Debug Turbo and Tres

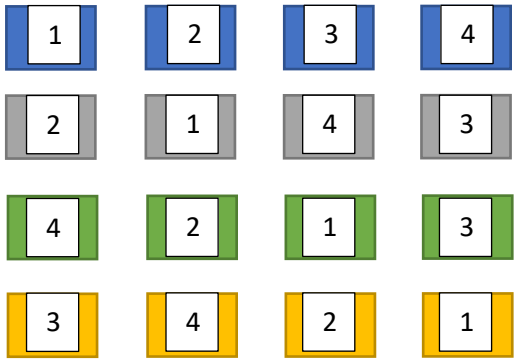
Grower Demonstrations in Greenhouse and Nursery

Objective: Description of what is intended to be accomplished in your research trials

Treatments and Replicates: Minimum 4 replicates for each treatment

- Replicates: a copy of a treatment. For each treatment, it should be "repeated" a minimum of 4 times in different but similar locations.

Example trial set up: each colored row is a new set of replicates (could be a potted plant or a 10' crop row), and each number represents randomized treatments within that replicated block. Replicates should be at least 10 feet apart to prevent neighboring treatment applications from influencing each other.



Replicates allow data to be averaged and generate what's referred to as a "representative sample". For example, section blue replicate, treatment 1 is on the edge of the trial and could mimic the "edge effect" in cropping systems. The edge effect can sometimes bias counts when you have insect populations that begin infesting from the edge and move inward. To avoid this in evaluations, we replicate treatments in different locations of the cropping system to get a better representation of the production system.

Treatments should always include:

Positive control - This is a treatment that is known to give the desired result, typically a benchmark product is preferred.

Untreated control- Mimics what would happen in the field if no control measures were applied.

Treatments to achieve your objective – Based on the objective you could have one extra treatment to achieve your objective, or you may need 5+ treatments.

Things to consider:

Understand your insecticide's Mode of Action (MOA)- one of Debug's active ingredients is Azadirachtin, an "unknown" mode of action, but literature supports it acting as an antifeedant and insect growth regulator (IGR).

- Antifeedant: The insect is less likely to feed on the treated crop.
- IGR: The insect will have difficulty molting from one life stage to another and reproductive capacity of adults can also be affected.
    - Consider targeting immature stages for this to be most effective.

Furthermore, Debug products also contain neem oil. Neem oil's MOA is labeled UNE, which is defined by the Insecticide Resistance Action Committee (IRAC) as, "Botanical essence including synthetic, extracts, and unrefined oils with unknown or uncertain MOA". Like Azadirachtin, this is another unknown MOA, but literature supports this compound's ability to suffocate, and damage the cuticle of insects it is applied to.

It is important to understand these MOA's as it will impact how often you collect data. Depending on the target insect, it could take days or weeks to move from one life stage to the next and see an impact on the insect population. Make sure to research the pest's life cycle to best gauge time between molts.

- Recommendation: Sample trials should be set up to collect counts for insects at a minimum of 1, 3, 7, and 14 days after treatment application. **Prior to initiating any trials, it is important to obtain pre-counts of pest pressure. This gives a reference of how crop infestation was impacted by treatments from before and after sprays have been applied.**

Sampling method:

The two common types of sampling methods are trap counts and hand counts. Sticky traps are a very common trapping method in greenhouses and are often used along with hand counts simultaneously. It isn't necessary to do both. It all depends on what works best in your situation. For simplicity we will only discuss how to do hand counts in this guide.

Hand count: Typically used in production settings where walking into/ up to the crop will not disturb the plant and cause insects to leave. This is popular in greenhouse and nursery settings where plants are spaced apart well enough to allow access to the crop canopy to record insect presence.

- To count insects, it is important to standardize counting methods across all treatments and repetitions. For example, you can count insects per leaf, insects per cm^2, average

insects per 3 leaves, etc. However you choose to count does not matter so long as each count is measured the same.
- When hand counting, make sure to handle plants and insects carefully to avoid altering count results. (e.g., insects dropping from crops due to human disturbance).

Measurement of Efficacy:

The counts of insects recorded on each crop will be the data used to measure the insecticides' efficacy. Treatments should be averaged across their 4 replicates to obtain the "representative average insect count" mentioned earlier. The average insect count per treatment will be the value used to compare and determine the success of treatment applications.

Keep in mind:

- If initial insect infestations are low, it will be difficult to determine differences in treatments to draw fair trial conclusions. If infestations are low, it would be recommended to attempt the trial when infestations are higher.
- Always be aware of the weather/climate your trial is being conducted in. For example, if an insecticide application is made and it rains soon after, be aware that results may not be as efficacious as they would be otherwise.
- If results don't seem to make sense at the end, take the time to consider what may have impacted the results.
    - E.g. All plots started with high insect infestations, but by the end of the trial all treatments had a major and similar decrease in populations. While these results are desired for the insecticide treated plots, this is not likely to occur in an untreated control, from a biological standpoint. This situation would create cause for concern in data interpretation and further investigation is needed.