Floriculture growers report western flower thrips (WFT, *Frankliniella occidentalis*) as being one of the most common and difficult to control pests. Effective Integrated Pest Management (IPM) programs for this pest include not only biological controls but also cultural control. In general, floriculture crops often receive more fertilizer than is required for adequate growth. Depending on the plant species, the excess nitrogen is stored in plant tissues, which may make plants more nutritious to pests, stimulating their population growth. In contrast, plants grown at lower fertilizer rates may upregulate their defenses against pests. In this project, we tested the hypothesis that optimizing fertilizer input to the crop could reduce its suitability as a host plant for thrips without compromising plant quality, offering a surprising addition to a successful thrips IPM program. Slowing down thrips population growth on less nutritious plants will also make it easier for biocontrol agents to manage this pest.

The first set of trials examined the effect of fertilizer level on plant quality in chrysanthemum and gerbera (*Figure 1*). Fertilizer rate affected plant height, mass, and number of flowers. In consequence, plant quality suffered at the lowest rates. In greenhouse trials with thrips, we found that adjusting plant nutrition could reduce thrips populations by 30 to 50 percent between high and low fertilizer rates. However, the results were highly variable, and the lowest rates that led to reduced thrips population growth also negatively affected plant quality. Biostimulants (e.g., beneficial bacteria, fungi, or extracts) could potentially be used to compensate for lower nutrient input by improving nutrient uptake. Several types of biostimulants may also induce host

*Figure 1. Plant size and quality increase as fertilizer rate increases from left to right in the photos. Rates were 25ppm to 300ppm of N in chrysanthemum (A) and 25ppm to 200ppm of N in gerbera (B) greenhouse trials.*
plant resistance to pests and improve shelf life. The first experiments with biostimulants were inconclusive and will be repeated this year.

We went back to the laboratory to investigate the effect of host plants grown at high and low fertilizer rates on thrips under more controlled conditions and to gain an insight into what happens in the plants. First, we sought to investigate the effects of fertilizer rate and chrysanthemum cultivar on thrips preference and oviposition (i.e., egg-laying) in choice and no-choice Petri dish trials. We grew four popular cultivars of chrysanthemums (Chesapeake Yellow, Vyron Yellow, Springdale Purple, and Grandview Pink) in an isolated growth chamber, free from pests and watered with 17-5-17 complete fertilizer at either 75ppm (low) or 250ppm (high) of nitrogen.

We conducted a no-choice experiment to determine the effect fertilizer level and cultivar had on thrips oviposition. Following that, we did a choice experiment to see which leaf female thrips preferred when offered both high and low fertilized leaves of the same cultivar.

Preliminary data suggests that thrips oviposition varies a lot among cultivars. In the no-choice experiment (Figure 2), females oviposited in all cultivars but laid the most eggs in Springdale and Chesapeake overall while laying the fewest eggs in Grandview. We found an effect of fertilizer in Grandview and Vyron, where more eggs were laid in leaves from the high fertilizer treatment compared to the low fertilizer treatment. When given the choice between leaves from plants grown with high or low fertilizer (choice experiment), thrips preferred to oviposit in leaves from the high fertilizer treatment plants (Figure 3). Although this experiment has to be repeated to confirm these preliminary results, the data suggest that manipulating plant nutrition can affect oviposition preference in thrips, and cultivars differ greatly in susceptibility to thrips.
At the same time, we took leaf samples and conducted metabolomics analysis to look at the biochemical compounds in plants from each treatment. We compared the metabolite levels within and between cultivars, also looking at the effect of fertilizer level. Surprisingly, the differences in biochemical compounds between cultivars are much larger than differences due to fertilizer rate. Combined with the choice and no-choice results from the experiment above, this indicates that the effect of cultivar on thrips may be stronger than the effect of fertilizer level.

It can be expected that thrips will proliferate on the most susceptible or preferred cultivars in commercial greenhouses. Although manipulating plant nutrition may help reduce thrips, growing resistant cultivars will be an important part of a successful thrips IPM program in chrysanthemums. Reduction in fertilizer applications could lead to cost savings for growers – directly, through a reduction in input costs and indirectly by reducing losses caused by high populations of thrips. Selection of thrips resistant cultivars and the adjustment of fertilizer application are two additional strategies that growers can add to their thrips IPM repertoire in chrysanthemums, joining dipping, early application of bios, mass-trapping, and spot-sprays. For the next portion of the project, we plan to examine the effect of select biostimulants on thrips life history and plant quality in chrysanthemum grown at different fertilizer levels. This will tell us whether biostimulants confer any resistance to plants against thrips or can compensate for the effects of lower nutrient input.

Figure 3. Generally, more larvae emerged from leaves grown at the higher fertilizer level compared to the lower fertilizer level.

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