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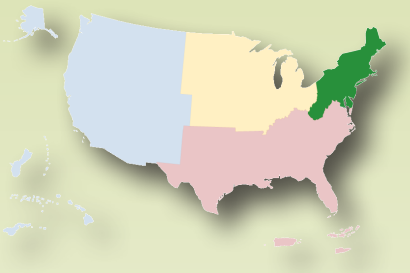

Organic Production of Blackberries in High Tunnels in West Virginia

Project Summary

Blackberries are a popular small fruit for market across West Virginia, but consistent commercial production can be risky because of the state's variable climate. The USDA Plant Hardiness Zones range from 5 to 7 across the state, which can result in winter injury to blackberries grown outdoors. In addition, fluctuating springtime temperatures can cause warm periods that promote early bud break, only to see those buds later damaged by frost.

The objective of this project was to evaluate the feasibility of growing blackberries organically within a high tunnel structure in central West Virginia, including pest management, cultivar and management considerations.

This project took place on a farm in USDA Plant Hardiness Zone 6a.

Top Findings and Lessons Learned

- Blackberries do not perform well in containers. Although it was beyond the scope of this project to understand why, some hypotheses include a restricted root zone, erratic media moisture and elevated root-zone temperatures. Nevertheless, it is recommended that any grower wishing to pursue high tunnel blackberry production focus on in-ground production.
- Triple Crown, a semi-trailing, thornless blackberry variety with excellent yield and quality performed well within the high tunnel, and had marketable yields about 25 days before field plots, with less winter injury.

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COVER PHOTO: Blackberries established in the high tunnel outperformed container-grown plants, and produced fruit earlier than field plots. *Photo courtesy Lewis Jett, West Virginia University*

- Primocane fruiting cultivars—in which the canes are removed at the end of the winter—are less labor intensive compared to floricane varieties (such as Triple Crown). In addition, the pest cycle of chronic pests such as spider mites is disrupted by removing the canes each season.

Methods

A 30-foot-by-96-foot high tunnel was constructed in 2008 on the Jett Farm, located in southern Harrison County, West Virginia. The high tunnel had a single layer of polyethylene plastic, and no supplemental heat. Two crops of annual strawberries were grown in the high tunnel in 2008-2009, preceding the blackberries. The soil inside the high tunnel was amended with organic dairy manure compost, at a rate of 0.9 pounds per square foot.

This project explored two methods of growing blackberries in a high tunnel: in-ground and in-container production.

Container Production

Five blackberry varieties—Triple Crown, Prime Jan, Navaho, Kiowa, Arapaho and Chester—were potted in seven-gallon nursery containers. Nine plants of each variety were potted, providing three replications of three plants each.

The containers were filled with a 1:1 mixture of peat moss and organic dairy manure compost. While in the containers, the plants were allowed to grow one year in the outside environment adjacent to the high tunnel, which was filled with strawberry plants at the time. For irrigation, each pot was drip irrigated with pot drippers to provide 1.5 inches of water equivalent either by rainfall or supplemental irrigation. No additional fertilizer was applied to the plants.

In October, the containers were moved inside the high tunnel to protect them during the winter.

In-Ground Production

In April 2010, four blackberry varieties were established within the mineral soil of the high tunnel—Prime Ark 45, Prime Jan, Triple Crown and Ouachita. Each plant was spaced 3 feet apart within the row, and the rows were 6.5 feet apart. Each variety was replicated three times with three plants per replication. Two drip irrigation lines were placed per row.

Plants were scouted for pest invasions. Bumble bees were placed inside the high tunnel to promote pollination and fruit set. Beneficial insects were released if pest densities exceeded economic thresholds. In 2010-11, a T-trellis was constructed to control canopy width and facilitate harvest.

Total marketable weight and individual berry weight were measured. Temperatures were recorded with a Hobo data logger.

Both Prime Jan (left) and Prime Ark 45 (right) produced about 1 pound of fruit per plant, but Prime Ark produced larger fruit. *Photo courtesy Lewis Jett, West Virginia University*

Outcomes

The high tunnel, with a single layer of poly, increased daily air temperatures by an average of 4 to 7 degrees compared with the outdoors. If a double layer had been used, the average temperature could have increased by about 10 to 12 degrees.

The potted blackberries were evaluated over the course of a 24-month period. Over that time, plant vigor was significantly inferior to the plants established in the ground. Blackberries grown in the field produced 2.5 times more canes than container-grown plants of the same variety. Because of insufficient growth, container-grown blackberries were abandoned after this two-year trial.

Variety Comparison

Triple Crown, Prime Jan, Prime Ark 45 and Ouachita were planted in the high tunnel in 2010. Triple Crown is a thornless, late, semi-trailing blackberry variety which produces high-quality fruit. However, this variety has shown symptoms of winter injury in West Virginia. Ouachita is a mid-season, thornless blackberry variety with good disease resistance. Prime Jan and Prime Ark 45 are primocane-fruiting blackberry varieties and could be used for late-season blackberry production within a high tunnel.

Yields were first measured in 2011, the first bearing year for the plants. Triple Crown produced approximately 0.75 pounds of marketable fruit per plant. While Triple Crown grown in open-field plots at the West Virginia University Organic Farm exhibited signs of winter injury on approximately

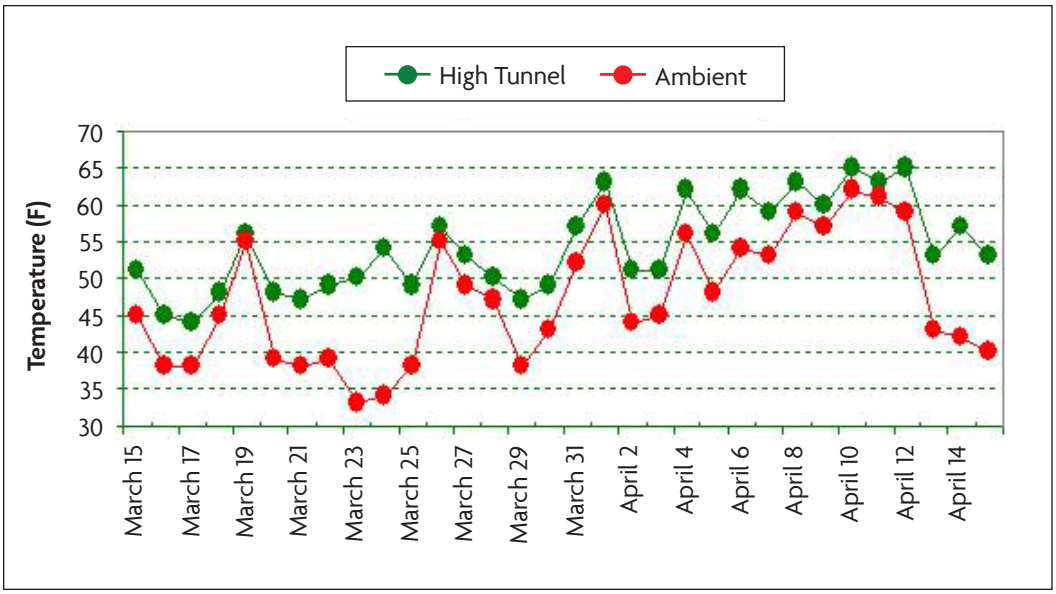

FIGURE 1. Mean daily temperatures recorded inside the high tunnel and outdoors, from March 15 to April 15, 2009.

two canes per crown, the Triple Crown grown in the high tunnel for this project did not show any winter injury symptoms. Triple Crown fruit was harvested from the high tunnel beginning July 8, approximately 25 days before field plots.

Prime Jan and Prime Ark 45 began fruit maturity in late August 2011, and harvest continued through early November. Both varieties produced approximately 1 pound of marketable fruit per plant, although fruit quality of Prime Ark 45 was superior to Prime Jan. However, Prime Ark had a significant number of unripened fruit when it was finally frozen out on November 10. If supplemental heat was available, perhaps another month of harvest could have occurred with this cultivar.

Pest Management

Pest management is one of the most critical management issues facing high tunnel crop producers because the dry, warm environment of the high tunnel favors pest development. For organic production, routine scouting to detect pest invasions is required. Two-spotted spider mites feed on blackberry foliage, indicated by typical symptoms such as leaf cupping and interveinal chlorosis (leaves turn yellow but veins remain green).

The two-spotted spider mite was detected within the high tunnel in April 2011, and whiteflies were observed in May 2011. A 10x hand lens was useful in identifying the spider mites. Botanigard, a fungus which attacks soft-bodied insects, was used to control the whiteflies and a small number of aphids. This biological fungicide was very effective in controlling the whiteflies.

Organic control options for spider mites may be more challenging. Predatory mites were used to control two-spotted spider mites when spider mite densities exceeded the threshold of 10 to 15 mites per leaf inside the high tunnel. Natural predators became common within the organically-managed high tunnel.

The predatory mites were effective in suppressing two spotted spider mites on blackberries. However, spider mites continued to survive on the blackberry plants through early fall. Only when weather conditions became cooler did they visibly disappear.

If attention is paid to early insect pest detection, organic blackberry production is extremely viable. Primocane fruiting cultivars may be a better choice for an organic production system because selective pruning is minimized and pest cycles can be broken.

Note: The project coordinator intends to continue collecting data from this research for an additional three to five years past the end of this SARE project.

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