Timing Nematicide Application for Control of Stem Nematode Infecting Arizona Alfalfa

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ABSTRACT

The stem nematode Ditylenchus dipsaci attacks non-dormant Arizona alfalfa in the desert valleys; damage occurs during the cooler months of fall and spring. Efforts to introduce and retain resistant alfalfa has had limited success. From October until temperatures decrease below 50 F., the nematode reproduces and feeds. In warmer years, damage may be sustained from October until spring temperatures exceed 85 F. Chemical control may be warranted during these periods of feeding activity. Field trials were established to determine the efficacy of pesticides registered for use in alfalfa. Temik, Vydate, Furdan, Disyston, Thimet and Dasanit applied either in fall or spring were effective in controlling populations when first detected following dormancy. The best control is obtained when pesticides are applied immediately after harvest and prior to irrigation. Yield increases up to 15-25%were obtained with decreased yields in non-treated controls of 40-80%. Stand decline was reduced as much as 50%when treatments were correctly applied.

INTRODUCTION

The stem nematode infects non-dormant alfalfa in the desert valleys of Arizona (2,3). Its present known distribution is restricted to the Salt River Valley, where the total number of infected fields may exceed 60% in warmer years (4,7). Growers may overlook the importance of this nematode because of the chronic nature of the pest and the fact that feeding and reproduction are limited to the favorable temperatures and humidity of early fall and late spring. Detection is frequently made after the populations have increased and spread throughout the field, resulting in serious yield reduction and stand decline.

Chemical controls have been demonstrated as effective and economical when properly applied (1,5,6). Until more effective non-dormant resistant cultivars are available, pesticides can be used to control the stem nematode as a pest management tool.

Reports are sometimes received that continued use of the systemic insecticides/nematicides has resulted in stem nematode resistance to the chemicals. Growers complain that adequate control may be obtained one time, but the next application may result in complete failure. Inspection of some of these fields has substantiated such complaints. However, since the nematode was controlled in one incident and not in another, factors other than chemical resistance may be responsible.

To determine if poor application and/or improper timing was responsible for erratic control, various trials were conducted with pesticides registered for insect control in alfalfa. These were applied during periods of nematode activity as well as at varying periods of time following harvest and irrigation. Data from these various trials is presented below.

METHODS AND MATERIALS

Pesticides registered for use in alfalfa are both granular and emulsified concentrates. They are applied by aerial or ground application equipment consisting of sprayers or tail-gate spreaders. Both were evaluated in trials reported here. Registered dose rates served as standards. Rates above and below the registered standards were selected to determine the efficacy of the commercially applied dosages. This allowed us to determine if the pest was either resistant or becoming resistant to a compound.

Grower - cooperator fields were used in all trials. Plot size varied, but in all cases, a complete border served as a replicate with treatment from one end to the other, regardless of length. All treatments were replicated a minimum of 3 times, with the exception of a few trials where heavy infestations would have resulted in excessive yield loss had the same number or size of untreated controls been used. Where this occurred, the fact is noted in the tables describing the control data.

In tests 1 and 3, application was made by aircraft and ground sprayer, respectively. Although these trials were in different fields they were treated the same day, thereby offering the opportunity of evaluating the two methods of application. Applications in both cases were made immediately after the last bale of hay was removed and prior to irrigation. In the ground-sprayer treatment in the third trial, two days were required to apply all compounds. Temik was applied in granular form using a tailgate spreader. Trials 1 and 3 were initiated in March with yield data obtained as indicated. In all trials except number 2, yields were based on the total bales produced in each border and are presented as an average of the total replications for each treatment as increased or decreased over the previous pre-treatment yield.

In trial 2, replications were increased, but the plots were decreased to square meter size. Application was made by back-pack sprayer or, in the case of granular Temik, by hand-powered cyclone seeder. Harvesting was conducted with a hand-operated power mower. The hay, after drying, was weighed from each replication and represented the total hay from each replication. This study began with the late October treatment and was terminated after yield results were obtained in the fourth cutting in March.

Trial 4 was a fall treatment with aerial application of pesticides. The yield and nematode population data was obtained comparing the December and February cuttings with those of the post-treatment harvest and nematode population of October. Pesticides were applied the first week of November.

Nematode populations were determined by randomly sampling the alfalfa from each replication at 6-8 different points. These sub-samples, consisting of approximately 2-3 ounces of alfalfa, were amalgamated. Stems were cut into approximately 2-inch lengths and thoroughly mixed. A 2-ounce sample was removed from the mixture and placed in a food blender with 500 cc water. It was blended for 45 seconds at low speed and the mixture was strained using 60, 100, 200 and 350 mesh sieves for gravity screening and removal of the nematodes from the host tissue. Each sample was then examined and nematodes counted. Increase or decrease was based on the population number established immediately prior to the pesticide application.

RESULTS

Trials 1 and 3 were conducted during the spring months of nematode activity. The pesticides and rates of each were all effective in reducing the nematode populations (Tables 1 and 2). In the third trial, the treatments with both rates of Disyston decreased the populations than the other pesticides. This may have been an error in determining the population since the degree of infection was exceedingly high. With such infested alfalfa, it is difficult to obtain even counts from sample to sample since one stem may be heavily infected and another may have fewer nematodes within its tissue.

Table 1. Chemical Control of Stem Nematode Populations in Irrigated Desert Alfalfa (spring application)

Treatment	Rate (ai/A)	Population % Decrease/ Increase (1)	Yield% Increase/ Decrease (2)
Temik	1.00	92 Decrease	11 Increase
Disyston	.33	95 Decrease	10 Increase
Disyston + Dasanit	.25 +.50	93 Decrease	17 Increase
Thimet	2.00	96 Decrease	15 Increase
Control with Nemas	--	42 Increase	17 Decrease
Control w/o Nemas	--	8 Increase	None

(1) Avg. of 4 reps.; (2) Yields taken 30 days following application.

Table 2. Effect of Chemical Treatment Applied by Ground Application Seven Days After Harvest (spring application)

Treatment	Rate (ai/A	Population % Decrease/ Increase (1)	Yield % Increase/ Decrease (2)
Disyston	.50	38 Decrease	8 Increase
Disyston	.30	22 Decrease	11 Increase
Thimet	1.00	60 Decrease	7 Increase
Thimet	1.50	49 Decrease	13 Increase
Furdan	1.00	61 Decrease	12 Increase
Furdan	1.50	54 Decrease	12 Increase
Control	--	2042 Increase	4 Decrease

(1) Avg. of 4 reps. @ 22x300 ft. - applied 7 days after cutting; (2) Total hay 30 days after treatment

In trials 2 and 4, which were conducted in the fall months of stem nematode activity, the five nematicides/insecticides tested gave excellent control Tables 3 and 4). Each was considered effective at the rates evaluated. Yield response was realized in all treatments. There was no evidence of nematode resistance to these pesticides, even though all but Vydate had been used for several years in the area where the trial were conducted. Results of subsequent fall trials with the same pesticides indicate that effective control as this time of year can reduce the nematode population which eliminates the necessity of spring treatment. Additional investigations are required to evaluate these observations.

Table 3. Effect of Chemical Treatment on Stem Nematode Population and Alfalfa Yield (fall application)

Treatment	Rate (ai/A)	Population % Decrease/ Increase (1)	Yield% Increase/ Decrease (2)
Temik	1.00	78 Decrease	15 Increase
Temik	.75	90 Decrease	17 Increase
Thimet	.75	91 Decrease	22 Increase
Thimet	1.00	87 Decrease	26 Increase
Thimet	1.50	96 Decrease	19 Increase
Vydate	1.50	94 Decrease	17 Increase
Vydate	1.75	90 Decrease	19 Increase
Vydate	2.00	92 Decrease	21 Increase
Control	--	297 Increase	46 Decrease

(1) Avg. of 8 (1 sq meter) reps.; (2) Avg./rep. of 4 cuttings following application.

Table 4. Chemical Control of Stem Nematode Populations In Irrigated Desert Alfalfa (fall application)

Treatment	Rate (ai/A)	Population % Decrease/ Increase (1)	Yield % Increase/ Decrease (2)
Furdan	1.50	96 Decrease	21 Increase
Thimet	1.25	92 Decrease	17 Increase
Timek	1.50	98 Decrease	19 Increase
Dysyston	.50	97 Decrease	21 Increase
Control	--	1185Increase	12 Decrease

(1) Avg 4 reps; aircraft applied (25x300 ft) immediately following cutting and during irrigation; (2) Yield increase avg of two cuttings following application

DISCUSSION AND CONCLUSIONS

Data from these four trials demonstrates that systemic insecticide/nematicide chemicals presently registered for insect control use in alfalfa are effective in the control of stem nematode. Registered dosage rates were also considered effective and, in several cases, controlled as well as, or better than, the higher concentrations.

The degree of control and resulting yield increases varied only slightly between the various pesticides tested. Therefore, the choice would probably depend upon economics, location of the field to be treated, availability of application equipment, and environmental hazards. Some of the compounds are available only as granules while others are only in the liquid form. Growers are cautioned to follow the labeled instructions explicitly to prevent any legal problems.

The results obtained in the fall treatments appeared to be as effective as those in the spring treatments. However, field evaluation and inspection of fields treated in the fall would indicate that, properly applied, most of the compounds, used at recommended rates, can sufficiently reduce the nematode population to levels that eliminate the need for spring treatment under normal temperatures. Where prolonged cool temperatures favor continued feeding and reproduction, chemicals may be required.

Spring treatments, while highly effective, have seldom eliminated the necessity of repeating application the following fall. These observations demonstrate the necessity of detecting the infestation early and acting rapidly to avoid population increases that reduce yields and are more difficult to control.

While direct comparisons have not been made in the same field, it would appear that when correct application procedures are followed there is little difference in the final control obtained between aerial versus ground application.

Results of these investigations reveal that stem nematodes economically reduce hay yields in alfalfa and losses may be effectively and economically reduced by chemical control procedures.

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