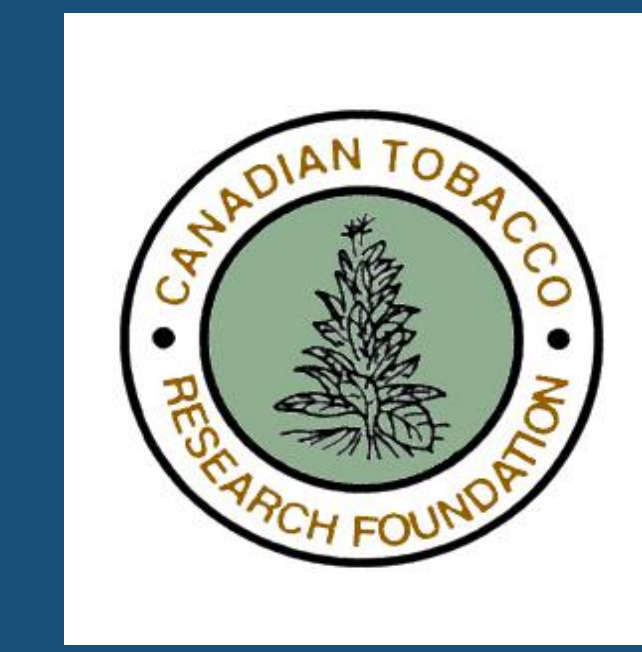


# Evaluation of MCW-2 (fluensulfone) as a nematicide in flue-cured tobacco production

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## Abstract

Field trials were conducted in 2012-2014 to evaluate the effects of three rates (1, 2 and 4 kg a.i./ha) of MCW-2 (a.i. fluensulfone) on plant growth and yield, and populations of Root-Lesion (RLN) (*Pratylenchus penetrans*) and Stunt (*Tylenchorhynchus* spp.) nematodes. The effectiveness of these treatments was compared to plants grown without soil fumigation and with soil fumigation using Chloropicrin 100 (a.i. chloropicrin 99.0%). The trials were conducted in fields with a history of high nematode populations. The flue-cured tobacco cultivar CT157 was used each year in the trials. The MCW-2 treatments were applied to the soil surface and incorporated to a 10-cm depth with a roto-tiller prior to transplanting. Precipitation occurred within 72 hours after MCW-2 incorporation. Combined data over the three years indicated that treatments did not have significant effects on topping height, leaf number at topping and eighth leaf width. The eighth leaf length, tip leaf measurements and bud percentage, were the highest for the Chloropicrin 100 treatment and similar among the MCW-2 treatments and the non-fumigated control. The eighth leaf area for the Chloropicrin 100 and the MCW-2, 1 and 4 kg a.i./ha treatments, were also similar. Yield, as plant dry weight, of the Chloropicrin 100 treatment was significantly greater than all other treatments. Yields for all MCW-2 treatments and the non-fumigated control were similar. RLN numbers were not affected by treatments, although for Chloropicrin 100, a slight decrease in RLN numbers was found for the mid-season assessment, and a slight increase in the RLN late-season counts. Chloropicrin 100 lowered mid-season numbers of combined RLN and Stunt nematodes. These results indicate that overall, the MCW-2 in the manner and rates used, was ineffective at altering numbers of soil nematodes and in enhancing plant growth and yield.



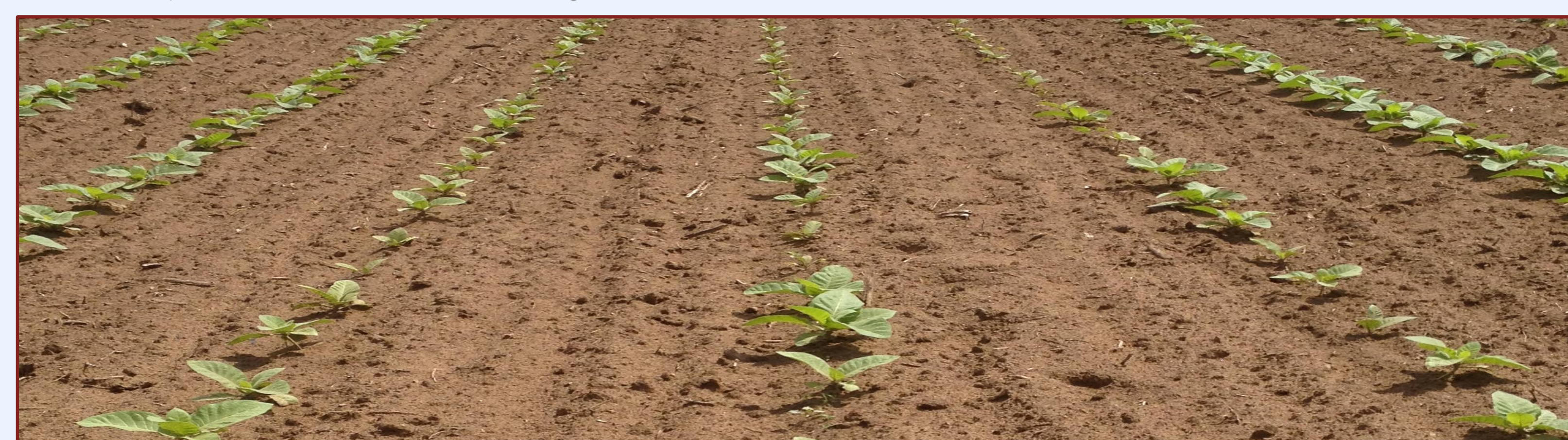
Figure 1. Stunted tobacco plants with chlorotic lower leaves (a) and roots with brown lesions (b) caused by Root-Lesion nematode (c) feeding.

## Objectives

- To evaluate the efficacy of three rates of MCW-2 in controlling soil-borne nematodes
- To determine if any of the MCW-2 rates would affect soil-borne nematodes, plant growth and yield of tobacco

## Materials and Methods

**Field trials.** Trials were conducted from 2012 to 2014 on a farm near Aylmer, ON, and the flue-cured tobacco cultivar CT157 was used. Tobacco seedlings were transplanted on May 30 (2012), June 7 (2013) and June 5 (2014) using a Powell planter. Treatments were: 1) no fumigation; 2) fumigation with Chloropicrin 100; 3) incorporation of MCW-2 into the field soil at a rate of 1 kg a.i./ha (non-fumigated plots); 4) incorporation of MCW-2 into the field soil at a rate of 2 kg a.i./ha (non-fumigated plots); and 5) incorporation of MCW-2 into the field soil at a rate of 4 kg a.i./ha (non-fumigated plots). All MCW-2 rates were incorporated into the soil at least three days before transplanting.



**Treatment application.** The MCW-2 treatments were applied using a CO<sub>2</sub> backpack sprayer equipped with one TeeJet 8004 VS nozzle, calibrated to deliver 300 L/ha at 32 psi. The MCW-2 treatments were applied on May 25 (2012), May 24 (2013) and June 2 (2014). Each MCW-2 treatment was sprayed in a 40 cm wide band ovetop of the row and incorporated to a depth of 10 cm with the aid of a roto-tiller immediately after spraying. For all trial years, a considerable amount of precipitation fell within 72 hours after the MCW-2 incorporation, which helped move the product further into the soil.

Table 1. 2012-2014 Treatment effects on topping height and leaf number at topping

Treatment	Topping Height (cm)	Leaf Number
Non-Treated Control	97.3	18.1
Chloropicrin 100	113.1	18.8
MCW-2 1 kg a.i./ha	104.0	18.8
MCW-2 2 kg a.i./ha	100.0	18.8
MCW-2 4 kg a.i./ha	101.0	18.7
<i>P-Value</i>	0.063	0.445



Numbers in a column followed by the same letter are not significantly different at  $P = 0.05$ , Tukey's b HSD

**Experimental design and assessments.** Plots consisted of two rows of plants, each 8 m (26') in length with a 1.168 m (46") between row spacing and a between plant spacing of 51-56 cm (20-22"). A randomized complete block design with four replicates of the treatments was used. Soil samples for nematode evaluation were collected in May or June, July and September each year and nematode extraction and counts were per the Baerman Pan method. Plants were measured for growth periodically during the season.

Table 2. 2012-2014 Treatment effects on the eighth and tip leaf measurements.

Treatment	Eighth Leaf Measurements			Tip Leaf Measurements		
	Length (cm)	Width (cm)	Area (cm <sup>2</sup> )	Length (cm)	Width (cm)	Area (cm <sup>2</sup> )
Non-Treated Control	56.6 b	30.1	1178 b	51.2 b	22.0 b	793 b
Chloropicrin 100	65.1 a	33.1	1463 a	59.8 a	26.7 a	1091 a
MCW-2 1 kg a.i./ha	59.3 b	31.6	1276 a	52.0 b	22.6 b	823 b
MCW-2 2 kg a.i./ha	58.3 b	30.7	1216 b	51.6 b	22.3 b	803 b
MCW-2 4 kg a.i./ha	59.4 b	31.7	1292 a	53.2 b	22.9 b	853 b
<i>P-Value</i>	0.002	0.127	0.008	0.000	0.000	0.000

Numbers in a column followed by the same letter are not significantly different at  $P = 0.05$ , Tukey's b HSD

The plots were harvested by hand four times each year and the fresh weights (i.e. the "green" weight) of the harvested leaves were determined. Sub-samples of the harvested material from each plot were dried to determine an estimate of the potential cured leaf weight. Cured leaf grades were not determined. Data were analyzed using Systat V13 and means separation was obtained using Tukey's HSD test at  $P = 0.05$  significance level.

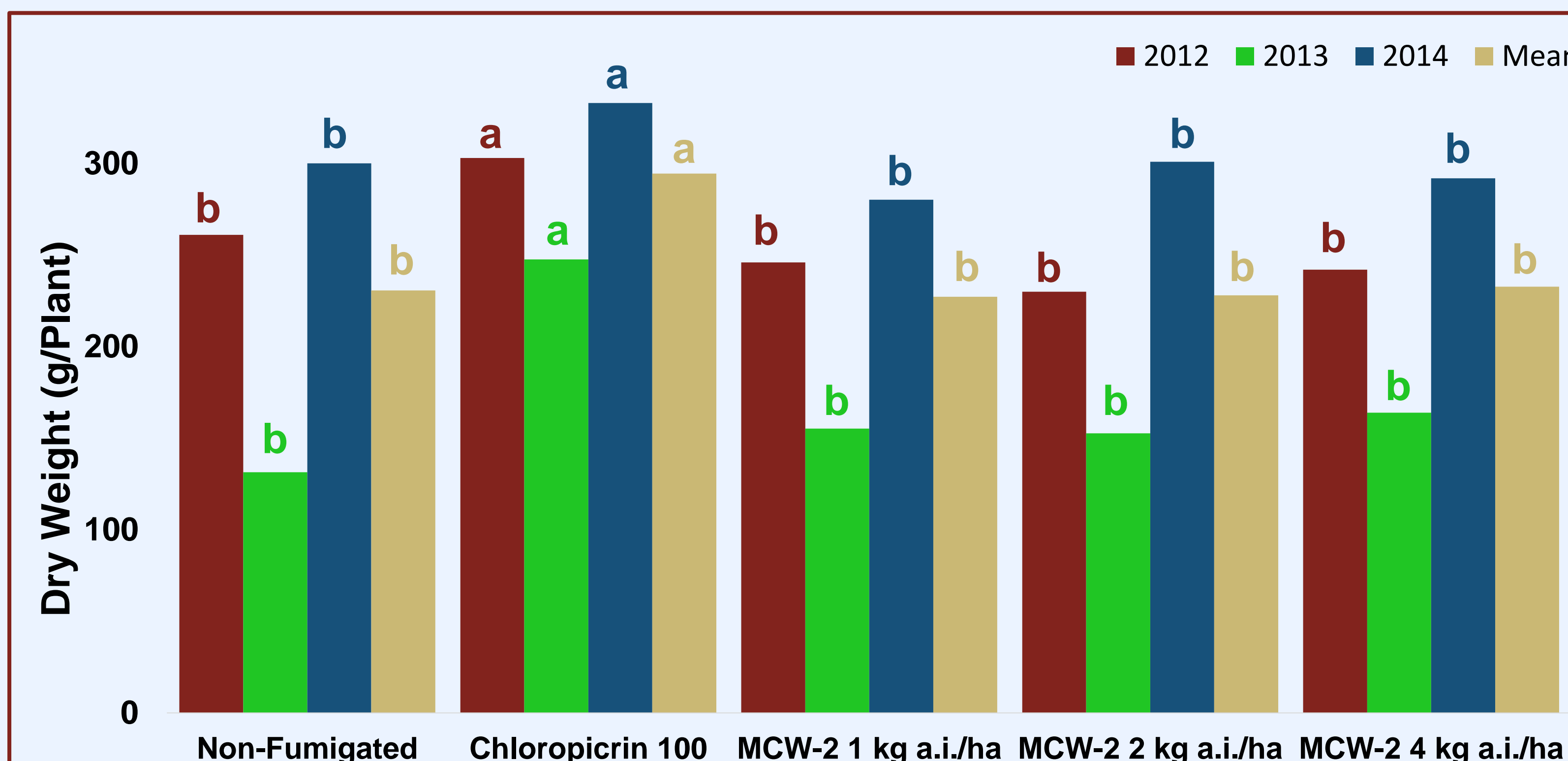


Figure 2. The effect of MCW-2 treatments on dry weight of the flue-cured tobacco CT157 evaluated in 2012-2014. Same colour columns with the same letter are not significantly different at  $P = 0.05$  HSD

## Results and Discussion

The treatment x year interaction of all parameters evaluated was not significant; therefore, the three year data are averaged. Treatments had similar effect on topping height and leaf number (Table 1). The eighth leaf length, the tip leaf length, width and area, were significantly greater for the Chloropicrin 100 treatment and similar for all MCW-2 treatments (Table 2). There were no significant differences in the eighth leaf area between the Chloropicrin 100, MCW-2 1 kg a.i./ha and MCW-2 4 kg a.i./ha treatments. The yields of the dry tissue per plant were significantly higher for the Chloropicrin 100 treatment (Figure 2). There were no significant differences in mean yield between the MCW-2 treatments and the non-fumigated control. However, the mean yield per plant for the non-fumigated control was slightly higher than for the MCW-2 1 kg a.i./ha and the MCW-2 2 kg a.i./ha treatments.

Table 3. 2012-2014 Analysis of Root-Lesion and Stunt nematode numbers (kg/soil) by sampling time.

	Root- Lesion	Stunt Nematode	Total
<b>Early-season</b>			
<b>Treatment</b>			
Non-Fumigated Control	317	60	378
Chloropicrin 100	196	65	266
MCW-2 1 kg a.i./ha	298	80	364
MCW-2 2 kg a.i./ha	318	60	437
MCW-2 4 kg a.i./ha	283	57	340
<i>P-Value</i>	0.326	0.936	0.339
<b>Mid-season</b>			
Non-Fumigated Control	177	123 b	300 b
Chloropicrin 100	95	15 a	110 a
MCW-2 1 kg a.i./ha	172	118 b	290 b
MCW-2 2 kg a.i./ha	123	105 b	228 b
MCW-2 4 kg a.i./ha	198	122 b	320 b
<i>P-Value</i>	0.074	0.019	0.010
<b>Late-season</b>			
Non-Fumigated Control	262	222	483
Chloropicrin 100	354	73	478
MCW-2 1 kg a.i./ha	253	222	432
MCW-2 2 kg a.i./ha	245	198	443
MCW-2 4 kg a.i./ha	232	195	427
<i>P-Value</i>	0.167	0.121	0.952

Numbers in a column followed by the same letter are not significantly different at  $P = 0.05$ , Tukey's b HSD

The application of MCW-2 from 1 to 4 kg a.i./ha did not affect the number of RLN when compared to the Chloropicrin 100 and non-fumigated control treatments (Table 3). However, mid-season evaluations showed a slight reduction in RLN numbers and an increase in the late-season assessment. Chloropicrin 100 significantly reduced mid-season counts of Stunt and combined RLN and Stunt nematode counts.

## Conclusions

- Treatments did not have significant effects on topping height, leaf number at topping and eighth leaf width.
- Eighth leaf length and tip leaf measurements were higher for Chloropicrin 100, and similar for all MCW-2 treatments and the non-fumigated control.
- Plant dry weight (yield) of the Chloropicrin 100 treatment was higher than all other treatments, and similar for all MCW-2 treatments and the non-fumigated control.
- Root-Lesion nematode numbers were not affected by treatments.
- Overall the MCW-2 in the manner and rates used, was ineffective at altering numbers of soil nematodes and was not comparable to Chloropicrin 100.