TIMING OF TRAP CROP DESTRUCTION FOR ROOT-KNOT NEMATODE MANAGEMENT ON CARROTS

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Trap cropping is a nematode management technique that has been tested periodically since the late 1800's. A susceptible host is planted and larvae of a sedentary parasitic nematode such as root-knot are induced to enter and establish a feeding site. Once this has occurred, and the female begins to mature, she is unable to leave the root. The plants are then destroyed before the life cycle of the nematode can be completed, trapping nematodes within the root. By itself, trap cropping is not likely to provide the same level of control as a chemical nematicide such as Telone II, because not all nematodes are induced to enter the roots. However, the potential for loss of registration of this and other chemical nematicides for various environmental reasons is great enough that an IPM approach using two or more techniques in combination, that will each provide partial control of the nematode population is warranted.

Two field trials utilizing carrots (*Daucus carota* subsp. *sativus*) as an indicator crop for root-knot nematode damage to vegetables were conducted at the University of California South Coast Research and Extension Center in Orange County, CA, U.S.A. in a field with an established population of root-knot nematode (*Meloidogyne javanica*). Each trial had 20-treatments, and each treatment consisted of five replicates in a randomized complete block design. Single row plots were 4.3-meters long plus a 0.91-meter buffer on either end, and 0.76-meters wide. The field location had a loam soil (66% sand, 21% silt, 13% clay and 0.6% stable organic matter) with a pH of 7.6 and a CEC of 0.68 milimhos^{-1}. The previous crop was sugarbeets (*Beta vulgaris*).

Treatments were either carrots planted as a trap crop, wet fallow as a trap crop (consisting of irrigation to germinate weeds naturally present in the field), dry fallow (an untreated control that did not receive irrigation), or standard chemical 1,3-Dichloropropene (1,3-D, Telone II, Dow Agrosciences, Indianapolis, IN) at 84.2 L ha^{-1}. Trap crops were terminated at three or four weeks following planting in the first trial, or two or three weeks following planting in the second trial. The crops were terminated either by tillage, by an application of Glyphosate (Roundup Herbicide, Monsanto, St. Louis, MO), or both. Six treatments in which Glyphosate was applied at 3 weeks after planting were the same in both trials. Two additional treatments: Carrot + tillage3 and Carrot + tillage3 + DiTera were also included in both trials. Following termination of the trap crops, all treatments were planted to carrots. Some of the treatments were treated at planting with a biological nematicide DiTera (*Myrothecium verrucaria*, Valent, Libertyville, IL) at 56 kg ha^{-1}. In both trials, 1,3-D was applied the same day the trap crops were

planted. Seeded plots and wet fallow treatments were watered daily or every other day as needed to maintain required moisture for germination and growth.

In the first trial, no treatments had a greater percentage of marketable carrots based on either number or weight of carrots. Based on number of carrots, increases over Untreated ranged from 2.1 to 15.5 percent for trap crop treatments compared to 16.6 percent for the standard chemical treatment. Based on weight of carrots, increases over Untreated ranged from 0.2 to 4.4 percent compared to 11.7 percent for the standard treatment. At *P=0.05*, all treatments had fewer root-knot nematode juveniles in soil at harvest than Untreated. Reductions in the number of root-knot juveniles in soil at harvest for trap crop treatments ranged from 33.3 to 89.6 percent compared to 93.6 percent for the standard chemical treatment.

In the second trial, at *P=0.05*, all treatments except Wet fallow + Glyphosate3, Carrot + Glyphosate3, Carrot + Glyphosate3 + tillage4 + DiTera, Carrot + tillage2, and Carrot + tillage2 + DiTera had a greater percentage of marketable carrots based on number than Untreated. At *P=0.05*, all treatments except Carrot + Glyphosate3 + tillage4 + DiTera and Carrot + tillage2 had a greater percentage of marketable carrots based on weight than Untreated. At *P=0.05*, all treatments except Dry fallow + tillage3 + DiTera, Wet fallow + Glyphosate2 + tillage3, Wet fallow + Glyphosate2 + tillage3 + DiTera, Wet fallow + Glyphosate3, and Carrot + Glyphosate2 + DiTera had fewer root-knot juveniles in soil at harvest than Untreated. Based on number of carrots, increases over Untreated ranged from 6.1 to 27.8 percent for trap crop treatments compared to 45.0% for the standard chemical treatment. Based on weight of carrots, increases over Untreated ranged from 13.1 to 59.7 percent compared to 57.1 percent for the standard treatment. Reductions in the number of root-knot juveniles in soil at harvest for trap crop treatments ranged from 31.2 to 89.3 percent compared to 96.8 percent for the standard chemical treatment.

The timing of crop termination is critical for the success of trap cropping. Nematodes develop more rapidly in warmer than in cooler soil. Therefore, a warmer carrot growing area would require earlier trap crop termination for successful nematode control than a cooler area. Root-knot nematode requires approximately 600 degree-days over 10C to complete one generation. Based on soil temperature data collected at a CIMIS weather station located on the research station, for the two years during which the trials were conducted, degree day accumulation varied by only a few degrees each week while the trap crops were in the ground: Week 2 (242 in Trial 1 vs 244 Trial 2), Week 3 (360 vs 366), Week 4 (482 vs 489), and Week 5 (608 vs 611). Following planting of the final carrot crop, degree-day accumulation from planting to harvest was greater for the first trial (2,321), than for the second trial (1,591). This difference in degree-day accumulation would account for approximately 1.2 more generations in the first trial. Root-knot nematode populations have been shown to increase at an exponential rate during a growing season, and this difference in number of generations helps to explain the relatively large differences in final populations between the two trials.