IN-FIELD EVALUATIONS OF NEMATICIDAL COMPOUNDS USING SIMULATED DRIP IRRIGATION

J.W. Noling
University of Florida, IFAS, Citrus Research & Education Center,
Lake Alfred, FL 33850

Drip irrigation delivery of nematicidal compounds is extensively used in Florida to manage plant parasitic nematodes. Complicated delivery manifolds are constructed and compounds are metered into the irrigation system to distribute toxic concentrations to specific plots over long injection periods to maximize soil coverage. In other scenarios, chemigational delivery is made through the grower cooperator's irrigation system at the irrigation well using primitive and or antiquated injection and delivery systems. Even though concerted efforts are made, distributional uniformity of irrigation flow, a measure of how uniformly water (and the chemicals injected into them) is applied to a given cannot be efficiently and adequately characterized in all situations. The distributional uniformity across the field and replicated research plots located within it is therefore always assumed to be within satisfactory range because it cannot be accurately and cheaply characterized. A simpler approach is needed in-field evaluate drip delivery of plant growth and nematicidal compounds.

A simpler approach, simulating drip irrigation delivery, was evaluated in Sting nematode infested fields during 2017 using perforated irrigation spikes threaded to the top of 0.6 l water bottles (Fig. 1). Concentration gradients of different nematicidal compounds were created within replicated water bottles, the spike delivery stake installed and the bottle inverted and pressed 12.7 cm into soil within the strawberry root zone at the base of the plant. In most experiments 6 contiguous plants within the plant row were sequentially treated to expand plot size from individual plants to 6 plant plots. Soil samples for Sting nematode population density determinations were taken prior to drip stake treatment and 8 weeks post treatment. Strawberry plant canopy diameters were measured prior to drip stake treatment in each infested field. The average of two separate bidirectional measurements was permanently recorded to the plastic mulch covering the raised strawberry plant bed so as to provide record of initial canopy size prior to treatment. Plant canopy measurements were reacquired from the same premeasured plants 6 to 8 weeks after drip stake treatment in each field. Positive or negative changes in canopy diameter were compiled from individual plants from each treatment and in each field.

Preliminary tests utilizing water soluble, blue soil staining dyes confirmed the desired vertical and horizontal spread of the water front outward from the single drip emission point on the spiked stake (Figure 2). This evaluation required that the width, depth, and area of soil covered by the drip stake water to be evaluated by digging cross sections across the beds to the depth of the wetting front. Mapped grid coordinates were then field recorded and later entered into the computer to analyze depth, width, and size of treated or dye stained areas relative to the water volume used in the treatment regimes. Subsequent studies with Majestene, Nimitz (Fluensulfone), and metam potassium (Kpam) have been successfully conducted to quantify nematicidal efficacy and crop phytotoxicity of the compounds. Majestene provided no apparent benefit to Sting nematode control or improvement to plant growth and canopy size at any of the rates tested (Figure 2). Metam potassium proved effective for Sting nematode control at concentrations in excess of 500 ppm, and for crop termination at concentrations in excess of 2000 (Figure 3). The new approach simulating drip irrigation delivery has proved to be a very quick and easy system of testing both old and a plethora of new compounds claiming nematicidal activity.

This work also suggests the need for additional, more defining research to quantify the dose response relationship for different nematode species, optimal concentration and injection volume, and to clarify appropriate times within the cropping season in which efficacy and plant growth benefit to infected plants can be effectively achieved. The ability to utilize commercial fields with existing nematode problems is value added in terms of satisfying starting conditions of nematode pressure, monitoring potential crop recovery and for involving grower participation and observation.

KEY POINTS:

- New approach for evaluating and confirming product efficacy and determination of dosing relationships for nematode management.
- Using drip stakes to simulate drip irrigation injection of nematicidal compounds is cheap, easy, simple, safe and an efficient means of product testing!
- Provides New Opportunities to Utilize Infested Fields for Product Testing and Extension Exposure
- Drip stakes can be important as research and extension tools for product testing in commercial grower fields.

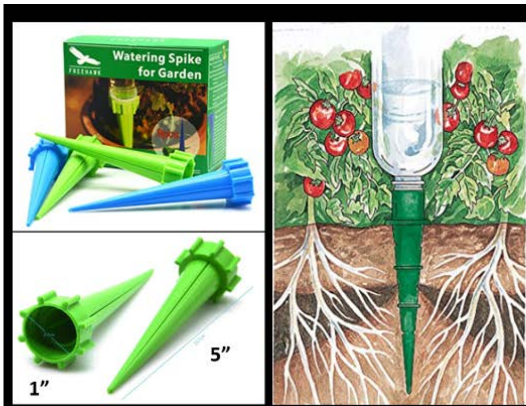


Figure 1. Using Drip Stakes to Simulate Drip Irrigation Injection of Nematicidal Compounds In Nematode infested field
Cheap, Easy, Simple, Safe EFFICIENT!

***Figure 2.** The first step in evaluation process of the drip stakes is to define what is the Treated Zone using a water soluble blue dye mixed into the drip water and measuring stained wetting area after.*

<u>Sequence of events</u>

- ***Drip the Dye***
- ***Cut the X-Section***
- ***Draw to Plexi-Glass***
- ***Transfer to Paper***
- ***Transfer Coordinates to computer***

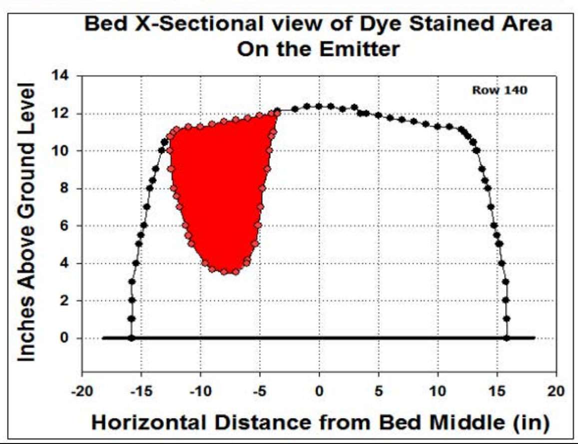
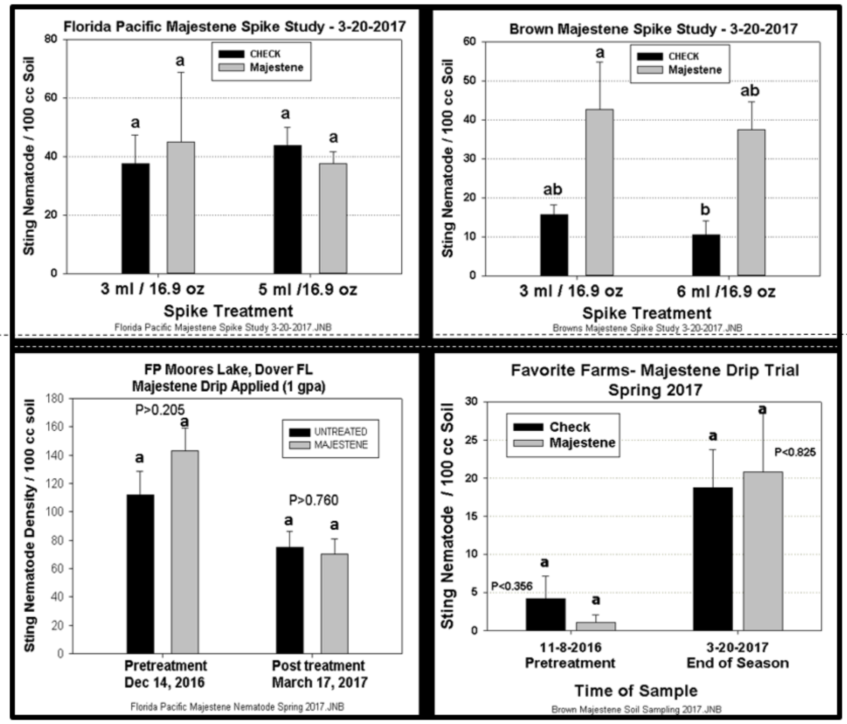


Figure 2. Impacts of the bionematicide Majestene on soil population densities of the Sting Nematode, *Belonolaimus longicaudatus*, measured before and after drip application or drip stake treatment.

Drip SPIKE Applied

DRIP Tape Applied



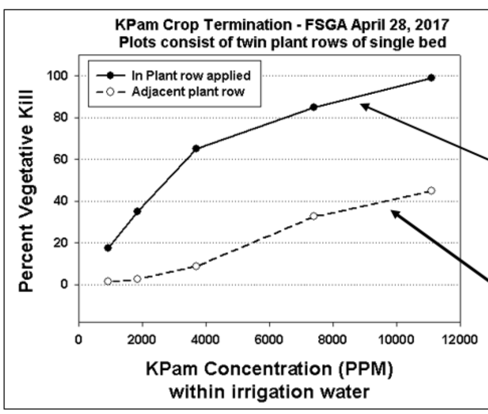
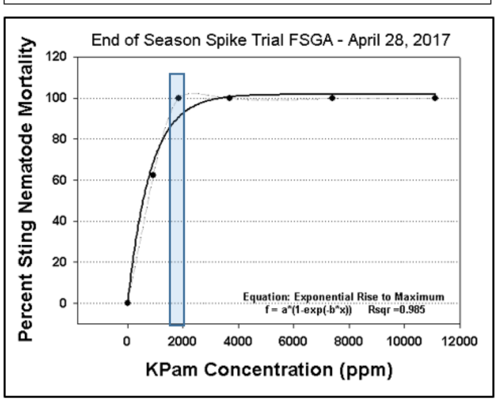


Figure 3. Percent vegetative kill of strawberry plants in-row and adjacent following crop termination treatments with Kpam® drip stake applied (16.9 oz) at various concentrations.

KPam kills more of the row with increasing concentration

and of the adjacent row on the opposite side of the plant bed



1500 - 2000 ppm
Is the effective
Nematicidal Concentration

Closely Corroborates previous studies