GSCSSA Final Report - 2006

Title: Cereal Leaf Beetle in Oregon: Potential Impacts on Grass Seed and Sustainable Management (Year 1)

Objectives:
Our objectives were to:

1. To evaluate foliage-feeding damage by larvae and adults on grasses grown for seed under choice and no-choice situations.
2. To determine if cereal leaf beetle development on grasses grown for seed is similar to its development on cereals.
3. To evaluate pheromone trapping of cereal leaf beetle for monitoring and early detection.

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Industry Cooperators:
Grass seed growers and field men in the Willamette Valley and eastern OR.

Abstract:

Diverse grasses that are grown for seed in Oregon, oats and wheat were planted in spring to determine host preference by cereal leaf beetles (CLB). Weekly observations indicated higher numbers of adults, eggs and larvae on cereals compared to the grasses indicating that, in spring, CLB prefers cereals to grasses. However, in late summer when the cereals dry, adults are likely to move to grasses and cause damage. Pheromone traps captured significantly higher numbers of adults compared with controls indicating they have potential as a monitoring tool for early detection of over wintering CLB adults as they move to host plants in spring.

Justification:

The cereal leaf beetle (CLB) is a pest in grains. It is also known to attack grasses, but its impacts on diverse grasses is not known. A study is needed to determine whether the grasses that are raised for seed in Oregon are at risk of attack by CLB. In addition, pheromone traps will be useful for detecting CLB adults when they move from overwintering sites to cropping systems in early spring. If high numbers of beetles are attracted to the pheromone, an attract-and-kill strategy can be developed for reducing populations before they migrate to grasses in late summer.

Report:

Objective1&2: To evaluate foliage-feeding damage by larvae and adults on grasses grown for seed under choice and no-choice situations, and to determine if cereal leaf beetle development on grasses grown for seed is similar to its development on cereals.

In this study we examined the responses of overwintering and late summer adult CLB to fall and spring planted grasses in the presence of oats and triticale. The following were planted: fall planted grasses (perennial rye grass, annual rye grass, orchard grass, Kentucky bluegrass, fine fescue, tall fescue), spring planted oats, triticale, plus spring planting of all 6 grasses listed above. The experiment was set up as a randomized block design with 3 replicates. Weekly observations were made on the number of adults, eggs and larvae in 1 foot row samples from the end of April till the first week in July.

There was no significant difference in numbers of adults on various fall planted grasses and cereals while spring planted grasses did not attract any adults. Feeding and egg laying was observed on these grasses but damage was not significant. Narrow leaved grasses such as Kentucky bluegrass and fine fescue attracted few adults in comparison. In late summer spring planted grasses had higher numbers of adults compared with cereals. This indicates that in the presence of spring planted oats and triticale, spring planted grasses did not attract overwintering CLB adults. However, in summer, adults that emerged were attracted to all grasses though fine fescue had few adults. Damage to grasses ranged from low to high. There was no difference in development of CLB adults or larvae on grasses compared to development on cereals.

This study indicates that spring planted grasses such as annual and perennial rye grass, orchard grass and tall fescue are at risk for damage by adults at the end of summer when the cereals are dry and CLB adults need a food source prior to dispersal to overwintering sites. Overall, the impact of CLB on grass seed appears to be dependent on the presence of cereals in neighboring areas. It is critical that CLB adults are monitored in grass seed fields in late summer to determine whether an insecticide application may be necessary. New seedlings need to be watched to see if damage in early stages of development affects plant growth as this can have an impact on subsequent seed yield

Objective 3. To evaluate pheromone trapping of cereal leaf beetle for monitoring and early detection.

The study was conducted at the Oregon State University Eastern Oregon Agricultural Experiment Station located in Union in a newly-seeded 2.4 hectare field of spring planted oats (var. Jerry) in 2002. Normal crop production practices were followed but insecticides were not applied at any time. Yellow sticky traps were attached to bamboo stakes for trapping CLB adults.. Traps were baited ten days prior to emergence of oat plants. Six treatments were evaluated and the experiment was set up as a randomized block design with ten replicates. In each block, traps were set up in a line, 15 m apart.

The pheromone was tested at 3 dose levels to determine if there was a dose response. In addition, we tested a volatile compound produced by oats in high quantities in response to feeding injury, (Z)-3-hexenyl acetate (HA), to determine if there was a synergistic effect to the pheromone attractant. Treatments included: 50 µg P + HA; 150 µg P + HA; 500 µg P + HA; HA alone; 500 µg P alone; unbaited control. Freshly formulated P was added to rubber septa and stored in a freezer prior to use in the field. HA (4 mg) was added to rubber septa that were placed in capped polypropylene vials to which a single pin-hole opening was made for slow release of the material. P and HA lures were attached with clips on the downward side of the yellow sticky traps. A week later, captured CLB adults were counted, removed from the sticky trap, and preserved in 70 % alcohol. Lures and sticky traps were replaced every week. The experiment was set up on May 9th and continued for 5 weeks.

The data on numbers of captured adults was analyzed using ANOVA. The analysis indicated that differences in the number of captured adults across treatments were highly significant (Fig. 1). While all three pheromone doses tested captured more adults than the control, the highest pheromone dose attracted the greatest numbers of adults. These results suggest that response to pheromone is dose-related. The trap baited with only the plant volatile compound, HA, attracted the same number of beetles as the control. In addition, there were no differences in numbers of captured adults when comparing the highest pheromone dose with and without HA. This suggests that HA does not have a synergistic effect on the pheromone. The number of captured adults across all treatments increased from an average of 12.5 beetles per trap in the first week to 27.5 per trap in the third week (Fig. 2). Subsequently there was a decline and the weekly average dropped to 1.08 per trap in the fifth week. In the first three weeks, a comparison of the treatments with the highest (500 µg P) and lowest (control) mean captures indicated that there were more than thrice as many adults on traps with 500 µg P compared to the control in each week. The experiment was repeated with higher doses of pheromone and wit an inverted T yellow sticky trap. The results indicated that with 5 mg of pheromone, on average, over 200 beetles were captured in a week.

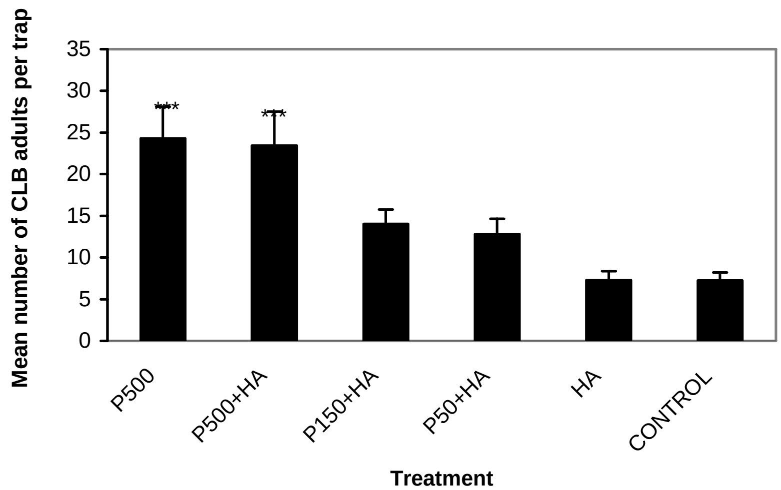

Fig. 1. Mean number (+ SE) of overwintering CLB adults captured in 5 weeks on yellow sticky traps baited with synthetic CLB aggregation pheromone (P) and plant-related compound (Z)-3-hexenyl acetate (HA) placed in an oat field in Oregon. Means significantly different from the control at the $\alpha = 0.001$ and 0.01 levels denoted by *** and **, respectively.

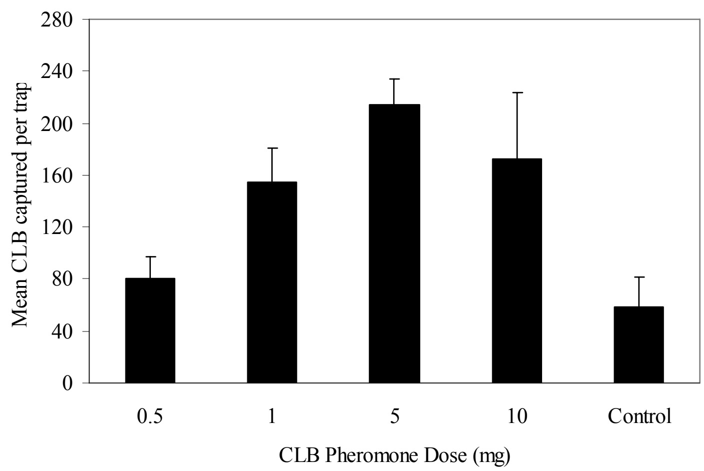

Fig. 2. Mean number of CLB adults captured on yellow sticky traps baited with aggregation pheromone.

Based on these results, the CLB aggregation pheromone has potential to become an important monitoring and management tool, especially in the spring, as new fields become infested by beetles emerging from diapause. A modified trap is required as the yellow sticky traps are messy. For large scale adoption, a source for the pheromone is critical. Currently the pheromone is being synthesized by researchers at the USDA lab in Peoria, IL. A private company, Pherotech, was interested in synthesizing the pheromone but preliminary attempts indicated tat the cost was too high.

Interactions: The research was conducted in collaboration with researchers at Oregon State University main campus and the Union County Extension Service, and with researchers at the USDA lab. in Peoria IL, who synthesized the pheromone.

Publications:

- Rao, S., Quebbeman, B. and Walenta, D. 2004. Host range of cereal leaf beetle. *In* Young, W. C., Ed., Seed Production Research, Oregon State University Publication 123: 50-51.
- Rao, S. 2004. Cereal leaf beetle: host range and field evaluation of aggregation pheromone. Proceedings 63rd Annual PNW Insect Management Conference, Portland OR, pp: 30-32.
- Rao, S., Cossé, A. A., Bartelt, R. J. and Zilkowski, B. W. 2003. Aggregation pheromone of the Cereal Leaf Beetle: field evaluation and emission rates. *J. Chem. Ecol*. 29:2165-2175.

Presentations:

- Cereal leaf beetle: host range and field evaluation of aggregation pheromone. Pacific Branch Meeting, Entomological Society of America, Bozeman, MO. June 2004.
- Cereal Leaf Beetle activities, Hyslop Farm Field Day, Corvallis, OR. May 2004.
- Rao, S. 2003. Cereal Leaf beetle impacts on grass seed production. Grass Seed Cropping Systems for Sustainable Agriculture, Annual Meeting, Spokane, WA.