MANAGEMENT OF ROOT-KNOT NEMATODES ON CARROTS

Becky B. Westerdahl, University of California, Davis, CA 95616
Joe Nunez, University of California Cooperative Extension, Bakersfield, CA 93307
John D. Radewald, University of California, Riverside, CA 92521

Root-knot nematodes (*Meloidogyne* sp.) are widely distributed throughout California and are the most important nematode pest of carrot (*Dacus carotae).* In addition, stubby root nematode (*Paratrichdorus* sp.) is found statewide, often in association with root-knot nematode, and needle nematode (*Longidorus africanus*) is important in the Imperial Valley. Current control methodology relies on the use of Metam sodium and Telone II. Metam sodium, for example, was used on 33% of California's carrot acreage in 1997 and Telone II was used on 10%. Although Methyl bromide is no longer registered on carrots, it was used on 1% of California's carrot acreage in 1997.

Materials and Methods: In 2004, a trial was established at the UC Shafter Research and Extension Center (SREC) in Kern County in a field with a history of root-knot nematode (*Meloidogyne incognita*). The previous crop was cotton (*Gossypium hirsutum*). An additional trial was established at the UC South Coast Research and Extension Center (SCREC) in Orange County in a field with an established population of root-knot nematode (*Meloidogyne javanica*). The previous crop was sugarbeets (*Beta vulgaris*).

The trial at SREC consisted of 14 treatments including an untreated control and a Telone II injection treatment as standards of comparison. The additional products tested included Quillaja 35% (an extract of the Soap Bark tree), DiTera DF, Mustard Bran, and Meadowfoam seedmeal alone and in various combinations. Telone II was applied on April 27, 2004. On May 4, 2004, Quillaja 35% was applied at 6.75 gpa followed by sprinkler irrigation. On May 20, 2004, at planting applications of Quillaja 35%, DiTera DF, Mustard Bran, and Meadowfoam seedmeal were conducted followed by sprinkler irrigation. On June 15, 2004 an additional Quillaja 35% application was applied to some treatments followed by sprinkler irrigation. The trial was planted on May 20, 2004 and harvested on December 3, 2004.

The trial at SCREC consisted of 14 treatments including an untreated control and a Telone II injection treatment as standards of comparison. The additional treatments included Quillaja 35% alone and in combination with Meadowfoam seedmeal or Agri-Mek, Meadowfoam seedmeal, Agri-Mek, Agent 2B alone or in combination with Chloropicrin, and Methyl Iodide plus Chloropicrin.

Telone II was injected on June 30, 2004. Also on June 30, 2004, Metam Sodium was applied as a spray followed by a water seal. On July 1, 2004 there were drip irrigation application of Methyl Iodide plus Chloropicrin and Agent 2B with and without Chloropicrin. At planting on July 14, 2004, Quillaja 35% and Agri-Mek were applied as a spray in 2 liters of water per replicate, followed by irrigation, and Meadowfoam seedmeal was sprinkled on plots, followed by irrigation. Carrots were planted on July 14, 2004, and harvested on November 15, 2004.

In both trials, each treatment consisted of 5 replicates in a randomized complete block design. Single row plots were 14 feet long plus a 3 foot buffer on either end. Products were applied according to manufacturer's directions. Trials were sampled for nematodes preplant to establish the level of the population, and at harvest. Soil samples consist of 12, 1-inch diameter cores per replicate to a 12 inch depth. The soil type at SREC was a loamy sand, and at SCREC was a loam. Nematode extraction is by elutriation followed by sugar centrifugation. Harvested carrots are graded into 4 categories: 1) marketable without nematode damage, 2) marketable with nematode damage, 3) not marketable with nematode damage, and 4) not marketable without nematode damage. Carrots in each category are counted and weighed. For data analysis, categories 1 and 2 are combined to determine marketable carrots. Data were analyzed with Analysis of Variance (ANOVA) followed by Fisher's Least Significant Difference Test. Percent values were arcsin transformed prior to analysis.

Results and Discussion: In the trial at SREC, the DiTera DF treatment at 25 lb/acre was the only treatment to produce a greater number and weight of marketable carrots without nematode damage than the untreated (P = 0.05). The Quillaja 35% at 1.25 gpa plus DiTera DF at 25 lb/acre treatment produced a greater number of marketable carrots (P = 0.10) than the untreated. The mustard bran treatment and the Quillaja 35% at 1.25 gpa applied at planting plus 4 weeks after planting treatment produced a greater weight of marketable carrots (P = 0.05) than the untreated. At P = 0.10, the two Quillaja 35% plus DiTera treatments produced a greater weight of marketable carrots than the untreated. The meadowfoam treatment had a greater total number of carrots that the untreated (P = 0.05). The percent marketable carrots based on weight was greater for the low rate of Quillaja 35% plus DiTera DF than for the untreated (P = 0.05). At harvest, there were no differences in the numbers of root-knot nematode.

In the trial at SCREC, only the Methyl Iodide plus Chloropicrin treatment produced a greater number and greater weight of carrots without nematode damage that the untreated (P = 0.05). The three treatments with Agent 2B, the two treatments with Methyl Iodide, and Telone II, produced a greater number of marketable carrots than the untreated (P = 0.05). At P = 0.10, the Quillaja 35% plus Meadowfoam treatment also produced a greater number of marketable carrots than the untreated. At P = 0.05, only the low rate of Agent 2B, and the high rate of Methyl Iodide produced a greater weight of marketable carrots than the untreated. Quillaja 35% at 6.25 gpa, Metam Sodium, the low rate of Agent 2B, Agent 2B plus Chloropicrin, and the low rate of Methyl Iodide produced a greater total number of carrots than the untreated (P = 0.05). At P = 0.10, the high rates of Agent 2B and Methyl Iodide, and Telone II produced a greater number of marketable carrots than the untreated. The three Agent 2B treatments, the two rates of Methyl Iodide, and Telone II all produced a greater total weight of carrots than the untreated (P = 0.05). Percent marketable carrots based on number of carrots was greater than the untreated for Quillaja 35% plus Meadowfoam (P = 0.05). The number of root-knot juveniles in the soil at harvest was lower than the untreated for the two Methyl Iodide treatments and for Telone II (P = 0.05). At P = 0.10, nematode levels were also lower than the untreated for Agent 2B plus Chloropicrin. Several of the new products tested in 2004 show promise for use in managing nematodes on carrots and should receive further evaluation. Additional trials are planned for 2005. Several potential new products are already available for testing.