

Slug Populations in Grasses Grown for Seed

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I. Effects of Annual Ryegrass Cropping System on Slug Population

Annual ryegrass has been produced for years in the Willamette Valley with post harvest open field burns and/or plowing used as standard practices in establishing the next season's annual ryegrass seed bed. As this basic pattern has shifted to cropping systems that incorporate alternate grasses, legumes or new crops with increased frequency within a field, post harvest residue management in these same fields is also evolving from a system reliant solely on open field burns and/or plowing to non-thermal means of straw management such as baling, flailing or vacuum sweeping. Concurrently, conservation tillage and no-till systems of field management are being adopted with increasing speed. A change of farming practices is often accompanied by a corresponding change in insect, mite and slug pests-- their population structure and role as pests.

Crop Science Department has a number of on-farm sites demonstrating effects of cropping system and residue management on production of seed, crop growth, stand characters and weed management over successive seasons. We have used one such site, Smith Farms, Shedd OR, to study the effects and interactions of cropping system (tillage, seeding and volunteer crop management) and residue management on slug populations. Gray garden slug and marsh slug are the two species encountered in annual ryegrass production of western Oregon. Tremendous differences in slug numbers and damage to the crop are noticed from field to field by producers of the commercial crop. Below we describe the practices and their effects on slug numbers during the 1996-1997 season.

The treatments included: (1) plowing and conventional seeding, (2) spraying off sprouts and then no-till drilling, and (3) volunteer crop establishment (without sprout spray or seeding). In addition, imposed on each cropping system treatment was a post harvest residue management system treatment of either full straw (flailed and left in the field) or straw baled and removed, and stubble flailed. Each plot is 25 ft. x 50 ft., and replicated three times in a randomized block experimental design.

Slug populations were determined using open bait stations consisting of three metaldehyde bait pellets per station, with three bait stations within each treatment in each replicate. Number of slugs visiting each bait station was recorded 24 hours after each baiting episode, approximately weekly, between mid-October 1996 and mid-February 1997. Due to unfavorable slug conditions (freezing temperatures, wind, flooding) number of slugs could not be determined for some weeks during the fall and winter.

Table 1. Effects of annual ryegrass cropping system and post harvest residue management on slug populations, Smith Farms, Shedd, OR, 1996-1997.

<u>Cropping system</u>	<u>Residue Management</u>	<u>Total number of slugs per plot</u>
Plow + conv. seeding	Full straw	2.9 ab ²
	Baled and removed	0.7 a
No-till drill + sprout spray	Full straw	22.4 ab
	Baled and removed	27.1 bc
Volunteer crop	Full straw	50.5 cd
	Baled and removed	56.2 d

² Means followed by same letter do not differ significantly by Fisher's protected LSD (P=0.05)

Table 2. Effects of annual ryegrass cropping system and post harvest residue management on slug populations, Smith Farms, Shedd, OR, 1996-1997.

<u>Sowing method</u>	<u>Number of slugs per plot¹</u>
Drill	1.8 a ²
No-till	24.8 b
Volunteer	53.4 c
<u>Residue removal</u>	
Bale	28.0
No removal	25.3

¹ Total number per plot from nine evaluation dates

² Means followed by the same letter do not differ significantly based on Fisher's protected LSD (P=0.05)

Results and Discussion:

How the annual ryegrass stand was established in the fall (cropping system) had a greater effect on slug population than did how post harvest residue was managed (Table 1). Plowed plots, with or without straw residue, had the fewest number of slugs. Plots established with volunteer seedlings had the greatest number of slugs. A simple explanation for these observed differences may be due to presence and availability of food source for the slugs. September and October is a critical time of renewed slug activity. Plots with volunteer seedlings generally have the most growth, and therefore food, at this time of year. Feed availability and quality is critical to an expanding slug population.

In this experimental design, slugs are also more likely to migrate towards the plots with lush growth, which provides ample food and cover, and allows for successful feeding and reproduction. The individual plot size in this experiment must be considered when interpreting these results and extrapolating to field-size situations.

There were no statistically significant interactions between cropping system and post harvest residue management system: Table 2 presents mean number of total slugs for cropping system or residue management system. Statistically significant differences in slug populations occurred within the three cropping systems (Table 2).

At this site during this study, no differences in number of slugs occurred between plots where the straw was baled and removed and plots that had full straw left in the field. Lack of significant differences may suggest that there are more critical factors than post harvest straw management affecting slug populations, such as weather and soil conditions. Also, the narrow plots in this experiment allow for rapid migration by slugs from one plot to the next, creating quite a large opportunity for error in interpreted results.

II. Effects of Post Harvest Residue Management on Slug Population

Trials were established in tall fescue (Koos Bros., Lebanon, OR) and perennial ryegrass (Stellmacher, Albany, OR) to determine the effects of post harvest crop residue management practices on slug populations. Treatments at both sites included plots that were either baled and vacuumed or were flailed and the straw left in the field. Each plot was approximately 25 ft. x 400 ft. and replicated three times in a randomized block experimental design. Slug populations were determined as per method described in Section I of this report.

Table 3. Effects of post harvest residue management on slug population, tall fescue, Koos Bros., Lebanon, OR, 1996-1997.

Treatment	Number of slugs per plot										
	10/24	10/31	11/7	11/14	11/21	12/13	1/10	1/24	1/29	2/12	Total
Bale + Vac	6.5	7.8	15.0	12.7	9.7	17.5	18.2	1.7	5.2	2.4	96
Full straw	9.7	5.2	22.3	13.8	5.7	16.2	19.7	1.9	9.4	4.1	108

Table 4. Effects of post harvest residue on slug population, perennial ryegrass, Stellmacher, Albany OR, 1996-1997.

Treatment	Number of slugs per plot									
	10/24	10/31	11/14	11/21	12/13	1/10	1/24	1/29	2/12	Total
Bale + Vac	17.0	9.2	11.8	5.3	10.8	33.3	7.9	12.5	14.5	122
Full straw	15.7	10.0	10.8	5.3	17.0	28.9	5.7	18.1	14.3	126

Results and Discussion:

In either field, there were no statistically significant differences in slug populations due to residue management technique. The trend was for slightly fewer numbers of slugs in the plots where post harvest straw had been baled and vacuumed (Tables 3 and 4). Again, differences may be due to the fact that the plots are narrow and slugs migrated between plots. Interestingly, previous observations indicated that a greater number of slugs are found with increased post harvest straw load. This difference in results from one year to the next may be a function of weather, particularly amount and time of precipitation, and its influence on slug activity and availability of food and cover.

III. Effects of Grass Species on Slug Population

Different grass species grown in the Willamette Valley appear to experience different degrees of slug problems. The differences can be due to the micro-climate or soil type on which the different grasses are grown, or they may be due to differences in the grasses themselves.

Four different grass species, two cultivars each, growing side by side under the same micro-climate and soil type at OSU's Hyslop Research Farm were monitored for slug populations. Each plot is 115 x 150 feet.

Slug populations were determined using the methods described in Section I of this report; however, evaluations for this trial began in mid-September 1996 and continued until mid-February, 1997.

Table 5. Effects of grass species on slug population, Hyslop Farm, 1996-1997

Grass species and cultivar	Total number of slugs ¹
Chewings fescue	
SR 5100	137
Jamestown II	49
Creeping red fescue	
Shademaster	95
Seabreeze	97
Perennial ryegrass	
Affinity	144
Buccaneer	105
Tall fescue	
Fawn	150
Rebel II	192

¹ Total number of slugs per plot from fourteen evaluation dates

Results and Discussion:

As plots are unreplicated, statistical analysis of the effects of grass species on slug population could not be performed. However, there appears to be differences in slug population between grass species (Table 5).

The Chewings fescue cultivar Jamestown II had from two to four times fewer slugs than any of the other cultivars. This could be an indication that Jamestown II provides less desirable food and/or habitat for slugs; however, the low slug counts in this plot may be more attributable to environmental conditions. The Jamestown II plot is located in the wettest part of the field and experiences saturated conditions more often than the other plots. Slugs do not tolerate saturated soil conditions very well and would be more likely to not establish or migrate out of the plot under such circumstances.

Overall Summary and Considerations:

The trials described in sections I and II were conducted on plots previously established by the grower and the Crop and Soil Science Department. In retrospect, this design served the agronomic aspects under study very well. Unfortunately, the narrowness of these plots very likely allowed easy access of slugs to adjacent plots. Slugs can travel over 20 feet in the course of being above ground while searching for food. Interpretation of experimental results must be done with migration as an overriding factor in these trials.

Results of studies reported here, as well as ongoing and previous trials, can be used to explain some of the key factors in annual ryegrass production that influence slug populations. Plowing, quite simply put, destroys slugs and is an extremely effective method to manage slugs. Shallower tillage also can contribute to slug mortality, by crushing individual slugs and destroying soil structure critical to subsurface survival and movement. However, there is a critical depth to which the soil must be disturbed to effect any control. Very shallow tillage, as used for weed control purposes, can create problems because slug populations are not impacted at this shallow depth. Additionally, the soil has been disturbed and, often, the structure thus created allows gray garden slugs to feed undetected under the soil surface, destroying swelling seeds and very young seedlings prior to appreciable emergence.

On the other extreme, no-till establishment favors optimum slug populations by allowing soil structural integrity to remain undisturbed. Volunteer seedlings used to establish a new crop in the fall provide an early, abundant and excellent food source for slug populations establishing in the fall. If these are removed by herbicide to accommodate a direct seeded crop, all subsequent feeding activity is shifted to the few plants that emerge in the row.