IPM Mini Grant Proposal 2008

Title: The use of oilseeds as biofumigants to control Alfalfa Stem Nematode, Second Year

Project Personnel:

David Drake, Principle Investigator
New Millard Co. Agent and Craig Poulsen Co-Principle Investigators
Kent Evans, Technical Advisor
Ken Skeem, Cooperator

Situation Statement:

Alfalfa Stem Nematode (ASN), *Ditylenchus dipsaci*, is one of the most important alfalfa pests in Millard and other counties in Utah. ASN is difficult to control, there are no cost effective chemical controls for ASN so the best controls are through management practices (2006, Evans et al.). This requires a field to be planted to a non-host crop for 2-3 years to decrease ASN numbers low enough to reestablish a new stand of alfalfa without significant losses. In Millard County and many other counties in Utah, alfalfa is the most economical crop for growers. Many growers have tried different measures to reduce the rotation interval. Very few leave a field out of alfalfa for three years. Many settle for two years while others push the rotation with only one year out of alfalfa or even planting a field straight back to alfalfa with no rotational crop. Invariably these producers that push the rotation loose significant yield from their new stands of alfalfa, even sometimes having to take a new stand out after only one or two years. If we could provide a biofumigant as a viable rotation crop then we could possibly reduce the numbers of nematodes to low enough numbers in a one year rotation to allow the replanting of alfalfa without the detrimental effects of yield reduction or reduced stand life.

We would like to look at using a cruciferous oilseed crop as a biofumigant to reduce the numbers of ASN while still providing some economical benefit to the grower. This is done in other cropping systems by plowing the crop down when green without harvesting the seed. Satisfactory control has been achieved with other types of nematodes that affect potatoes and wheat.

This trial is in the second year of study with rotational treatments having been completed and a crop of alfalfa having been planted in the fall of 2007 (Drake, 2007). Two measures of ASN control will be used to determine treatment effectiveness. A measure of pre and post treatment soil ASN will be completed. Pretreatment soil tests were conducted in 2007 and post treatment soil tests will be conducted in spring of 2008. The second measure of treatment effect will be determined from ASN infection rates in the new alfalfa crop and measurement of alfalfa yield differences between treatments.

Objectives:

1) Determine if biofumigant mustard, canola, and camelina will function as biofumigants when soil incorporated as green biomass.
2) Determine if Canola and Camelina will act as biofumigants for the control of ASN if the post harvest stubble is soil incorporated after a seed crop has been removed.
3) Determine if a one year rotation to an oil seed or biofumigant crop will achieve satisfactory control of ASN to reestablish alfalfa without economic loss due to decreased stand life and/or yield reduction.

Procedures:

First Year: Ken Skeem, the cooperating farmer in Oasis, Millard County volunteered a heavily ASN infested four-year old stand of alfalfa to conduct the study. The stand was removed by use of an herbicide and tillage. Three replications of four crop rotation treatments in a randomized complete block design were planted in 0.2 acre dikes of approximately 25 feet in width and 320 feet in length. Treatments included oats, as a control, spring canola, camelina, and a biofumigation mustard. Triflurilin was applied to mustard treatments at a rate of 2 pts/ac as a pre-emergent weed control. All twelve plots were again cultivated prior to planting to incorporate the herbicide or to maintain the control treatment integrity. Soil samples from all plots were taken, after tillage but prior to planting, and sent off to a nematode lab for nematode identification and quantification. The experiment was irrigated by level basin irrigation twice during the 2007 growing season. Dikes kept irrigation water from contaminating adjacent treatments. The oat or control treatment was swathed and baled for oat hay at the milk stage as customarily done in the area. The fumigation mustard was mown and tilled into the soil when the plants were green and the oldest flowers were in the pod stage. Canola and camelina crops were randomly split into two half treatments with the whole plant being tilled into the soil and the other half being harvest for seed and the crop stover being tilled into the soil. The field was then replanted to a single variety of alfalfa, with dikes left maintained, then irrigated. See Figure 1 for a representation of the experimental design. The first year proposal and report are available at http://utahpests.usu.edu/ipm/files/uploads/MiniGrantDocs/2007/IPM-mg07-prop-poulson.pdf and http://utahpests.usu.edu/ipm/files/uploads/MiniGrantDocs/2007/ipm-mg07-rep-drake.pdf

Second year: Growth of fall seeded alfalfa will be monitored in the spring of 2008 for stand establishment and ASN infestation. Alfalfa tissue samples and soil samples from each treatment will be collected in May 2008 to determine the ASN population levels in the plants and the soil. Effect of treatment will be determined by pre and post treatment ASN soil populations and alfalfa infestation levels. Economic evaluation of treatments will be done by collecting forage yield data from each of the treatment area.

Camelina Plowed Down	Camelina for Seed
Canola Plowed Down	Canola for Seed
Oat Hay	
Commercial fumigation mustard	

Figure 1. Diagram of a complete block of crop rotation treatments for alfalfa stem nematode separated by dikes, Oasis, Millard County, UT 2007. Irrigation water runs left to right.

NOTE: Craig Poulsen has left USU Extension but the organization is in the process of filling the position. The new agent will be encouraged to participate in the project.

Data Analysis and Presentation of Results:

First year nematode infestation levels will be compared statistically to second year soil and tissue infestation levels to determine effect of treatments on ASN.

Oil seed and alfalfa yield data will be used to determine economic effects of treatments and to provide another measurement of ASN control.

Results will be presented at grower meetings and published in fact sheet form. The results should be suitable for publication in scholarly journals. Results will also be presented at grower meetings as well as professional meetings. The field has already received much attention would potentially make a good location to hold a farm field day.

Evaluation:

Knowledge of public will be evaluated through the use of surveys at meetings where the results are presented. Follow up surveys will also be used to asses the impact of the study as to the number of people implementing the procedure.

Budget for second year:

Budget needed to complete ASN infestation sampling	
Nematode lab analysis alfalfa tissue 18 @ $50	$900
Nematode lab analysis soil samples 18 @ $50	$900
Travel 1 trip by D.Drake 160 miles roundtrip @ 0.485/mile	$ 78
Total	$1,878
Budget needed to complete alfalfa yield evaluation	
Additional labor for 3 harvests 10 hours @ $10 per hour	$100
Supplies for forage harvesting	$200
Travel 3 trips by D.Drake 160 miles roundtrip @ 0.485/mile	$234
Total	$534
Total funds requested	$2,412

References

Drake, D., (2007) Use of Oilseeds as Biofumigants to Control Alfalfa Stem Nematode [Research Report]. Utah State University Extension, Logan, UT. http://utahpests.usu.edu/ipm/files/uploads/MiniGrantDocs/2007/ipm-mg07-rep-drake.pdf

Evans, K., Isrealson, C., Pace, M., and Poulsen, C., (2006) Alfalfa stem nematode. Utah Pest Fact Sheet, PLP-001-06. Utah State University Extension, Logan, UT.