year and plant dessication is a principle cause of plant mortality, use of low tunnels will help both in establishment and early production of S & C crops. Low tunnels are usually 1-mil rolls of perforated (for ventilation) polyethylene stretched over metal hoops (no. 9 wire) placed every 6' to 8' over the row of S & C crops. The tunnels are immediately placed over the row after transplanting the crop and left in place until the afternoon high temperatures exceeds 85°F for 3 successive days.

Some of the newer polypropylene floating row cover materials work rather well for this application, especially for the 1.0 and 1.5 oz/sq. yd. materials.

High Tunnels – They are designed to reduce environmental extremes during the early spring and late fall growing season. The tunnels themselves are generally 14' to 30' in width and up to 96' in length. While high tunnels are not greenhouses (no heat or automatic ventilation), the greenhouse principle is the basis for the function and design of a high tunnel. Metal bows approximately 1.5" to 1.75" in diameter are used as the support frame for the polyethylene covering. The bows are spaced 4' apart and are connected to metal posts that are driven 2 feet into the ground. The end walls generally have minimal framing and should be easily removed to facilitate ventilation and use of power tillage equipment. The high tunnel frame is covered with a 6-mil, greenhouse grade clear polyethylene film which is left on during the entire year. Snow removal from the top of the tunnels