EVALUATION OF NON-FUMIGANT BASED AND DRIP APPLIED NEMATICIDES TO MANAGE ROOT-KNOT NEMATODE (*MELOIDOGYNE SPP.*) ON YELLOW SQUASH.

James G. Driver and Frank J. Louws.
Department of Plant Pathology. North Carolina State University. Raleigh, NC 27525

INTRODUCTION: With the phaseout of methyl bromide, according to the Montreal Protocol, growers have been searching for alternative measures to control weeds, soilborne pathogens, and nematodes in vegetables grown on plastic mulch. Alternative fumigants have been used successfully when combined in a system, but buffer restrictions and rising costs limit their use. Non-fumigant fungicides and nematicides do not have buffer restrictions may expand useable acreage for growers. Vydate® (oxamyl) can be used as a soil or foliar treatment for nematode suppression. MCW-2 is a new product that can be applied through drip applications, similarly to Vydate®. The goal of this trial was to evaluate the use of MCW-2 and other products that can be applied through drip application as an alternative to soil fumigation.

Materials and Methods: The experiment was established at the Horticultural Crops Research Station (Clinton, NC) in a field with a history of root knot nematode (*M. incognita).* Telone II (1,3-dichloropropene) was shank applied 11 Jun at a broadcast rate of 12.0 gal/acre. On 3 Jul, pre-plant drip applications were made with 2 drip tapes to provide adequate coverage of the product. Post-plant drip applications were made 30 Jul following application schedule 4 (see table below). Plots consisted of one row, 20 ft long, 30 in bed width, 6 in tall, spaced on 5 ft centers. Soil cores were collected from each plot to assess nematode population levels at pre-plant and trial termination (10 Sep). The trial was planted on 7 Jul and plants were thinned to one plant per hole on 23 Jul. Each plot had a final plant stand of 20 plants. The experiment was set up as a RCBD with five replications. The treatments are listed in the table below (Table 1). Plants were sampled bi-weekly and rated for plot vigor (Plot Vigor Index: 1= Excellent plant vigor – 5= poor vigor) and root galling severity (Gall Index: 0= No galls – 10= 100% galled). Plants were collected 23 Jul, 6 Aug, 18 Aug and 1 Sep. Fruit were harvested 12 Aug, 18 Aug, 25 Aug, 1 Sep, and 10 Sep. All fruit were graded and fruit number and weight were recorded. Data were analyzed using ANOVA and a mean separation test was carried out by using an F-protected least significance test ($a = 0.05$).

RESULTS: Overall galling severity was low compared to previous years. The UTC consistently had higher galling severity and Telone II limited severity to near zero for the first three observation dates (Fig 1A). The majority of nematicide treatments resulted in modest plant vigor compared to the negative control and Telone II (Fig 1B). The drip applied nematicides had intermediate

vigor, with the exception of the 4.17 l/ha rate treatment which had poor vigor . The UTC had the lowest overall vigor and Telone II tended to have the most vigorous plants. The area under disease progress curves (AUDPC) were calculated, integrating the data from the disease progress curves (Fig 1C). AUDPC values were calculated based on the square root transformation values of the galling index values. The untreated control (UTC) had the highest overall severity of galling and was statistically greater than all other treatments except the MCW-2 applied at 4.17 l/ha (Fig 1A/C). All MCW-2 rates and application sequences were similar to each other; there did not appear to be a rate response nor a beneficial response with the combination of a pre and post application. Vydate treatments limited gall severity similarly to the MCW-2 treatments. Telone II applied as a preplant fumigant suppressed galling the most and was similar to the MCW-2 6.25 l/ha rate and Vydate when applied as a pre and post plant sequence. (Fig 2D). Total number of fruit, total fruit weight, marketable fruit values, percent marketable fruit and average fruit weight were not impacted by nematicide treatments (data not shown). The density of root knot populations in the soil were dramatically impacted by treatments as sampled at the end of the season (Fig 1D). Repeated applications of Vydate and selected MCW-2 treatments suppressed high populations comparable to the Telone II treatment and significantly lower the negative control.

CONCLUSIONS and DISCUSSION: MCW-2 (thiazosulfene) provided similar levels of control to Vydate and specific combinations offered similar efficacy as Telone II. The combined use of pre- and post-applications of MCW-2 provided the highest plant vigor and greatest number of harvestable fruit, though these values were not significantly different than the other MCW-2 treatments. There did not appear to be a rate response to MCW-2 as all rates of the product were equally effective at reducing RKN galling index. Adequate distribution of MCW-2, especially in sandy soils, will be an important consideration for maximum efficacy.

North Carolina with a farm gate value of approximately $458 million annually. Fresh market vegetable production in North Carolina has greatly benefited from the development of a raised bed, plastic mulch vegetable production system (plasticulture). Plasticulture in North Carolina depends heavily on the use of methyl bromide fumigation to manage the multitude of pests that are associated with the subtropical climate. Among the most troublesome pests in plasticulture-grown vegetables are the root-knot nematodes, purple and yellow nutsedges, *Phytophthora capsici* and other soilborne pathogens. With the continuing phase-out of methyl bromide from use in vegetable production worldwide, intensive efforts have been made to develop methyl bromide alternatives. Alternative fumigants may provide some level of control of nematodes, diseases and weeds when combined in a system, but buffer restrictions and rising costs limit their use. Using non-fumigant pesticides eliminates buffer restrictions and potentially reduces input costs compared with fumigants. Non-fumigant nematicides, fungicides and herbicides do provide good suppression of nematodes, soilborne

pathogens and weeds, but their efficacy has not been compared directly to fumigants extensively. In this project, a newly available and promising non-fumigant nematicide was evaluated, in comparison to 1,3-dichloropropene a standard soil fumigant, to develop alternative approaches for control of root-knot nematodes in vegetable production. The long-term goal of the project is to develop an integrated system for the management of root knot nematodes of plasticulture-produced vegetables using IPM-based tactics and multiple tools that may be available to growers.

Table 1: Treatment list:

Trt #	Treatment	Rates/A	Appl. Timing	Code Number
1	MCW-2	2.08 L/Ha	Pre-plant	3
2	MCW-2	4.17 L/Ha	Pre-plant	3
3	MCW-2	6.25 L/Ha	Pre-plant	3
4	MCW-2	8.33 L/Ha	Pre-plant	3
5	MCW-2	8.33 L/Ha + 4.17 L/Ha	Pre-plant/ Post plant	4
6	Vydate 2L	8.0 pt	Pre-plant	3
7	Vydate 2L	8.0 pt + 4.0 pt	Pre + Post-plant	4
8	Telone II	12 Gal/A	Pre-plant	2
9	UTC	- - -	- - -	1

CODE:
1= Untreated check.
2= Standard pre-plant application of Telone II, 12 Gal/A (brdct).
3= Pre-plant drip application 4-7 days prior to transplanting.
4= Pre-plant drip application 4-7 days prior to transplanting, followed by drip irrigation application @ 28-days.

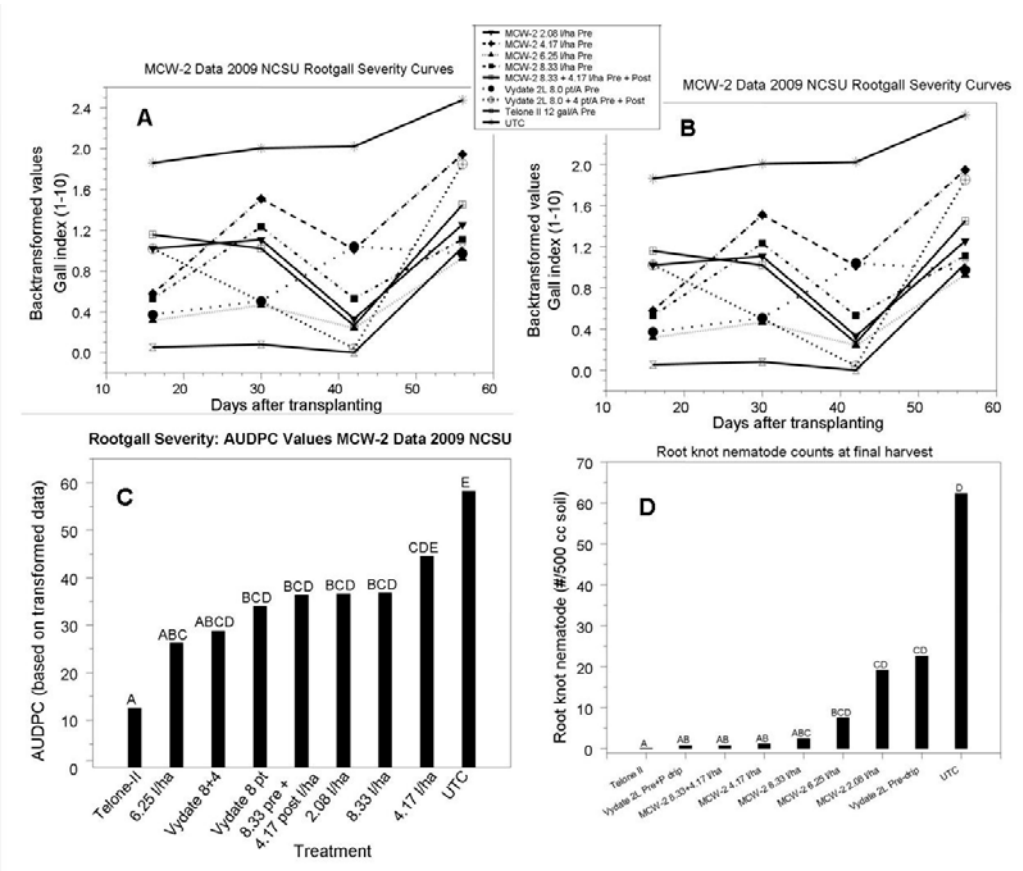

Figure 1: A) Root gall incidence over time; B) Plant vigor over time; C) Area under disease progress curves integrated over time; D) Final root knot nematode counts resident in soils at the end of the season.

ACKNOWLEDGMENTS:

- MANA Crop Protection, 4515 Falls of the Neuse Road, Suite 300, Raleigh, NC 27609.
- Reddick Fumigants, LLC; President/Sales Manager, Victor Lilley, 3002 W. Main St., Williamston, NC 27892.
- Horticultural Crops Research Station (NCDA&CS); Superintendent Rodney Mozingo and Station Staff, 4250 Faison Highway, Clinton NC, 28328-9501.
- Cary Rivard, Graduate Research Assistant, N.C. State University, Department Plant Pathology, Raleigh NC, 27695.
- Mike Carnes, Research Assistant, N.C. State University, Department Plant Pathology, Raleigh NC, 27695.