PROJECT TITLE: Taproot Damage by Clover Root Curculio, *Sitona hispidulus* (Coleoptera: Curculionidae) and Other Factors Affecting Alfalfa Stand Longevity in Montana

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ABSTRACT: This study addresses critical concerns of forage alfalfa farmers in Montana where lack of stand persistence significantly reduces profit and in some cases effectively prevents sustainable forage production. Several factors have been identified in this study as possible effects of reduced stand density and yield including: plant disease, insect pests, weeds, moisture, field management and especially taproot damage by the cover root curculio complex, *Sitona hispidulus* (F.), *S. flavescens*, and *S. lineellus*.

INTRODUCTION: Alfalfa is the major forage crop grown in Montana with over 1.8 million acres in production supporting the $2.5 billion livestock industry. Producers and extension agents throughout Montana have identified stand productivity and longevity as critical issues, due to extraneous costs associated with planting and statewide problems with stand establishment, growth, and persistence. A well-known insect pest of alfalfa, notorious for reducing stand quality, density, yield, and longevity, is the Clover Root Curculio *Sitona hispidulus* (F.). Adults feed on foliage, however the larvae cause the majority of damage by burrowing into the soil in the spring and feeding on alfalfa nodules, lateral roots and eventually the taproot as the instars progress. This type of feeding removes plant tissues and leaves characteristic scars on the taproot, creating open wounds that invite the entry of various pathogens. In this first year of a three-year study, we look at state-wide incidence and severity of clover root curculio taproot damage along with incidence and severity of alfalfa diseases, both known to individually and collectively reduce stand vigor and longevity. We also consider other insects, field management, nurse crop and soil moisture as factors affecting stand longevity.

METHODS: Thirteen 1st year alfalfa fields in Montana (Fig.1) were sampled in spring and fall of 2005, coordinating visits with county extension agents and producers:

- Stand density counted within 14” metal ring (10 replicates) - percentage of weeds or nurse crop noted.
- Bi-monthly sweep samples of 25 sweeps per field taken by extension agents.
- Field management information recorded and updated by producer.
- Ten plants dug and assessed for foliar plant disease and growth parameters. Roots washed, presence of disease noted, and damage by
CRC determined on a six-increment rating scale, based on rough visual estimates of percent damage adapted from Kalb et al. (1994): 0=0%; 1=1-10%; 2=11-35%; 3=36-65%; 4=66-90%; 5=90-100%.

- Plants tested for alfalfa mosaic virus using DAS-ELISA pathoscreen-AMV kit from Agdia; blue results positive, clear negative.

**RESULTS and DISCUSSION:**

**Clover Root Curculio.** During adult species identification collected from sweep net samples, we found that the majority, 61% of *Sitona* were *S. hispidulus*, 26% *S. flavescens*, and 12% *S. lineellus*. Although the official Clover Root Curculio, according to the Entomological Society of America and Canada, is *S. hispidulus*, Bright (1994) writes of other *Sitona* known to cause economic damage to alfalfa including *S. flavescens* and *S. lineellus*. Therefore, in this study we refer to the Clover Root Curculio as a complex of these three *Sitona* species.

Most of the 13 field sites showed no taproot damage by clover root curculio in the early spring, but by fall, all fields had ratings of at least .5 varying up to 2.9. The variation in ratings seemed to be influenced by soil type; sandy soils have lower rates of damage, and silty and clay soils have a higher rate of damage (Fig.2). These findings are consistent with Pacchiolo and Hower (2004) who demonstrated that slightly moist silt-clay loam contained cracks larger than 1.0mm for CRC larvae increased access of first instars to alfalfa root nodules, whereas sandy loams did not contain large enough pores and the texture is abrasive to the cuticles of the larvae. Farming practices such as planting into an infested field, and available soil moisture determined as dryland versus irrigated systems also play a role in the amount of damage, but soil type is the major factor.

**Plant Disease.** Foliar diseases were more prevalent in the spring consisting of Spring Black Stem, Alfalfa Mosaic Virus (AMV), and cases of general leaf spotting and discoloration. The fall yielded mostly foliar discoloration and increased cases of AMV (an aphid or seed vectored disease). Fields in spring showed no evidence of crown or root rot but increased to 69% of fields in fall showing at least some disease. Incidence of crown or root rot did not seem to be correlated with rating numbers. For example, a field root with an average rating of .5 in the fall showed 30% root and crown rot and a root with a 2.9 rating showing no signs of root or crown rot. Kalb et al. (1994) found significant evidence that feeding by clover root curculio predisposed alfalfa plants to more severe crown and root rot, and in this case it seems that it is not the amount of CRC damage but only the presence is important to allowing pathogens into the roots.

**Other Factors.** Stand longevity and vigor are greatly affected by harvest or grazing and other field management practices like planting date and irrigation versus dryland systems. Insects in high numbers such as the alfalfa weevil and alfalfa caterpillars have been found in every field and can severely affect hay quality. Nurse crops and weeds also pose problems with stand density and yield.

**FUTURE ENDEAVORs:**

This statewide study will continue for the next two years and with more data we will correlate stand density and yield with the identified factors affecting stand longevity. Concurrent studies are continuing at Central Ag. Research Station looking at the use of nurse crops on stand density and longevity, and at the Southern Ag. Research Station and in Gallatin County looking at the effectiveness of Spring and Fall applications of Carbofuran on CRC taproot damage. We hope to eventually implement decision-making tactics for pest control and field management, leading to longer stand life and less economic stress for producers.
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LITERATURE CITED:

