2020 Progress Report to the Southern Region Small Fruits Consortium

Project Title: Increasing lateral branching of primocane-fruiting blackberry with 6-benzyladenine and GA_3

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Objective: 1) Identify effective 6-benzyladenine + GA_3 rates to enhance lateral branching of 'Traveler' blackberry.

Public Abstract:

Primocane growth management of blackberry by commercial growers relies on summer pruning/tipping primocanes at multiple heights throughout the growing season. Tipping can increase lateral branch development, bearing surface, and subsequent yields. However, tipping is a labor intensive and expensive process (~$600 per acre) that increases risk of cane blight infection. If effective, chemical management of blackberry primocane growth could reduce labor inputs associated with manual summer pruning/tipping, reduce incidence of cane blight due to manual summer pruning, and reduce the number of fungicide applications for managing cane blight. This project will determine: 1) optimal rates for 6-BA + GA_3 to induce lateral branching on blackberry, and 2) if branching agents have potential in southeastern blackberry production. Unfortunately, restrictions on research activity related to COVID-19 did not permit the initiation of new research projects at North Carolina State University in spring 2020. We plan to complete this project in 2021.

Justification and Description:

Inadequate lateral branch development can have negative consequences on blackberry productivity and profitability, since yield is positively correlated with lateral branch number (Strik et al., 2012). Primocane growth management of blackberry by commercial growers relies on summer pruning/tipping primocanes at multiple heights throughout the growing season. Tipping can increase lateral branch development, bearing surface, and subsequent yields (Fernandez et al., 2016; Strik et al., 2012). However, tipping is a labor intensive and expensive process (~$600 per acre) that increases risk of cane blight infection. Cane blight (caused by Leptosphaeria coniothyrium) can result in mortality of fruiting canes and/or severe economic losses in the southeastern US (Brannen and *Krewer, 2012).* Alternative vegetative growth management strategies for primocane-fruiting cultivars must be developed. We plan to investigate use of 6-benzyladenine and GA_3 to induce lateral branching of primocane-fruiting blackberry.

Methods to promote lateral branching are well developed in tree fruit production (Cowgill et al., 2017). Application(s) of a cytokinin (6-BA; 6-benzyladenine) and/or gibberellins (GA_3 or GA_{4+7}) are effective in enhancing apple lateral branch development. In 2018, PI's Kon and Fernandez evaluated a mixture of 6-BA and GA_{4+7} to induce lateral branching of 'Traveler' however, this treatment was ineffective, even at relatively high concentrations (data not presented). However, Malik and Archbold (1992) demonstrated that lateral branch number and length was increased with 100 ppm 6-BA + GA_3. Surprisingly, primocane cane height was reduced by 48% with foliar GA_3 treatments. This research was conducted on potted plants in a greenhouse and effects on node number, internode length, and flower bud development were not reported. To our knowledge, this is the only report of 6-BA + GA_3 effects on lateral branch development of blackberry. Based on Malik and Archbold (1992) we believe that additional research is warranted.

If effective, chemical management of blackberry primocane growth could 1) reduce labor inputs associated with manual summer pruning/tipping, 2) reduce incidence of cane blight due to manual summer pruning, and 3) reduce the number of fungicide applications for managing cane blight. This management strategy could have utility in field and high tunnel production systems. This project will determine: 1) optimal rates for 6-BA + GA_3 to induce lateral branching on blackberry, and 2) if branching agents have potential in southeastern blackberry production.

Objective: *Identify effective 6-benzyladenine + GA_3 rates to enhance lateral branching of 'Traveler' blackberry.*

The following treatments will be evaluated:

1) untreated control,
2) 50 ppm 6-BA + GA_3,
3) 100 ppm 6-BA + GA_3,
4) 300 ppm 6-BA + GA_3,
5) 500 ppm 6-BA + GA_3,

The experiment will be conducted in a two year-old blackberry planting at NC State University's' Mountain Horticultural Crops Research and Extension Center in Mills River, NC. The planting was established in 2019 at 4' x 12' spacing. Twenty uniform three-plant plots will be selected and flagged. The experiment will have a completely randomized design and will be replicated four times.

Plant growth regulator treatments will be applied using a CO_2 sprayer at ~3 week intervals, until flower bud development is observed. Primocane height will be measured at ~3 week intervals throughout the growing season. Three floricanes per plot will be selected to quantify blossom density and subsequent fruit set. When fruit reach a commercially acceptable level of maturity, plots will be harvested twice a week. Marketable yield, unmarketable yield, and average fruit weight will be determined.

After harvest, a morphometric characterization of three primocanes per plot will occur. Canes will be cut at the base and moved to the lab for analysis. Basal cane cross-sectional area will be determined, and number of fruiting nodes per cane will be counted. The number of lateral

branches per cane will be counted. On each lateral branch, nodes will be counted and length will be measured. Leaves will be excised, counted, and leaf area per cane will be determined with a leaf area meter. Fresh and dry weight of each tissue type (cane, lateral branches, leaves) will be determined.

The experiment will have a completely randomized design with four replications. The PC version of SAS (version 9.4; SAS Institute, Cary, NC) will be used to carry out all statistical analysis. Regression analysis will be performed PROC GLM at $P = 0.05$. Where appropriate, repeated measures will be used.

Results:

Restrictions on research activity related to COVID-19 did not permit the initiation of new research projects at North Carolina State University in spring 2020. With permission of the sponsor, we plan to complete this project in 2021 and provide a final report when appropriate.

References:

Brannen, P.M. and G.W. Krewer. 2012. Cane blight of blackberry. University of Georgia Cooperative Extension. Circular 894.

Cowgill, W., J. Clements, and W. Autio. 2017. Branching young apple trees with plant growth regulators. UMass Extension Fruit Publications. F-140. https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/f-140_ _branching_young_apple_trees.pdf

Fernandez, G.E., E. Garcia, and D. Lockwood. 2016. Southeast Caneberry Production Guide. Southern Region Small Fruit Consortium. NC Cooperative Extension Service. AG-697. https://rubus.ces.ncsu.edu/spotlight/caneberry-production-guide/.

Malik, H. and D.D. Archbold. 1992. Manipulating primocane architecture in thornless blackberry with uniconazole, GA3, and BA. HortScience 27(2):116-118.

Strik, B.C., J.R. Clark, C.E. Finn, and G. Buller. 2012. Management of primocane-fruiting blackberry: impacts on yield, fruiting season, and cane architecture. HortScience 47(5):593-598.