

MANAGEMENT OF NEMATODES IN ALFALFA

Dr. Donald R. Miller¹

ABSTRACT

Management of the potential economic damage to alfalfa production fields due to nematodes is generally accomplished by a combination of several factors: **alfalfa genetics, cultural practices, nematode specific crop rotations, bio-fumigants, and to a lesser extent chemical control.** The selection of a highly resistant variety is the first line of defense in combating nematodes. Cultural practices can be very effective in preventing the initial spread of the nematodes into new production fields and help minimize the damage in established alfalfa fields. Fields with existing nematode infestations can be managed by utilizing “non-host” crop rotations and/or fallowing, combined with the use of a nematode specific bio-fumigant crop species. However nematode control in established alfalfa fields is difficult, especially since most of the major damage occurs at or below the soil surface. Once an alfalfa field is planted, there are few if any chemical controls available that are effective and/or economical.

Keywords: Alfalfa, nematology, cultural practices, pest management, nematode control, alfalfa nematodes, stem nematode, root knot nematode, southern root knot nematode, northern root knot nematode, columbia root knot nematodes, lesion nematode, crop rotation, integrated pest management, bio-fumigants

INTRODUCTION

Much progress has been made by alfalfa breeders in the last 30 years in improving the genetic resistance of alfalfa varieties to nematodes. Utilization of these genetic advances in the selection of adapted resistant varieties is still the best and most economical means of insuring maximum yield, quality, and stand life. Variety selection, beyond yield and forage quality, should be based on knowledge of which alfalfa nematodes are most prevalent in a grower’s field or are historically known to reduce yield and stand life in the region. Knowledge of any potential new nematode reported in the area should be also considered in the selection of a variety with resistant traits. It should be noted that having genetic resistance to one nematode species doesn’t necessarily provide resistance to other nematode species.

Selecting an adapted variety that has a high level of nematode resistance, combined with proper cultural practices, is the grower’s best defense in minimizing nematode incurred production losses. Selecting a good resistant variety, adapted to his or her farm, is also the cheapest line of defense against potential production losses. It is hard not to over emphasize this point. The variety choice the grower makes at planting, will often determine the extent and severity of any future nematode outbreaks, and more importantly the length of time that field will remain profitable. Growers often become fixated on the initial cost of the alfalfa seed, but often fail to realize that the choice they make will determine the profitability of that field for many years. A poor choice can cost money in the form of lost yield and/or quality due to stand losses and the

¹ Dr. Donald R. Miller (alfalfadoc@outlook.com), Alfalfa Breeder, 312 Crestwood Dr. Nampa, ID 83686 Email : **In:** Proceedings 2022 World Alfalfa Congress, San Diego, CA November 14-17, 2022. (See <http://alfalfa.ucdavis.edu> for this and other alfalfa Conference proceedings)

resulting weed encroachment. A poor variety choice can result in the grower having to prematurely take fields out of production. The unexpected replanting costs can be significantly more than what the producer would have paid in seed costs for a better nematode resistant variety. Picking a low-cost inferior susceptible variety often results in the grower having to fight an uphill battle to optimize forage production and profit.

For the most part, once a variety is planted, there are only a limited number of options available to the grower to prevent or eliminate nematodes from damaging an established field. There are few chemical controls available that are effective and/or economical. Proper cultural practices implemented during the life of the stand can limit the spread and extend of damage. However complete control in established fields is often difficult once a nematode has become established.

ALFALFA NEMATODES

Nematodes are microscopic wormlike animals that live in the water held between soil particles. These plant parasitic animals are generally more prevalent in moderate to clay soils and have a high reproductive rate. They can persist in soil for many years in the absence of a host and move from field to field on farm equipment and/or irrigation water contaminated from runoff water of infested fields. Numerous plant parasitic nematodes are known to occur in alfalfa fields, but most of the damage is attributed to the following five.

Major Nematodes Species that Damage Alfalfa

1. Stem Nematode (Ditylenchus dipsaci)
2. Southern Root Knot Nematode (Meloidogyne incognita.)
3. Northern Root Knot Nematode (Meloidogyne hapla)
4. Columbia Root Knot Nematodes (Meloidogyne chitwoodi)
5. Root Lesion Nematodes (Pratylenchus penetrans)

Management of Nematodes in Alfalfa: What Are Your Options?

The best control option is to eliminate or reduce the nematode threat prior to planting. This can be approached in several ways. First take a soil sample and send it to a lab to see if any harmful nematodes are present. Your local soils lab or extension office should be able to help you locate a nematode lab. The nematode lab can identify any problem nematodes found in the soil you send them. I recommend sending soil and plant samples (if field is not fallow) to get the most accurate evaluation. Depending on where the nematode is in its life cycle it may be more prevalent in the soil or the plant tissue.

Approximate Nematode Threshold Levels for Soil Samples/gram:

(Samples that contain a majority of female nematodes is more of a concern)

- STEM – any number
- NRKN – 500
- CRKN – 1,000
- LESION – 2,000

If an alfalfa parasitic nematode is present, you can use the following management options to eliminate or minimize the number nematodes in the field:

-Fallow The Field: Cultivation of the field drastically reduces the number of nematodes and eliminates their food source. Most parasitic nematodes can only survive on living plants.

-Trap Crop: Some species of nematodes can lay dormant in the soil for a period of time even following field fallowing. Planting a specific crop that is known to stimulate the dormant parasitic nematode to hatch and feed, is a method of control called a “Trap Crop”. Plowing down this “trap crop” before the newly hatched nematodes have a chance to reproduce, can be effective in further reducing a nematode population.

-Non-Host Plant Rotation: This is a practice of planting a rotational crop that the problem nematode can’t feed or reproduce on. Growing a non-host crop for 1-2 years can reduce nematodes numbers, especially if used in conjunction with other control measures.

-Fumigation (Chemical or Bio-Fumigation): Chemical fumigation is generally considered too expensive for new fields for alfalfa production. However, some alfalfa growers have taken advantage of rotating with high value crops where soil fumigations are cost effective, such is the case for potatoes. Alfalfa following the potato crop can take advantage of the prior fumigation by starting out with few if any nematodes in the soil profile.

A more cost-effective alternative to chemical fumigation, is bio-fumigation. Certain species of plants when grown and subsequently plowed down and incorporated into the soil, release a natural bio fumigant that controls parasitic nematodes. Several varieties of radish and mustards (i.e., white mustard) are currently available to growers to use in short term rotations for this purpose. Bio-Fumigation can be a very effective tool in an integrated approach of controlling nematodes prior to planting a new alfalfa field.

The following is some specific information on the nematodes known to damage alfalfa in order of importance:

Stem Nematode (Ditylenches dipsaci)

Conditions that promote damage:

- Cool moist spring
- Sprinkler irrigation (surface moisture on lower plant canopy increases stem nematode infestation of lower plant stems and crown buds).
- Susceptible plant and weed hosts
- Alternate host in rotation- potatoes, garlic, and beets

Symptoms:

- In the spring or fall sporadic white stems or “White flags” may be seen throughout the alfalfa field.
- Stunting in somewhat circular patterns in the field
- Swollen stem buds

- Shortened internodes and swollen nodes on lower stems
- In advanced stages lower stem may blacken
- Fewer symptoms may be seen during summer months

Control:

- Plant alfalfa variety with Resistance (R) or High Resistance (HR)
- Rotate with non-host crop for 2-3 yrs.
(Non-host crops-sorghum, small grains, beans, and corn)
- Utilize a bio-fumigant crop in the rotation just before planting a new alfalfa crop.

**Root Knot Nematode (Meloidogyne spp.)
(Northern, Southern, and Columbia)**

Conditions that promote damage:

- Susceptible crop species in rotation and weed hosts

Symptoms:

- Stunting in somewhat circular patterns in the field
- Stand reduction
- Excessive root branching and small galls on roots

Control:

- Plant alfalfa variety with Resistance (R) or High Resistance (HR)
- Crop rotation with a non-host is generally not feasible due to wide host range
- Fallow field for one growing season (if non-host crop is not an option)
- Utilize a bio-fumigant crop in the rotation just before planting a new alfalfa crop

Lesion Nematode (Pratylenchus spp.)

Conditions that promote damage:

- susceptible crop species in rotation (i.e., corn) and weed hosts

Symptoms:

- Stunting in somewhat circular patterns in the field
- Major symptoms occur in the form of black lesions on the outside of the root. Lesions may become severe enough to completely darken taproot.
- Taproots appear stunted with reduced lateral root growth.

Control:

- Resistant varieties
- Crop rotation with a non-host is generally not feasible due to wide host range
- Fallow field for one growing season
- Utilize a bio-fumigant crop in the rotation just before planting a new alfalfa crop

**INTEGRATED APPROACH TO NEMATODE CONTROL:
BENEFICIAL CULTURAL PRACTICES AND CROP ROTATION OPTIONS**

Cultural Practices:

- Don't reuse tail-water for irrigation from infested fields (nematodes can be spread in the water from infested fields)

- Clean equipment between infested fields to prevent spread into un-infested fields

Crop Rotation Options for Stem Nematode Control:

Alfalfa => 2yrs small grain => Bio-fumigant crop => Alfalfa (Plant Variety with High Resistance to Stem Nematode)

Crop Rotation Options for Root Knot Nematode spp. Control:

Alfalfa => fallow => Bio-fumigant crop => Alfalfa (Plant Variety with High Resistance to Root Knot Nematode)

Crop Rotation Options for Lesion Nematode Control:

Alfalfa => fallow => Bio-fumigant crop => Alfalfa (Plant Variety with Resistance to Lesion Nematode)

SUMMARY

An alfalfa grower's first line of defense against nematodes should always be a nematode resistant variety, if available. A resistant variety's built-in genetic protection is the best insurance policy a grower can get against yield losses. Whenever conditions occur that are favorable for nematode buildup, the genetic protection is always there and doesn't have to be applied by the farmer.

Purchasing a variety that lacks adequate resistance may result in an uphill battle in preventing yield and stand losses due to nematode. Alfalfa is a perennial crop, so a poor variety choice at planting time is one that the farmer will have to live with for many years. Following the selection of a good, adapted resistant variety, the grower should use good common sense agronomic practices to prevent the spread and/or limit the buildup of nematodes on their farm.

REFERENCES

Holmes, G. J. and Miller, D. R 1996. Management of Nematodes and Diseases in Alfalfa using Genetic and Cultural Approaches. Proc. of 27th National Alfalfa Symposium 1996 San Diego, CA

Miller, D. R. 1997 Diseases and Nematodes. 27th California Alfalfa Symposium

Miller D.R. and Frate C. 2000. Alfalfa Pests (Insects, Diseases, and Nematodes) 30th California Alfalfa Symposium and 29th National Alfalfa Symposium

Miller D. R. and Hafez S. 2003 Alfalfa Diseases And Stem Nematodes: What Are The Effects Of Equipment And Varieties? 33rd California Alfalfa & Forage Symposium

UC IPM alfalfa production guidelines, 2006.

<http://ipm.ucdavis.edu/PMG/selectnewpest.alfalfahay.html>

Westerdahl B, P Goodell and S Hafez. 2006. Alfalfa nematodes. UC IPM Pest Management Guidelines for alfalfa: <http://ipm.ucdavis.edu/PMG/r1200111.html>

Frate, C.A. 2007 Diseases And Nematodes Of Alfalfa, 37th California Alfalfa & Forage Symposium

Westerdahl BB and Frate C. 2007. Parasitic nematodes in alfalfa. *In*: Irrigated Alfalfa Management

Westerdahl , B.B. 2008. Alfalfa Nematodes: What can be Done?
38th California Alfalfa & Forage Symposium and Western Alfalfa Seed Conference

Miller, D. R., 2013. Diseases and Nematodes in Alfalfa- What are your options? Proc. 2013 43rd Western Alfalfa & Forage Conference, Reno, NV

Westerdahl BB and Long R. 2014. Nematode Management in Alfalfa Production. Proc. 2014 44th California Alfalfa & Grain Symposium