Final Report Grant code 2013-04

Proposal Category: \_X\_Research \_\_Outreach

## Title: Postharvest Evaluation of Small Fruit after Application of Fruit Coatings

Name, Mailing and Email Address of Principal Investigator(s):

Principal Investigators:

Penelope Perkins-Veazie Professor, Postharvest Physiology Horticultural Sciences Dept., North Carolina State University Plants for Human Health Institute, NCRC Suite 1321, 600 Laureate Way Kannapolis, NC 28081 Penelope\_perkins@ncsu.edu

Dr. Gina E. Fernandez Department of Horticultural Science North Carolina State University Raleigh NC 27695 <u>Gina Fernandez@ncsu.edu</u>

Dr. Hannah Burrack Department of Entomology North Carolina State University Raleigh NC 27695 hannah burrack@ncsu.edu

## **Objective:**

Test fruit coatings and preharvest non pesticide sprays on storage life and composition of small fruits, in concert with ongoing work by Dr. Burrack to test effectiveness in reducing spotted wing drosophila infestation.

#### Justification and Description

Fruit waxes and coatings are not usually applied to small fruits in the U.S. This is due partly to the trend to pick directly into final display container for strawberry, raspberry, blackberry, and muscadine grape, and because of added costs and management when applying postharvest waxes. Coatings can offer advantages in fruit such as apple, by adding gloss and decreasing weight loss.

In the last two years, spotted wing drosophila (SWD) has become a major pest of organically and conventionally grown raspberry and blackberry in North Carolina. Blueberry, the small fruit with the largest acreage in North Carolina, may also be affected. There are very few effective insecticides for SWD, and applications must be done frequently, greatly increasing grower costs.

Fruit coatings may offer advantages both in altering SWD preferences and in improving gloss or preventing weight loss of small fruits. The objective of this proposal is to provide the postharvest information needed should use of coatings applied pre harvest turn out to be an effective deterrent to SWD. Additionally, there is an indication in preliminary work that Primafresh, a carnauba based coating developed specifically for plums as a postharvest wax may be useful in muscadine grapes for general extension of postharvest life and quality. Because Primafresh is designed to protect the bloom on fruit, it may also prove to be helpful in blueberries.

Fruit coatings require several levels of evaluation, at room temperature, desired storage temperature, and after warming cold stored fruit to room temperature. Coatings can cause an undesirable crisp texture, or a sticky wet feel to fruit. For some small fruits, it may be more desirable to apply a coating spray preharvest in the field. This could improve fruit toughness and decrease bruising, but could also cause anaerobic respiration of fruit, especially under warm temperatures. Dr. Burrack will evaluate the usefulness of these coatings on reducing SWD infestation in separate experiments. Postharvest evaluations are being done to speed up grower recommendations if outcomes are positive for deterring infestation. While muscadine grapes most likely will not have SWD issues, the coatings may help prevent berry softening and weight loss and be useful in the expanding fresh market industry.

### Materials and methods:

'Camarosa' strawberries harvested from the Piedmont Research Station were dipped in coatings then spun dry using a salad spinner. Controls were dried (not sprayed) and wet (sprayed with water then spun). None of the treatments were found to be particularly effective in preventing mold or firming fruit (Table 1). Raynox proved to be unsuitable in further lab experiments as a coating after harvest with the equipment we used. Primafresh, while promising, was found to be difficult to obtain due to the sale of the company and there was not enough to conduct field trials. So, we obtained two proprietary compounds (R, W), and ZeroTol (a peroxygen fungicide/bacteriacide approved as a spray for organic farming) for testing instead. R and W are designed as preharvest sprays for tree fruit and citrus, respectively. These three compounds were applied as sprays in the field on trellised blackberries (NS) (Figure 1), using hand-pumped 2 liter sprayers and following recommended dilution rates, once a week from first appearance of fruit (about 14 days post anthesis) to first harvest, a total of 4 to 6 sprays. Nutrical (chelated calcium) was used on one replicate per side of the EW trellis, along with a control. Control berries were not sprayed.

Ouachita, Von, and Apache were used as cultivars, planted on a rotating arm trellis, in their second fruiting year. Row 1 faced east and row 2 faced west in the NS trellis, and rows faced north and south in the EW trellis.

Blackberries were harvested into  $\frac{1}{2}$  pint containers and held at 4 C in masters that were then enclosed in plastic bins (to increase relative humidity) until either weight loss became too high (over 3%) or fruit were unmarketable in appearance.

Fruit that has no decay after storage, as well as day 0 fruit, of treated and untreated fruit was placed at -20 to -80C then thawed and pureed for general tests of fruit composition. These tests

include soluble solids content, pH and acidity, total anthocyanin and phenolics content and are not yet complete.

# Results

Strawberries targeted for testing in the upper mountains had poor fruit set; application of test solutions did no harm to plants or leaves but there were no strawberries to sample of the targeted cultivar. Blackberries were the major fruit targeted for preharvest spray trials. Of the sprays, we found that ZeroTol caused browning/blackening of both fruit and leaves. This appeared about 2 weeks after spraying began, so further sprays were stopped. Applications to strawberries in the fall did not cause visible damage. The ZeroTol label warns that if downy or powdery mildew is present, application can cause spots. Given the highly humid, often overcast conditions through mid summer in North Carolina, we could well have had downy mildew in the blackberries and the reaction with ZeroTol caused the 'burn' effect (Figure 2).

When applied preharvest to blackberries of three varieties, no differences were found in final postharvest quality or storage life among the treatments. None was better or worse than the control (no spray). However, Nutrical was found to slightly (but not significantly) improve fruit firmness. When applied to harvested blackberry or raspberry as a dip followed by spin, the percent leaky berries was increased with the coatings R and W.

SWD was first noticed in the blackberry fruit in early July. A rigorous spray program (insecticide and fungicide) greatly reduced infestation rates and fungal growth on fruit in the field. We noticed that SWD flies were higher in the lower (near ground) areas of the trellis.

## Conclusions

Application of preharvest sprays (by hand) to blackberry showed no negative effects on postharvest shelf life. Dipping berries into solutions after harvest negatively affected shelf life (more leak, softer). Given the results from Dr. Burrack's study, it appears that the coatings need to be fairly impermeable to oxygen in order to slow larval development.

## Impact statement

Application of a non pesticide spray to soft small fruits to decrease SWD attraction or larval development should be done as a preharvest spray rather than a postharvest application to best preserve fruit quality.

Table 1. Postharvest ratings for strawberry when applied on harvested fruit. Ratings 0-3 where 0 is best and 3 is worst.

	Treatment	fruit dark	calyx brown	firmness	pmold	overall firmness	ovall mold
Camarosa	control-dry control-	2 2	2 2	2 2	12 13	2 2	8 10
	wet Raynox	2	2	2	27	2	27





Figure 1. Trellis system used. Ribbons divide the cultivars into treatment groups. Figure 2. Apperance of 'burning' on leaves and berries after Zerotol application.