

National Watermelon Association Research Report 2010

Title: Evaluation of resistant rootstocks for managing root-knot nematodes in grafted watermelons

Principle investigators

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The southern root-knot nematode (*Meloidogyne incognita*) can significantly reduce watermelon yields in the southern U.S. Pre-plant fumigation of soil beds with methyl bromide has been the primary method for controlling root-knot nematodes (RKN) and soil-borne diseases in watermelon. However, the reduced availability and escalating cost of methyl bromide for pre-plant soil fumigation has stimulated interest in the development of new methods, such as grafting on resistant rootstocks, for managing RKN in watermelon. We have recently identified accessions of wild watermelon from the USDA Watermelon Plant Introduction Collection that are moderately resistant to RKN (Thies and Levi, 2003 and 2007). We have developed improved germplasm lines derived from these wild watermelon Plant Introductions that may be useful as rootstocks for grafted watermelon (Thies et al., 2010).

Objective: Evaluate performance of selected wild watermelon lines and commercial rootstocks of bottle gourd, hybrid squash, and wild watermelon for managing root-knot nematodes with and without methyl bromide treatments.

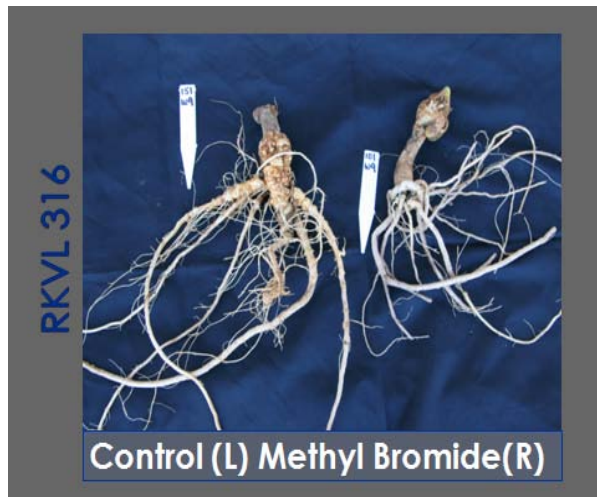


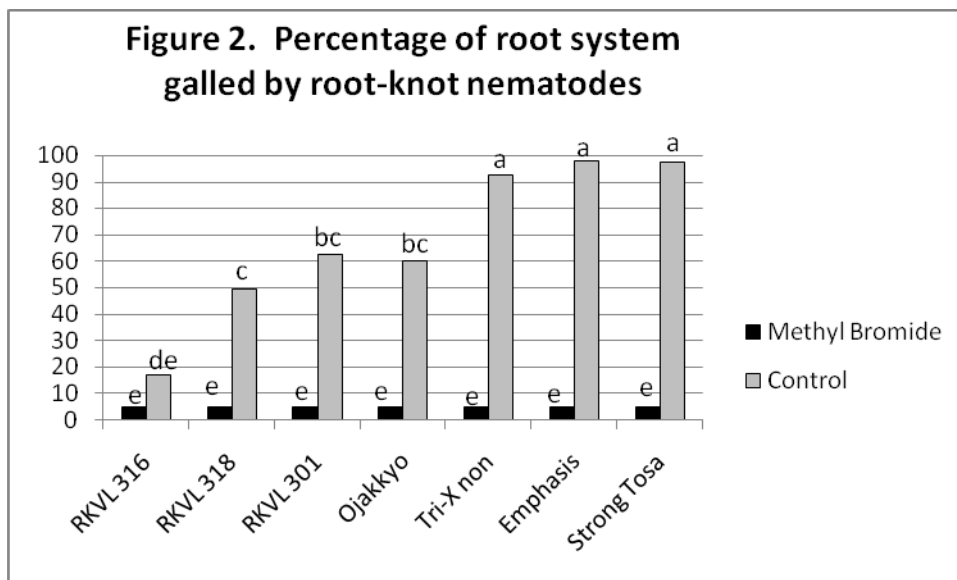
Figure 1a



Figure 1b

Figure 1a. RKN-resistant RKVL 316 wild watermelon breeding line: root system from untreated control plot (left) with very minimal RKN galling and root system with no galling (right) from methyl bromide treated plot. Figure 1b. RKN-susceptible 'Emphasis' bottle gourd: root system with no RKN galling from methyl bromide-treated plot (left) and root system with severe RKN galling from untreated control plot (right). September 2010, Charleston, S.C.

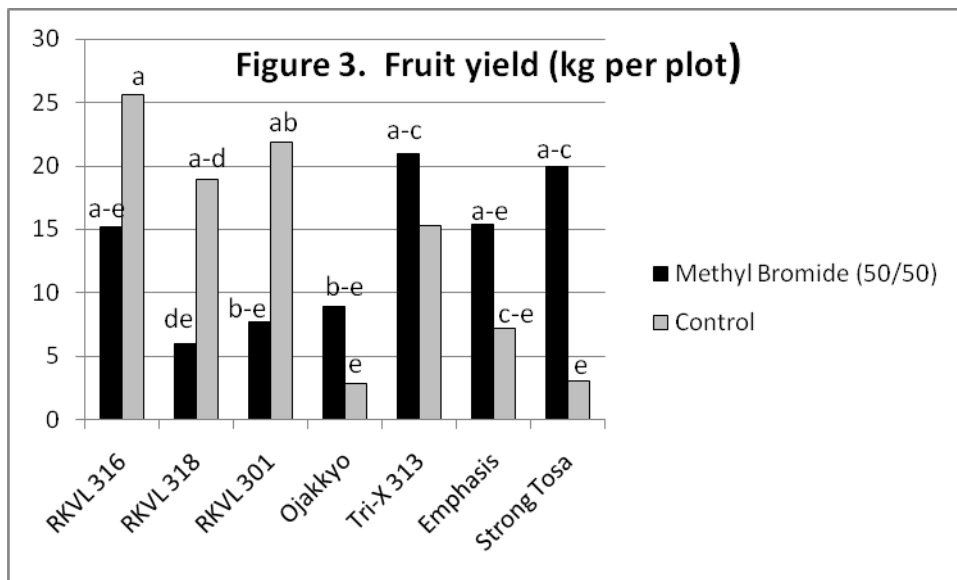
Materials and methods: Six rootstock/seedless watermelon scion combinations and a non-grafted control ('Tri-X 313') were evaluated in a field infested with the southern root-knot nematode, *Meloidogyne incognita*, at the U.S. Vegetable Laboratory, Charleston, S.C. Rootstocks were grafted to the scion triploid watermelon 'Tri-X 313' and planted on raised white plastic mulched bed at 8' x 3' plant density on 28 June 2010. One-half of the plots were fumigated with methyl bromide-chloropicrin (50/50) at 350 lbs/A when beds were prepared. **Rootstock genotypes.** Three of the best performing wild watermelon lines (*Citrullus lanatus* var. *citrioides*) were selected for testing based on data from the 2009 Charleston, SC study and previous tests (Thies et al., 2010). One bottle gourd (*Lagenaria siceraria* 'Emphasis') cultivar, one squash (*Cucurbita moschata* x *C. maxima* 'Strong Tosa') hybrid, and one commercial watermelon rootstock (*C. lanatus* var. *citrioides* 'Ojakkyo') were also included in the study. Non-grafted 'Tri-X 313' was included as a check entry in the study. **Experimental design.** The experimental design was a split-plot design where whole plots were methyl bromide treatments [non-treated control and methyl bromide (50%):chloropicrin (50%) at 350 lbs/A] and sub-plots were the 8 rootstock/scion combinations. The rootstock genotypes were arranged in a randomized complete block within the methyl bromide whole plot treatments. The experiment had six replicates of six plants per replicate. The pollinizer 'SP-4' was interplanted between every third and fourth grafted seedless watermelon. Watermelon fruit were harvested and yield data were collected. After the final harvest, roots of all plants were dug, washed, and evaluated for the percentage of root system galled by southern root-knot nematode.



Results and Discussion: Untreated control plots. The three RKVL wild watermelon rootstocks exhibited resistance or tolerance to RKN with percentages of root system galled ranging from 10.9% for RKVL 316 (Fig. 1a) to 56.3% for RKVL 301 in the untreated control plots (Fig. 2). 'Ojakkyo' had 51.7% of root system galled. The RKN pressure was extremely high in the 2010 field test as illustrated by the extreme root galling on 'Emphasis' bottle gourd (Fig. 1b) and 'Strong Tosa' hybrid squash rootstocks which had 96.9% and 96.0% of root systems galled, respectively. 'Tri-X 313' seedless watermelon (non-grafted) was also highly susceptible to RKN with 96.2% of root system galled.

The three RKVL wild watermelon rootstocks produced the heaviest fruit yields of all entries in the test in both the untreated control plots and the methyl bromide treated plots (Fig. 3). Fruit yields in the untreated plots were 21.9, 25.6, and 19.9 kg/plot for RKVL 301, RKVL 316, and RKVL 318, respectively (Fig. 3). Yields were significantly greater ($P<0.05$) for the three RKVL rootstocks than for ‘Strong Tosa’ (3.0 kg), ‘Emphasis’ (7.2 kg), and ‘Ojakkyo’ (2.8 kg) in the untreated plots, but significant differences were not detected between the RKVL rootstocks and non-grafted ‘Tri-X 313’ (15.3 kg).

Methyl bromide treated plots. Methyl bromide was highly effective in controlling RKN in all rootstock entries with essentially no galling observed for any entry (Fig. 2). Fruit yields of watermelon grafted on ‘Strong Tosa’ were nearly 7X greater ($P<0.05$) in the methyl bromide treated plots than in the untreated plots. Although significant differences were not detected for fruit yields of watermelon grafted on ‘Emphasis’ rootstocks, yields were more than 2X greater for plants grown in the methyl bromide plots than for untreated plots. Similarly, yields were greater for ‘Tri-X 313’ watermelon (non-grafted) and ‘Tri-X 313’ grafted on ‘Ojakkyo’ in the methyl bromide treated plots than in untreated plots. In contrast, yields of RKVL 301, RKVL 316, and RKVL 318 were higher in the untreated plots than in methyl bromides.



Conclusions

The three RKVL wild watermelon rootstock lines (developed at USDA, ARS, Charleston) exhibited resistance/tolerance to southern root-knot nematodes in the 2010 test. RKVL 316 had low root galling and produced the heaviest fruit yield and greatest numbers of fruit of any rootstock evaluated. The bottle gourd and hybrid squash rootstocks were highly susceptible to RKN with severe root galling and very low yields, demonstrating that bottle gourd and hybrid squash are unsuitable for use in RKN-infested fields without methyl bromide or other nematicide treatment. Our results confirm those of our previous greenhouse and field studies, indicating that the RKVL wild watermelon rootstock lines (*C. lanatus* var. *citroides*) possess durable resistance to RKN in the field. These rootstock lines should be useful sources of RKN-resistance for rootstock breeding programs and also useful in the development of RKN-resistant watermelon cultivars.