

EVALUATION OF A NEWLY FORMULATED SLUG BAIT (FERROXX AQ) FOR CONTROL OF GRAY FIELD SLUGS IN WESTERN OREGON

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Introduction

Slugs remain one of the most damaging economic pests of the grass seed industry in western Oregon. The wet, mild climate of the Willamette Valley is especially conducive to the growth of slug populations, and grass seed fields with heavy amounts of crop residue are usually the crop most damaged by slugs (Dreves et al., 2015). Slug control is a particular challenge in the fall, when field crops are slowly emerging and vulnerable, dropping soil temperatures and increased moisture bring slugs to the soil surface, and baits do not withstand the heavy rains.

Metaldehyde and iron-based baits are commonly used in the Willamette Valley, and companies continue to formulate baits with the goal of making them more attractive to slugs and more rain-fast. Metaldehyde baits are available in multiple formulations (liquid, sand granules, and cereal-based). Their mode of action destroys the mucus-producing system unique to slugs, resulting in fairly rapid death. The cereal-based minipellets with metaldehyde have been shown to provide better coverage and last longer in rainy climates compared to larger baits. However, under wet conditions, baits degrade and slugs reduce feeding, thus potentially ingesting a sublethal dose of metaldehyde (Dreves et al., 2015). Baits also differ in their reapplication windows, and it is important to read the label; for example, Deadline MP has a reapplication interval of 21 days.

There are two types of iron-based baits on the market: iron phosphate and iron chelate baits. Iron-based baits cause slugs to stop feeding, and they usually die underground. Ferroxx (Neudorff North America) is an iron chelate bait that contains the active ingredient sodium ferric EDTA. It has been used for several years in the United States. Neudorff recently released a newly formulated iron bait called Ferroxx AQ, which is meant to hold up better under wet conditions. Both Ferroxx baits have no reapplication restrictions and may be reapplied when needed as the bait is consumed, or every 2 weeks. The objective of this study was to evaluate the newly formulated iron bait for control of slugs in a grass seed field in Oregon.

Materials and Methods

The study was conducted in a volunteer annual ryegrass field in Linn County during November and December 2015. The field was in its third year of volunteer annual ryegrass production, and no tillage had been completed for 5 years. The plots measured 50 feet x 50 feet and were established in a randomized complete block design that was replicated four times. The trial was located in an area of the field that was known to have high slug pressure.

There were five treatments as outlined in Table 1: (1) untreated control, (2) Ferroxx AQ, (3) Ferroxx, (4) Ferroxx AQ + Ferroxx (Ferroxx 50:50), and (5) Deadline MP. All baits were in minipellet form and

Table 1. Slug bait treatments and corresponding slug days per blanket calculated up to 14 days after bait applications.

Treatment	Composition	Rate	Slug days/blanket ^{1,2}
Control	NA	0	81.4 a
Ferroxx AQ	3% iron phosphate	15 lb/a	26.6 b
Ferroxx	5% sodium ferric EDTA	15 lb/a	17.7 b
Ferroxx 50:50	see above, 50:50 blend	7.5 + 7.5 lb/a	25.1 b
Deadline MP	4% metaldehyde	15 lb/a	32.7 b

¹Slug days were calculated by averaging the number of slugs per plot on two consecutive evaluation days, and multiplying the average by the number of days between the evaluations. Slug days between evaluations were summed for the sampling period until 14 days after application.

²Means followed by different letters are significantly different ($P < 0.05$).

were applied with a rotary bait spreader at dusk on November 9, 2015. Temperatures were between 50 and 55°F, soil moisture was present, and the wind speed was less than 5 mph.

Slug blankets were used to record slug numbers prior to baiting and at regular intervals after baiting. Three slug blankets (18 inches x 18 inches, designed by Liphatec, Inc.) were soaked in water and randomly placed in each plot. The first slug count (“precount”) was on November 8, one day before the baits were applied. Slug counts were then conducted at 4, 7, 14, and 25 days after the first bait application timing (Table 2). For each date, the number of slugs per plot was determined by averaging the number of slugs counted under the three slug blankets. After each evaluation, the blankets were moved to a new location within the plot.

The Ferroxx treatments were reapplied after 14 days, on November 23. The Deadline MP treatment was to be reapplied after 21 days, but freezing conditions were unfavorable for baiting; therefore, it was decided to delay the reapplication. Due to continued cold weather, precipitation and consultation with Neudorff, the trial was concluded after 25 days, on December 4. The Deadline treatment was not reapplied during the trial.

Data were analyzed by using analysis of variance (Statistix 10), and means were separated by using Fisher’s Protected LSD values ($P < 0.05$). Slug days were calculated by averaging the number of slugs per plot on two consecutive evaluation days (e.g., 4 and 7 days) and multiplying the average by the number of days between the two evaluations (e.g., 4). This calculation was done for each counting interval, and then slug days were summed for a total count across the sampling period. Slug days were compared only until 14 days after application, since the Deadline MP treatment was not reapplied at 21 days.

Results and Discussion

Approximately 6.25 inches of rain fell during the sampling period of this study. The prebait slug counts revealed high variability in slug numbers across the field (Figure 1). Prebait numbers ranged from an average of 4 to 11 slugs per blanket. Initial numbers were significantly higher in the Ferroxx 50:50 plots than in the Deadline MP or regular Ferroxx plots, and initial numbers were also significantly higher in the Ferroxx AQ than the regular Ferroxx plots (data not shown).

Slug bait applications significantly reduced slug numbers compared to the control plots ($P < 0.05$), both the overall slug days (Table 1) and across the sampling intervals (Figure 1). Results in the control plots demonstrate the effect of weather conditions on slug density; numbers increased as soil moisture increased and temperatures stayed above 40°F. Slug density drastically decreased as temperatures fell toward freezing at 14 days (Figure 1).

The Ferroxx treatments tended to perform better than Deadline MP (Figure 1). All of the Ferroxx treatments had significantly lower slug densities than the Deadline treatment at 25 days after application (data not shown), which is not surprising since Ferroxx baits were reapplied at 14 days and Deadline MP was not. The Ferroxx AQ and Ferroxx 50:50 treatments resulted in the sharpest reduction in slug densities (Figure 1), although the overall slug populations were not the lowest. Overall, the original Ferroxx bait had the lowest slug densities and was able to control slugs the longest (Table 1, Figure 1).

Results of this study indicate that both metaldehyde and iron-based baits can effectively reduce slug densities, as has been found in other bait efficacy studies (Anderson, 2011). The newer, more rainfall-resistant bait formulation of Ferroxx AQ seems to have

Table 2. Weather conditions noted in the field throughout the sampling period.

Sampling interval	Date	Air temperature (°F)	Conditions
Precount	Nov. 8	52	Intermittent rain
4 DAA ¹	Nov. 13	51	Cloudy
7 DAA	Nov. 16	41	Cloudy and windy
14 DAA	Nov. 23	37	Cloudy
25 DAA	Dec. 4	45	Cloudy, windy, rain

¹ Days after application

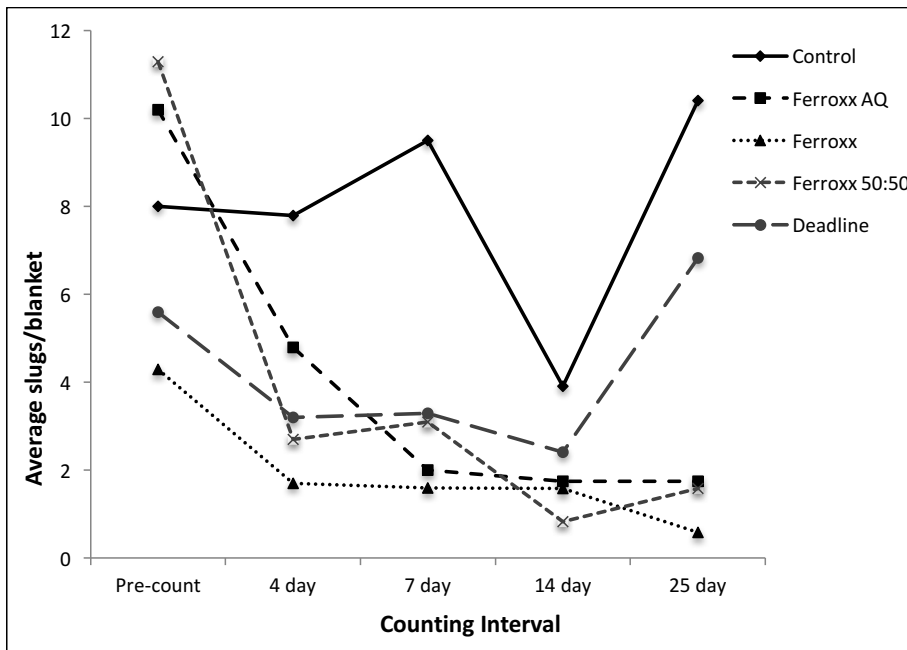


Figure 1. Average slug counts for each treatment across sampling intervals, Linn County, OR.

performed well at reducing slug populations early on, although overall does not seem to have improved the performance of these iron-based baits. Considering that slug populations were so variable across the plots, it would be best to perform additional efficacy studies. We were unable to evaluate the advantage of the narrower reapplication window with the Ferroxx baits as compared to metaldehyde, since Deadline MP was not reapplied at 21 days.

References

- Anderson, N.P. 2011. Evaluation of Ferroxx® slug bait for control of gray field slugs in western Oregon. In W.C. Young III (ed.). *2011 Seed Production Research Report*. Oregon State University, Ext/CrS 136.
- Dreves, A.J., N.P. Anderson, and C. Sullivan. 2015. Slug control. *PNW Insect Management Handbook*. Oregon State University. <http://pnwhandbooks.org/insect>

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