Foliar Spray Effects of Selected Amino Acids on Sunflower Infected with *Meloidogyne incognita*

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Overman and Woltz (3) indicated that amino acid antimetabolites applied to the soil suppressed reproduction of *Paratrichodorus minor* (*Trichodorus christiei*) and root galling caused by *Meloidogyne incognita* on tomatoes. Eight DL-amino acid antimetabolites similarly decreased the population of *Aphelenchoides ritzemabosi* on Lucerne, whereas DL-alanine suppressed the population of *Heterodera* spp. without harming the host plants (5). Evans and Trudgill (1) found that DL-methionine was toxic to *H. rostochiensis* (*Globodera rostochiensis*) infecting potato plants. Methionine did not act as a contact nematicide; it was presumably ingested in sap extracted from giant cells after being taken up by the host plant. Krishna Prasad and Setty (2) showed that two amino acids used as foliar sprays on tomato had no adverse effect on plant growth and vigor, but significantly affected the development and reproduction of *M. incognita*. Parvatha Reddy et al. (4) reported that DL-methionine suppressed root galling, egg-mass production, and fecundity of *M. incognita* on tomatoes. The amino acid also delayed the completion of the nematode life cycle by about 8–9 d. DL-methionine reduced the number but not the size of giant cells incited by *M. incognita*.

We extended this line of exploration to include a comparison of the effects of other amino acids as foliar sprays on the biology of a population of *M. incognita* on sunflower.

Stock cultures of *M. incognita* were maintained on tomatoes (*Lycopersicon esculentum*) cv. VF 145 in the greenhouse. Sunflower (*Helianthus annus*) cv. Hybrid 894 seeds were planted in 10-cm pots containing a steam-sterilized mixture of clay soil and sand (1:1). Two-week-old sunflower

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seedlings, one plant per pot, were inoculated with 1,000 freshly hatched second-stage larvae of *M. incognita* by pouring the nematode suspension into four holes around the base of the plant. After inoculation the holes were closed by pressing the soil and watering. The different amino acid concentrations were applied as foliar sprays once, after 7 d, or twice, 7 and 15 d after inoculation. The amino acid solutions were uniformly atomized over the plants, care being taken to see that no amino acid solution fell on the soil. Hoagland solution, 1/2 strength, was used for watering as needed.

The number of galls and egg-masses and plant shoot heights and weights were determined for each treatment 45 d after nematode inoculation (Table 1).

In single spray applications the number of galls on plants treated with phenylalanine at each concentration were significantly ($P = 0.01$) fewer compared to the control. Similarly, plants with the two highest concentrations of cysteine had significantly ($P = 0.05$) fewer galls. The number of galls on plants treated with the lowest concentration of cysteine, and each concentration of valine, did not differ from the controls. All treatments, except valine at the lowest concentration, significantly ($P = 0.01$) reduced the number of egg masses/plant, compared to the control. Plant shoot heights and weights were not significantly affected by any treatment. No plant growth disorder was observed by the application of these amino acids.

In double spray applications nearly all amino acid concentrations were effective in inhibiting root galling. The maximum suppression in root galling occurred with phenylalanine at 1,000 μg/ml, but 4,000 μg/ml had no effect. Egg-mass production with the 1,000 μg/ml phenylalanine was the lowest observed among the amino acids tested. Again, as observed by others (1,3,4,5), there appeared to be no adverse effect on plant growth as a result of amino acid application.

These findings support the contention that selected amino acids applied as post-planting treatments may have a role in the

Table 1. The nematode and plant response to selected amino acids as foliar sprays on sunflower infected with *Meloidogyne incognita* (10 replicates/treatment).

Treatment: Amino Acid	Treatment: Concentration μg/ml	No. of galls per plant	No. of egg-masses/plant	Plant shoot: Height (cm)	Plant shoot: Weight (g)
Control		349	216	74	17
Single spray application:					
L-Phenylalanine	1,000	237**	116**	65	16
	2,000	180**	88**	64	14
	4,000	248**	121**	63	14
L-Valine	1,000	311	194	68	16
	2,000	287	127**	66	16
	4,000	303	128**	64	15
L-Cysteine	1,000	327	171**	71	17
	2,000	276*	156**	66	15
	4,000	260*	97**	61	14
Double spray application:					
L-Phenylalanine	1,000	211**	100**	67	16
	2,000	237**	11**	69	16
	4,000	302	143**	74	18
L-Valine	1,000	277**	138**	62	14
	2,000	294**	168*	66	16
	4,000	243**	131**	72	17
L-Cysteine	1,000	307	150**	64	14
	2,000	287**	123**	69	17
	4,000	274**	117**	72	17

Difference from control $^{*}P = 0.05$, $^{**}P = 0.01$.

integrated pest management philosophy. The intent would be to reduce or delay the nematode population build-up until an acceptable yield was assured, as is usual with toxic nonfumigant nematicides. An added benefit of nematode control with amino acids is the human nutritional value of any residual material. Furthermore, these findings clearly establish the feasibility of alternative chemotherapy as a practical, safe means of managing nematode pest populations for acceptable crop production.

LITERATURE CITED

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