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Melissa Muñoz, Gabriela Calidonio, Ana Maria Borda, Guido Schnabel and James E. Faust
Clemson University

New Bioproducts for Botrytis Blight Management of Floriculture Crops

This report covers recent studies examining 1. the effects of natamycin (Zivion™ M) and calcium (CaCl2) postharvest dips with or without coadjuvant (Capsil®) on the severity of Botrytis on roses, and 2. the effect of time of bioproduct application relative to exposure to Botrytis spores. Two additional bioproducts were used in the second study: polyoxin D (Affirm) and calcium propionate (CrystalPro).

Natamycin, Calcium, and Coadjuvant Study

Two experiments were conducted using commercial cut roses (var. Orange Crush) harvested at two farms. Roses were harvested and taken to the postharvest room, where they were dipped for 15 seconds in a solution containing natamycin (125, 250, 500, 750 ppm), calcium (1000, 2000 ppm), or a combination of both products at eight concentrations. Then flowers were packed and shipped to Clemson University. At arrival (6 days after treatment), flower buds were inoculated with a Botrytis spore solution and placed in humid chambers. The severity of Botrytis infection was evaluated 3, 5, and 7 days after inoculation. Non-inoculated flowers with and without coadjuvant were used as controls.

The performance of the roses treated with both calcium and natamycin at a concentration of 2000 ppm Ca and 500 to 750 ppm natamycin was comparable with the non-inoculated control treatment (Figures 1 and 2). The addition of a coadjuvant did not have an effect on the severity of the botrytis blight on roses.

Figure 1. Botrytis blight severity of cut roses treated with dips of natamycin (Nat), calcium (Ca), or a combination of both products with or without coadjuvant. Data were collected from cut roses harvested at two commercial farms.
Figure 2. Effect of natamycin (Nat), calcium (Ca), or combinations of both products applied as postharvest dips on Botrytis blight severity of roses and compared to inoculated and non-inoculated controls.

Time of Product Application Study
The results described in Study #1 were obtained with the application of the products 6 days before inoculation with Botrytis spores, and we observed different responses compared to our previous studies, where the products were applied 24 hours prior to inoculation. Namely, natamycin appeared to be less effective when applied 6 days before exposure to Botrytis spores, i.e., inoculation.

In this study, the application time before inoculation was 1, 3, 5, or 7 days. The products used were natamycin, polyoxin D (Affirm), and calcium propionate (CrystalPro). Polyoxin D products are currently available to growers. Calcium propionate is a food preservative used internationally in bread products for many decades and is currently being considered for use in agriculture. The experiment was performed using roses (var. Orange Crush). A commercial fungicide (Miravis Prime) was included as an additional control. Inoculated and non-inoculated roses also were used as controls.

We observed that the time of application prior to botrytis inoculation (infection) influenced the efficacy of the product. Specifically, natamycin and polyoxin D showed different responses depending on the time of application prior to inoculation (Figure 3). For polyoxin D, efficacy increased as the time between application and inoculation increased, while the opposite was true for natamycin (Figures 3 and 4). Polyoxin D applied 7 days prior to inoculation provided a
response equivalent to the commercial fungicide; however, when polyoxin D was applied the day
before inoculation, it showed no significant effect. This suggests that polyoxin D is turning on
disease resistance mechanisms in the plant. In contrast, natamycin applied 1 day prior to
inoculation was very effective, but when it was applied 7 days prior to inoculation, the effect was
greatly reduced. This suggests that natamycin is being broken down over time from either UV
light and/or microorganisms. Calcium propionate displayed a similar response pattern as
natamycin. These results have tremendous implications for Botrytis management strategies
during production and postharvest, depending on the expected timing of exposure to Botrytis
spores.

Figure 3. Botrytis blight severity of cut roses treated with polyoxin D (Affirm 0.5 g/L), calcium
propionate (CrystalPro, 0.1%), and natamycin (Zivion™ M, 750 ppm). These products were
applied 1, 3, 5, and 7 days prior to inoculation with Botrytis spores. Miravis Prime (a commercial
fungicide), inoculated, and non-inoculated roses were used as controls.
Figure 4. Effect of time of application of polyoxin D and natamycin relative to the time of inoculation for reducing Botrytis blight severity on roses. Pictures were taken 5 days after inoculation.

Conclusions

• Natamycin and calcium showed an additive effect for reducing botrytis severity, i.e., the combined effect was higher than each product used alone; therefore, this combination is very promising for commercial use as a postharvest dip.

• Coadjuvant is not needed for natamycin and calcium dips on roses.

• Polyoxin D has a maximum efficacy when applied 7 days prior to inoculation, while natamycin and calcium propionate are more effective immediately after inoculation. This has implications for application timing in the production and postharvest environments.