RESPONSES OF GARLIC TO NEMATODE SEED TREATMENT, NEMATICIDE AND TIME OF PLANTING

Frederick J. Crowe
Central Oregon Experiment Station
Oregon State University
Redmond, Oregon

ABSTRACT

Planting date effects likely are far greater than single or interactive effects from (these particular) seedlots, hot water-formaldehyde seed treatment, or Nemacur in-furrow treatments. With late planting and with no nematode disease pressure, hot water-formaldehyde seed treatment favored slightly better spring emergence and yield over Nemacur in-furrow treatment, but these differences were small and did not occur with early planting. In fact, with early planting, there was evidence that Nemacur aided early establishment in the fall, but this affect did not carry over into measurable spring emergence or harvest responses, and no such affect was seen with later planting.

INTRODUCTION

Garlic (Allium sativum) is grown using cloves as seedstock. Production continually is threatened by the clove-borne nematode Ditylenchus dipsaci, which proliferates in the storage leaves and, in high populations, degrades the developing bulb. This nematode pest persists only a few years in soil in the absence of garlic or other Allium species. Hot water treatment of cloves prior to planting eradicates the nematodes from planting stock, or supresses populations to sub-damaging levels. However, such treatment reduces clove vigor, especially if planting is delayed. If improperly done, hot water treatment may kill the cloves. Formaldehyde has been incorporated into hot water treatments for additional nametode control, but formaldehyde increasingly is under regulatory restriction. Nematicides applied at seeding might substitute for hot water-formaldehyde treatments, but there is some suspicion that the most available nematicide. Nemacur might be phytotoxic. This study was designed to evaluate this possibility compared to standard seed treatments. In the absence of nematode disease pressure, will nematicide effect garlic performance (emergence,

ACKNOWLEDGEMENT: This research was supported in part by a grant from The American Dehydrated Onion and Garlic Association.

winter survival, yield) as much or more than hot water/ formaldehyde seed treatment? Will this response vary with delayed planting?

MATERIALS AND METHODS

Except where indicated, all handling of seed and plants was as per standard industry practices, and is not specified here. Two seedlots of 'California Early' garlic, harvested from Oregon in 1987, were obtained as #32134 and #31338, provided by Gilroy Foods. Based on seedlot history and prior seed testing, these seedlots, were considered to be as free as possible of Ditylenchus dipsaci, the garlic stem and bulb nematode. Seedlots were cracked and part of each seedlot was treated with hot water and formaldehyde on September 14, 1987; all seed was shipped by truck to Madras, Oregon and all seed was stored prior to planting. The Madras Field of the Central Oregon Experiment Station was utilized. No Allium species had ever been grown in the field selected, and no Ditylenchus dipsaci was found in the soil based on soil analyses prior to planting. Planting dates 1 and 2 were on September 18 and October 2, 1987, respectively. For each date, cloves were sized and planted 200 per plot in two adjacent 5-ft bed sections (20 cloves/bed-ft). Seed was dropped with uniform spacing into planting slices opened by hand with hoes, and hoes were used to cover seed 2 1/2 inches deep. Prior to planting, granules of Nemacur 15 G (15% active ingredient, fenamphos, Mobay Chem. Corp.) were spread into planting slices which were to receive seed that had not been seed treated, in an attempt to simulate a commercial granular application. The labeled rate is 9.2-18.4 oz/1,000 ft of row (15-30 lbs/ac on 40-inch beds, 2 rows/bed). The highest rate was utilized.

The test was arranged as two separate experiments: experiment one was on Planting Date 1, and experiment two was on Planting Date 2. Planting dates were not replicated treatment variables, and therefore were not directly statistically compared. Within each planting date each seedlot was combined with either hot water-formaldehyde seed treatment or with Nemacur in-furrow application. Each combination was replicated four times in a complete, randomized block experimental design. Data were evaluated by analysis of variance. Each experiment was in four beds; the two experiments were located side by side, with no separating alleys between them; and commercial garlic was planted adjacent to the outside beds of the experiments. All garlic was irrigated within 1/2 day of planting, and all irrigation and fertilization was as per normal commercial practices. All weeds were removed by hand every two wks during the season. Both fall and spring stand counts were made, as were other observations on general growth during the season. On July 7, 1988, all plants in each plot were lifted by shovel

slightly prior to complete drydown, roots and tops were trimmed, and bulbs were weighed.

RESULTS

Unless otherwise indicated, all statements of statistical significance, or lack of, refer to a 5% level ($P \leq 0.05$). Table 1 shows summarized treatment means for stand and yield data for the first planting date. Each treatment combination is not shown. Stand counts were the number of plants present as a percentage of the number of cloves planted. Garlic in the first planting date partially emerged in the fall of 1987, averaging about 17% emergence. At that time, there was 1) a significant difference between nematode control treatments, 2) no significant seedlot effect, and no significant interaction between seedlot and nematode control treatments. In the fall, Nemacur treatments seemed to be emerging faster than the hot water/formaldehyde treatments. The final emergence data (May 13, 1988) for the first planting showed no statistically significant differences among any factors, except for an interaction which was not considered meaningful. Harvest weights were expressed as lbs per plot. Harvest weights were not statistically different among seedlots or among nematode control treatments, or for interactions. Harvest weight differences shown in Table 1 were consistent with differences found for planting date 2, shown in Table 2, and are discussed further below. Growth observations during the 1988 growing season showed plants among all plots to appear identical. Table shows summarized treatment means for stand and yield data for planting date 2. Again, each treatment combination is not shown. No emergence occurred in 1987 for any plots. Time of emergence in 1988 was about the same as for planting date 2. For stands counts evaluated on May 13, 1988, there were highly-significant differences between seedlots ($P \leq 0.004$) and between nematode control treatments ($P \leq 0.002$), but not for interaction between seedlot and nematode treatments. Seedlot #32134 averaged 84.4% and seedlot #31338 averaged 80.8% emergence. Hot water-formaldehyde treated seed averaged 84.6% and in-furrow Nemacur averaged 80.6%. Harvest weights showed no statistically significant differences among any factors, nor among interactions. The following trends were noted, however, for both planting dates: seedlot #32134 averaged slightly higher harvest weight than seedlot #31338, and garlic treated with hot water-formaldehyde averaged slightly higher harvest weight than garlic treated only with in-furrow Nemacur. As within planting date 1, plants in plots from planting date 2 grew uniformly and no growth differences were discerned during the season among plots. Plants in planting date 2 were noticeably smaller than those in the earlier planting for approximately half the season, at which time this difference could not be discerned visually.

DISCUSSION

Differences between planting dates were not statistically evaluated, due to experimental design considerations. Clearly, however, garlic planted earlier emerged faster (beginning in the fall), were larger for much of the 1988 season, and yielded about 20% above garlic planted later.

Within the earlier planting date, although non-seed treated garlic planted into Nemacur-treated soil began to emerge slightly faster in the fall than did seed-treated garlic, this effect did not persist. No other significant differences were observed in the early planting date experiment with respect to spring stand, growth or yield. Within the later planting date, spring emergence favored one seedlot over the other, and hot water-formaldehyde treated garlic performed better than garlic in Nemacur treatments. None of the emergence data was reflected in statistically significant harvest weight differences, so the commercial significance of these differences is not clear. There was a trend with both planting dates for higher yield with one seedlot over the other, and for hot water-formaldehyde treatment over Nemacur treatment, but the importance of this trend is not further evaluated here.

Table 1. Mean values for plant stand and harvest weight from planting date 1 (September 18, 1987).

Stand on 11/2/87

Treatment	lbs/plot	Statistical Significance[a]
Seedlot #1 32134	14.7	N.S.
Seedlot #2 31338	18.5	
Hot water-formaldehyde	11.3	
Nemacur in-furrow	21.9	*

Stand on 5/13/87

Treatment	% Stand	Statistical Significance
Seedlot #1 32134	93.1	N.S.
Seedlot #2 31338	93.3	
Hot water-formaldehyde	93.1	N.S.
Nemacur in-furrow	93.2	

Harvest weight on 7/20/88

Treatment	lbs/plot	Statistical Significance
Seedlot #1 32134	12.8	N.S.
Seedlot #2 31338	11.6	
Hot water-formaldehyde	12.6	N.S.
Nemacur in-furrow	11.8	

a. N.S. = no significance, $P \leq 0.05$; * indicates significance $P \leq 0.05$. No interactions were significant [$P \leq 0.05$] except for stand 11/2/87.

Table 2. Mean values for plant stand and harvest weight from planting date 2 (October 2, 1987).

Stand on 5/13/88

Treatment	lbs/plot	Statistical Significance[a]
Seedlot #1 32134	84.4	**
Seedlot #2 31338	80.8	
Hot water-formaldehyde	84.6	
Nemacur in-furrow	80.6	**

Harvest weight 7/20/88

Treatment	lbs/plot	Statistical Significance
Seedlot #1 32134	11.0	N.S.
Seedlot #2 31338	9.5	
Hot water-formaldehyde	10.4	N.S.
Nemacur in-furrow	10.1	

a. N.S. = no significance, $P \leq 0.05$; ** indicates significance $P \leq 0.01$ (see text). No interactions were significant.