BIOLOGY AND MANAGEMENT OF CLOVER ROOT CURCULIO AND STEM NEMATODE IN ALFALFA

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ABSTRACT

Clover root curculio (CRC) and alfalfa stem nematode (ASN) are pests of alfalfa that spend part of their life in the soil. Their increase in abundance and damage may be linked to the ban of carbofuran. The current options to manage these pests are limited to multiple year, non-host crop rotation, and resistant varieties. We investigated the local timing of the CRC lifecycle and the successive impacts of managing alfalfa weevil with pesticides on CRC. The effects of ASN on aphid populations and on rotation timing have also been examined.

Key Words: clover root curculio, alfalfa stem nematode, below-ground pests

INTRODUCTION

Clover root curculio (*Sitona hispidulus*) is a weevil pest of alfalfa. The adult is similar in appearance to the alfalfa weevil (*Hypera postica*) but it is smaller, mottled grey in color, and has a shorter rostrum (nose). The larval (grub) stage is legless and cream-colored with a large brown head. Adults are most active in the field during spring and fall laying eggs during these times; thus, they overwinter in both the adult and egg stage. During summer, larvae pupate and become adults. The new generation of adults remains inactive during the hottest parts of summer until feeding and egg laying is initiated during the cooler fall temperatures. Adults, which feed on leaves, cause negligible losses in established stands (Bigger 1930, Wenninger and Shewmaker 2014). However, in fields planted in the spring, they can cause economic losses by damaging seedlings (Jewett 1934). Larvae, on the other hand, feed on belowground tap roots and have been shown to reduce yields in the eastern United States (Godfrey et al. 1986, Godfrey and Yeargan 1987). Heavy damage to the root system has been implicated in reducing stand longevity, delaying spring green-up, and making plants more susceptible to attack from pathogens (Wenninger and Shewmaker 2014). Aboveground symptoms of damage to the roots can be confused with nutrient deficiency or disease (Tietz 2012, Wenninger and Shewmaker 2014). There are currently no pesticides registered to control CRC larvae, which are the most damaging life stage. Most of the research done on CRC has been done in the eastern US. For the western US, the differences in biology and economic impacts of this pest are not well understood. More work is needed to develop efficient CRC management options that target the most susceptible life stages. Management of alfalfa weevil, a pest which lives entirely aboveground, consists of pesticide applications made early in the season. It is unknown if these pesticide applications have an effect on CRC later in the year. Our goals are to, 1) track when damaging larval stages are occurring to better time management decisions, and 2) evaluate effects of alfalfa weevil chemical control measures on CRC.

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Alfalfa Stem Nematode (*Ditylenchus dipsaci*) is one of the most problematic alfalfa pests to control because populations can remain in the soil for extended periods of time. It reproduces inside stems causing short thickened internodes and is most damaging during the cooler times of spring and fall. As populations increase in plants, nematodes cause chlorosis (yellowing or white-flagging) and small, misshapen, "mouse eared" leaves. Infection can reduce green-up time, increase winterkill rates, and make plants more susceptible to damage from other pathogens and pests like aphids (Ramirez and Spears 2014). Fields with flood irrigation tend to have more problems than fields with sprinkler irrigation. Damage in flood irrigated fields is typically observed first at and around the headwater. ASN is best managed by preventing movement of contaminated soil and debris from affected fields to unaffected fields. This can be done by washing harvesting equipment before entering subsequent fields and cutting/bailing fields with known ASN populations last. Selecting alfalfa varieties with high ASN resistance ratings can assist in reducing damage in fields with a history of infection. Recommendations and model predictions suggest rotating to non-host crops for 2-4 years and, when reestablishing alfalfa into a field with a previous history of ASN, being aware that a rotation may be needed around 5-6 years depending on the ASN population buildup (Jordan et al. 2015).

METHODS

We took 16 soil cores from 4 fields distributed throughout northern Utah every other week, between June and July 2015, to obtain data on CRC life stage timing. Each soil core contained a plant including the taproot and surrounding soil. Soil was washed through sieves to recover insects and we recorded the number of CRC larvae, pupae, and adults.

To evaluate alfalfa weevil chemical control on CRC populations, we used a modified leaf blower as a suction sampler. We sampled six fields that applied insecticides and five fields that did not treat for weevil from May through September, in both 2012 and 2013.

RESULTS

In 2015, medium to large sized CRC larvae were already established in fields by June 1 and had mostly pupated by July 13 (Fig.1). During June 30 and July 13 we found equal numbers of larvae, pupae, and adults. After which, there was an increase in the number of adults found.

Results from 2012-2013 indicate that throughout the course of the season there were no differences in adult CRC numbers between insecticide treated and non-treated fields (Fig. 2). It is important to note that adult CRC peaked in August.

DISCUSSION

Based on collections made in 2015, the expectation is that larvae and eggs are in high abundance earlier in the season. However, more sampling is needed to verify their presence in the soil early on.

Spring pesticide applications targeted to control alfalfa weevil larvae do not have an overall effect on CRC adults. Since CRC deposit eggs in both the fall and spring, it is assumed that during the time period when early spring insecticide applications are made, the new generation of CRC is still in the egg or larval stage. Treatments for alfalfa weevil aboveground probably do not affect larvae that may be protected in the soil. This would suggest that control measures,

where necessary, may need to target the larvae themselves or adults occurring in the fall before they can oviposit. By further refining our understanding of the timing of each life stage in the region, we will be able to more appropriately time management decisions as options become available.

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Figure 1. Tracking clover root curculio life stages in northern Utah soil (2015)

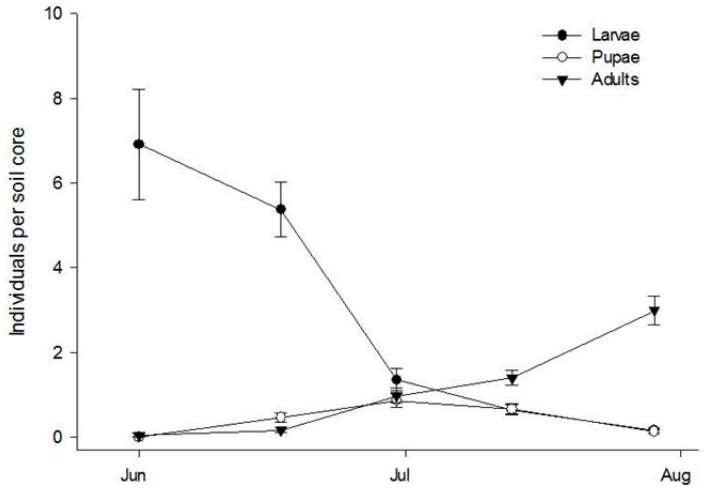

Figure 2. Effects of weevil pesticide treatments on clover root curculio adults (2012-2013)