IMPACT OF ETHANEDINITRILE APPLIED BY SHANK AND HOT GAS FOR VEGETABLE PRODUCTION

Mary C. Stevens*, Joshua H. Freeman, University of Florida, North Florida Research and Education Center, Quincy, FL, Nathan S. Boyd, University of Florida, Gulf Coast Research and Education Center, Balm, FL

Introduction

The ban on methyl bromide has led to the development and examination of potential fumigants for the control of soil-borne pests such as nematodes, plant pathogens, and weeds, primarily nutsedge species, which can reduce yield in high-value vegetable crops. Initial studies with ethanedinitrile (EDN) have shown promising results in several countries including Australia, Israel, Turkey, and the United States on a wide range of pests. The primary focus of this research was to determine an efficacious use rate and evaluate the performance of EDN against various pests.

Materials and methods

Two experiments were conducted to determine the efficacy of EDN when applied through shank or the hot gas method at various rates. Experiments were conducted at the North Florida Research and Education Center (NFREC) in Quincy, Florida and the Gulf Coast Research and Extension Center (GCREC) in Balm, Florida. Shank applied EDN was deployed with a single row combination bed press with three mole shanks. EDN was delivered 12 inches below the surface of the bed at rates of 300, 400, 500, and 600 lb/a. Beds were immediately covered with Guardian totally impermeable film (TIF). Hot gas treatments were injected directly into 7/8 inch drip tape buried one inch below the soil surface with emitters every 12 inches at rates of 400, 500, and 600 lb/a of EDN. A non-treated control and 250 lb/a of a 39:60 mixture of 1,3-dichloropropene and chloropicrin (Pic-60) were also included under TIF. Pic-60 was delivered through three back-swept shanks with fumigant delivered at 8 inches below the bed surface. Tomatoes were transplanted in the center of each experimental plot. Fruit were weighed and graded based on USDA standards. Nutsedge population data was collected at both sites. Plants that punctured the plastic were counted in the planting area at 30, 60, and 90 days after fumigation (DAF). Nematode data was collected at the NFREC site at 30, 60, and 90 days after transplanting (DAT).

Another experiment was conducted at NFREC to compare the efficacy of EDN to methyl bromide (MB) on nutsedge populations and muskmelon yield. This experiment was conducted in the same manner as the aforementioned studies, with exceptions being fumigant was applied using 2 mole shanks, no hot gas treatments were included, and muskmelon were transplanted. Rates of EDN were 300, 400, 500, and 600 lb/a. Methyl

bromide was applied at 300 lb/a through three back-swept shanks and delivered 8 inches below the bed surface. All treatments were applied under Berry Total Blockade TIF. A non-treated control was also included. Nutsedge data was collected at 30, 60, and 90 DAF and muskmelon was harvested, counted, and weighed at appropriate intervals.

An experiment was established in Levy County, Florida where 300, 400, 500, and 600 lb/a of EDN was shank applied with two mole shanks with fumigant delivered 12 inches below the bed surface. A non-treated control and 250 lb/a of Pic-60 were included and all treatments were covered with Guardian TIF. Pic-60 was delivered through three back-swept shanks with fumigant delivered 8 inches below the bed surface. Watermelon seedlings were transplanted into the center of each experimental plot, however, no yield data was collected. Nutsedge shoots that penetrated the plastic were counted at 30, 60, and 90 DAF in the center of each experimental plot.

Results

Results of the hot gas and shank experiments consistently demonstrated EDN performing well against nutsedge populations when compared to the non-treated control, regardless of application method. While EDN did not out-perform Pic-60, populations were not significantly higher. EDN did have an effect on plant vigor at the NFREC location with 500 and 600 lb/a of EDN for both application methods negatively impacting vigor, however, the effect did not persist all season and did not have an effect on yield, as total yield was not significantly different from those of Pic-60. At the NFREC location, several tomato plants were affected by *Sclerotium rolfsii*, however, there was no significant treatment effect. Nematode data revealed no significant differences in total root knot nematode populations in the soil or found in the roots between the treatments. Root gall index (RGI) at 30 and 60 days after transplanting had no significant difference. 90 days after transplanting, hot gas treatments resulted in significantly higher RGI than 600, 400, and 300 lb/a EDN shank treatments. Only 400 and 500 lb/a EDN hot gas resulted in significantly higher RGI than the control.

In the EDN and MB comparison experiment at NFREC, no vigor differences were observed. Nutsedge populations in the MB treated plots were significantly lower than the non-treated control at all evaluation dates. 30 DAF, only 400 lb/a EDN and 300 lb/a MB had nutsedge populations lower than the non-treated control, with 400 and 500 lb/a having populations similar to MB. At 60 DAF, nutsedge populations for 300, 400, and 500 lb/a EDN were similar to MB, however, 300 lb/a was not different than the non-treated control. By 90 DAF, 300, 400, 500, and 600 lb/a EDN had nutsedge populations similar to both MB and the non-treated control, with MB being the only treatment significantly different from the non-treated control. It is unclear why 600 lb/a EDN did not control nutsedge populations better than the non-treated control at any time.

The Levy County, Florida results indicated that EDN controlled nutsedge as well as Pic-Clor 60, with all treatments performing better than the non-treated control. No differences in plant vigor were observed.

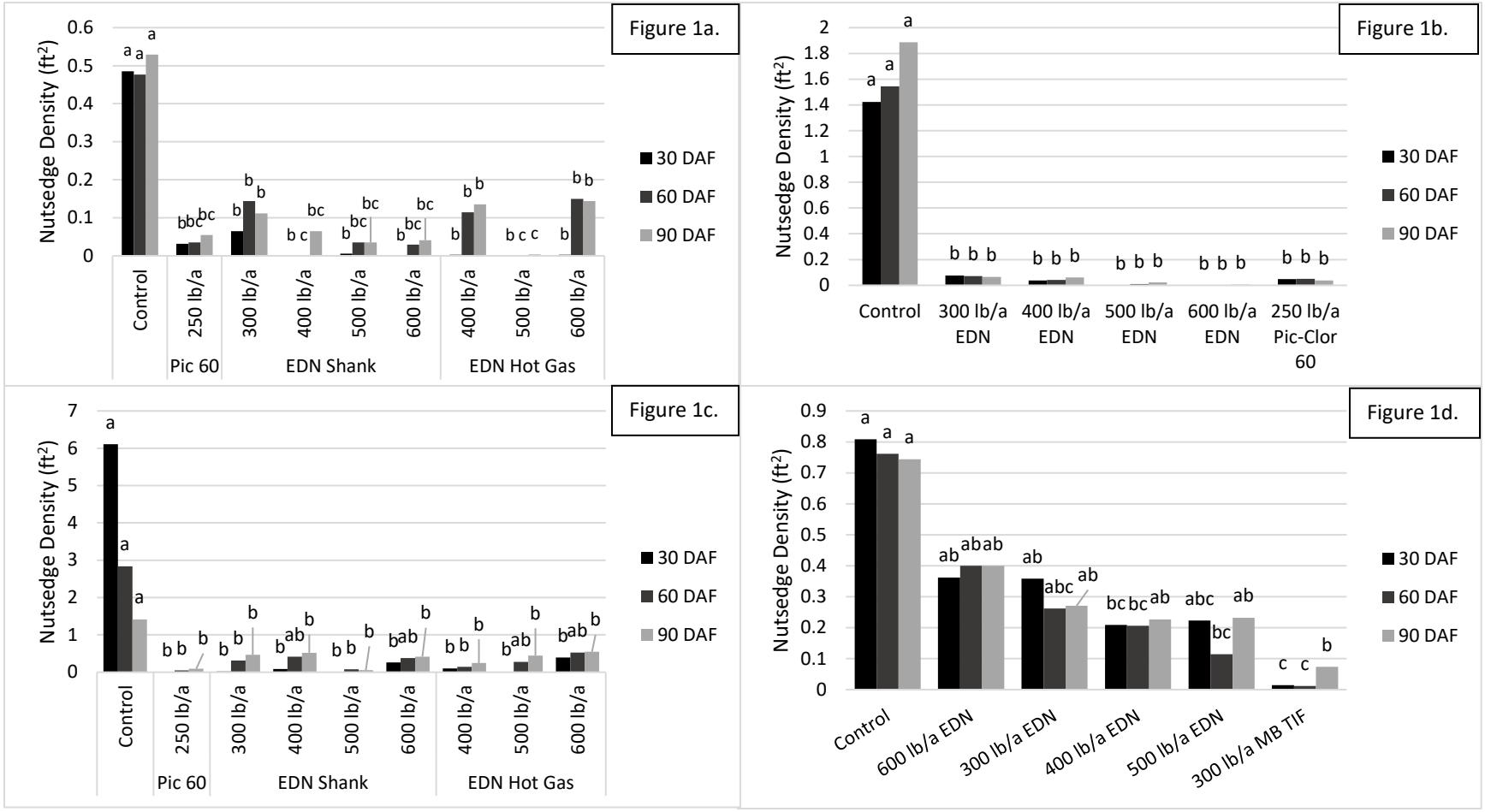

Figure 1a. Control of nutsedge by EDN at various rates and application methods at NFREC in spring 2017. Means followed by the same letter are not significantly different at P<0.05 by least significant difference. Means are compared within the same day. Figure 1b. Control of nutsedge by EDN in Levy County, Florida in spring 2017. Means followed by the same letter are not significantly different at P<0.05 by least significant difference. Means are compared within the same day. Figure 1c. Control of nutsedge by EDN at various rates and application methods at GCREC in spring 2017. Means followed by the same letter are not significantly different at P<0.05 by least significant difference. Means are compared within the same day. Figure 1d. Control of nutsedge by EDN versus a single rate of MB at NFREC in spring 2017. Means followed by the same letter are not significantly different at P<0.05 by least significant difference. Means are compared within the same day.