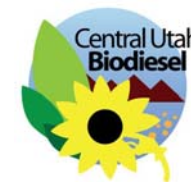


Canola, Camelina, and Fumigation Mustard Crop Rotations for Alfalfa Stem Nematode Control

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ABSTRACT

Alfalfa Stem Nematode (ASN), *Ditylenchus dipsaci*, is an important alfalfa pest in the state of Utah. Symptoms are manifest as stunted plants, slower spring "green up", poor stand density, weed infestations, and losses in forage yield and quality. Current control methods include prevention by sanitation, crop rotations for two or more years with a non-host crop, and pesticide treatments. Other control methods are needed for an improved integrated pest management strategy. The use of a fumigation mustard crop rotation has been shown to provide nematode control in wheat and potatoes in the Pacific Northwest. There is also a considerable interest in growing oilseed mustard crops, canola and camelina, as sources of biodiesel. This project was initiated to determine the possible ASN control benefits from a biofumigant mustard, spring canola, and camelina crop rotation as compared to a traditional oat hay rotation. A nematode infested alfalfa stand in Millard County was selected for study with three replications of the four crop rotation treatments being planted in spring 2007. Pre-plant soil samples from all plots were taken and analyzed for ASN, none were identified. The oat or control treatment was swathed and baled for oat hay. The fumigation mustard was mown and tilled into the soil when the plants were flowering and the earliest seed pods were still green. Canola and camelina crops were randomly split into two half treatments with the whole plants being tilled into the soil and the other half being harvested for seed and the crop stover being tilled into the soil. The field was then replanted to alfalfa. Treatment effects on ASN were measured by soil and plant nematode infestation levels, alfalfa stand visual symptoms, and forage yield. Significant yield differences in the first year of alfalfa were not identified.

OBJECTIVES

- Determine if biofumigant mustard, canola, and camelina will function as ASN biocides when soil incorporated as green biomass.
- 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.
- 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.

MATERIALS AND METHODS

Pre-plant soil samples were taken and sent to the University of Nebraska lab for nematode identification. Trifluralin at a rate of 2 pints per acre was applied to all mustard treatments and tillage incorporated prior to planting. Canola, fumigation mustard, and camelina were seeded at 5-6 pounds per acre. The plots were flood irrigated twice during the 2007 growing season. Whole fumigation mustard, canola, and camelina plants were mown and tilled into the soil when the oldest seed pods were filled but still green. Random half plots of canola and camelina were combined for seed at maturity and the stubble was disced into the soil for alfalfa planting. Oat hay was cut, dried, baled, and removed prior to disc incorporating the stubble. Alfalfa was seeded in the fall of 2007 at 20 lbs/ac and irrigated for germination. The new alfalfa stand was treated with Pursuit for weed control in the spring of 2008. Forage yields were evaluated by mowing two strips per plot of approximately 2.3 ft X 21 ft, weighed, and subsamples taken and oven dried at 65 degrees Celsius to determine moisture content.

Alfalfa Stem Nematode Biocontrol Treatments

Crops

Camelina (*Camelina sativa*) cv. *Ligena*
Spring Planted Canola (*Brassica rapa*) cv. *DKL 38-25*
Fumigation Mustard (*Brassica spp.*) cv. *Calliente 119*
Oats (*Avena sativa*) cv. *Monida*
Alfalfa (*Medicago sativa*) seed fall 2007

Experiment Design

Randomized Complete Block Design with 3 replications
Plots were 25 ft X 360 ft divided by irrigation dikes
Camelina and Canola plots were randomly split into harvested for seed and whole plant incorporated treatments

Location

Oasis, Millard County, Utah
Established in March 2007



Figure 1. Alfalfa crop rotation treatments for Alfalfa Stem Nematode in 2007. Treatments shown are oats, upper left; camelina, and canola.



Figure 2. Alfalfa Stem Nematode treatment plots reseeded to alfalfa, 2008

RESULTS and DISCUSSION

Pre-plant soil tests did not contain ASN nematodes but other important alfalfa nematodes were identified. Post-treatment soil tests should confirm treatment effectiveness on these additional pests. Canola, camelina, fumigation mustard, and oat hay produced satisfactory crops in the 2007 season. Alfalfa was successfully established in the fall of 2007. The first cutting of alfalfa was not measured for alfalfa yield because of the high weed content, typically associated with new alfalfa plantings. Diseased plants per plot were identified before the first cutting and no significant differences were observed between treatments. Yields of second and third alfalfa cuttings were measured with no significant yield differences identified (Table 1.) Disease incidence, plant tissue analysis, and forage yields will be monitored in subsequent years to determine treatment affects over the alfalfa stand lifetime, up to five years.

Table 1. The average number of diseased alfalfa plant per plot and the average alfalfa forage yield per plot for two harvests of camelina, canola, fumigation mustard, and oat hay crop rotation treatments.

Treatments Soil Incorporated	Average Number of Diseased Plants Per Plot	2 nd Harvest Alf. Forage Yield (tons DM ac ⁻¹)	3 rd Harvest Alf. Forage Yield (tons DM ac ⁻¹)
Camelina whole crop	2.6	1.66	1.06
Camelina crop residue	2.3	1.61	1.16
Canola whole crop	0	1.94	1.09
Canola crop residue	2.6	1.69	1.16
Fumigation mustard whole crop	3.3	1.89	1.11
Oat hay crop residue	1.6	1.97	1.15
Significance of F-test	0.69	0.18	0.97

CONCLUSIONS

- Camelina, canola, and fumigation mustard crop rotations did not show significantly different ASN treatment results than traditional oat hay as measured by infected plants and alfalfa yield.
- Incorporating whole plants of camelina and canola did not show a significant difference in ASN control than incorporating crop residue.
- All treatments provided satisfactory control as determined by the first year alfalfa stand

REFERENCES

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.

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