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Grasshopper Management in the Pacific Northwest

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Introduction

GRASSHOPPERS ARE COMMON plant-feeding insects found in the Pacific Northwest. Large numbers of them can greatly injure crops such as alfalfa, cereals, corn, potatoes, and grasses. A greater understanding of these insects can help farmers, ranchers, and other landowners keep populations at manageable levels. The most economically damaging and commonly found grasshopper species in the region include the two-striped grasshopper, *Melanoplus bivittatus* (Figure 1); the migratory grasshopper, *Melanoplus sanguinipes*; the clear-winged grasshopper, *Camnula pellucida*; and the red-legged grasshopper, *Melanoplus femurrubrum* (Figures 2 and 3). To properly manage grasshoppers, it is important to understand their life cycle, to estimate their populations, and to identify the best-available management options.

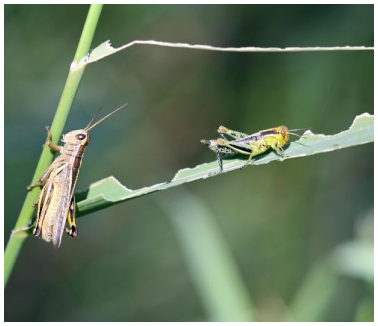

Figure 1. Two-striped grasshopper, multiple life stages. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org. Licensed under a Creative Commons Attribution 3.0 License.

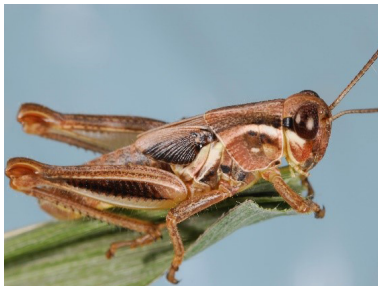

Figure 2. Red-legged grasshopper nymph. Photo by Joseph Berger, Bugwood.org. Licensed under a Creative Commons Attribution 3.0 License.

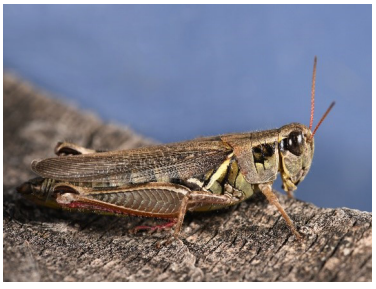

Figure 3. Red-legged grasshopper adult. Photo by Joseph Berger, Bugwood.org. Licensed under a Creative Commons Attribution 3.0 License.

Biology—Life Cycle

Grasshoppers begin their life cycle in the fall when a female lays her eggs in the top 1–2 inches of soil, starting in July and ending in September. Most eggs that hatch are laid in grasslands, ranges, pastures, ditches, and field borders. Hatching can occur as early as April and continues into late May (Pfadt 2002).

Newly emerged grasshoppers are called **nymphs** and quickly begin feeding. At this stage of their growth (nymph) they can crawl, jump, and travel more as they develop. They feed on a variety of plants, including crops, native plants, and weeds. While in the nymph stage, grasshoppers go through five growth stages, or instars. After each instar, they shed their exoskeleton (sometimes called the cuticle), a process known as molting. With each subsequent instar the insect increases in size until it reaches the adult stage, which is characterized by the development of functional wings.

Because nymphs molt during each instar stage, and temporarily lack a cuticle, they are more static and vulnerable. Management techniques are consequently much more effective when applied at this stage. Indeed, adults feed less and are much more mobile as they mate and lay eggs (Hewitt 1983). Therefore, the best time to manage grasshoppers is at the smaller nymph or instar growth stage.

Scouting

Scouting should begin in the spring, one hundred days after the first 50°F daytime temperature. One key to successful scouting is to pay attention to where females lay their eggs in the fall. Typical areas to scout include field borders, sides of dirt or gravel roads, or areas with more open soil such as next to public land and desert. If you know where the egg beds are located, you can more easily control the nymphs as they emerge and before they start to move. To scout:

1. Familiarize yourself with an area one square foot in size.
2. Identify a location approximately 50–75 yards from your current location.
3. Walk towards the location. Once you are within easy viewing of the ground and vegetation, count any grasshoppers you see in the one square foot area.
4. Record the number of grasshoppers seen.
5. Repeat steps 2–4, eighteen times.
6. Add up the number of grasshoppers seen across all locations and divide the total by two.
7. Record this figure as the total number of grasshoppers per square yard.

Sites should be random, 50–75 feet apart, and include north- and south-facing areas. Use your scouting results to determine the threshold of the field or area monitored. The threshold numbers will help you decide if it is economical to control the pest population (Table 1).

Life Stage	Span	Time Period	Behavior	Effective Controls	Less Effective Controls	Damage Amount
Egg	6-8 Months	July-April	Hibernating.	Fall or Spring Tillage.	-	-
Nymph	5-6 Weeks	April-May	Rapid Growth, High Feeding, & Low Movement.	Dimilin 2L. NoLo Bait.	Carbaryl. Malathion.	High
Adult	5-6 Weeks	June-August	Reproduce, Disperse, High Movement & Low Feeding.	Carbaryl.	Malathion.	Low

Figure 4. The life cycle or stage of grasshoppers as it relates to age (span), time period, behavior, effective control methods, and potential damage to crops.

Table 1. Threshold numbers. Treatment guidelines based on the number of grasshoppers (nymphs and adults) per square yard. Adapted from Wright and McMechan 2017, Table 1.

Grasshopper Population	Within Field	Field Border	Treatment Necessary
Noneconomic	0–2	5–10	No
Light	3–7	11–20	Depends
Moderate	8–14	20–40	Probably
Abundant	>15	>41	Yes

The most effective way to scout for grasshoppers is by using the random sampling method described above. Scout the borders of your field early in the season because grasshoppers generally hatch in untilled field borders before migrating into the field. If you observe populations >41/yd^2 in field borders, treatment is necessary (Table 1). If you scout early enough, you can treat the grasshoppers in the field borders before they have caused significant crop damage. Later in the season, if you scout and discover an average of 15 grasshoppers/yd^2, control is necessary.

If populations are such that you must control grasshoppers each year, be sure to start scouting earlier the following year because populations are cyclical and don't usually disappear in a single year. Paying attention to growing populations of grasshoppers year after year can be a clue that populations are building and may become a problem.

Control Methods

Biological Methods

Nosema locustae is a commercially available fungus, commonly referred to as Nolo Bait. Nolo Bait should be applied near known hatching areas early in the spring before the nymphs emerge from the soil. The bait is slow to act but can provide long-term management in highly infested areas. It causes a debilitating disease, so there may not be a noticeable population decrease in the first year, but its effect carries over from year to year. The product can be used in small grain fields and applied at 1–2 lb/acre. A second application can be applied 2–6 weeks after the first application if the grasshoppers have migrated.

Chemical Methods

Contact or stomach poisons. Malathion is one of the most commonly used insecticides. It kills nymphs, adult grasshoppers, and Mormon crickets. It is a contact and stomach poison insecticide, so it kills grasshoppers after you spray them with it or if they ingest it. It acts quickly, usually killing within 24–72 hours, with essentially no residual effects. It generally works better in warm weather. Use it with caution, however, for it is nonselective, with a high risk of affecting nontarget species. Thus, use it only when populations are high and require immediate control.

Malathion can be highly effective on hatching areas and used when the nymphs emerge. This will help keep treatments to small areas and save on application costs. Indeed, disciplined treatments are important, because malathion is a cholinesterase inhibitor—exposure due to improper application can be harmful to humans. Read and follow label directions, paying attention to the Personal Protective Equipment (PPE) requirements found on the label.

Carbaryl (Sevin) is a general-use carbamate insecticide for outdoor use only. It is available as wettable powder, liquid concentrate, dust, granules, and a ready-to-use product. A stomach poison, carbaryl must be ingested by a grasshopper to be effective. Although it will kill nymphs or adults, it works best on nymphs when they are actively eating. The United States Department of Agriculture–Animal and Plant Health Inspection Service has approved formulations to impregnate wheat bran, rolled whole wheat, and grape and apple pomace with carbaryl. In that case, aerially apply it at 10 lb/acre and reapply it after rain. What's convenient about carbaryl is that it can be applied manually at ground level and without temperature restrictions. Be cautious when using this pesticide, because it can harm other insects, especially bees. A cholinesterase inhibitor, carbaryl can be harmful to humans as well, particularly after skin exposure due to improper application. As always, read and follow label directions, paying attention to the PPE requirements found on the label.

Growth regulators. Diflubenzuron (Dimilin 2L) is a general-use insecticide and the preferred choice for widespread control because it is safer

to use around pollinator species, fish, birds, and mammals. Indeed, it only affects creatures that have a chitin exoskeleton (like juvenile grasshoppers). The pesticide inhibits the formation of chitin, thus preventing a grasshopper from fully forming a complete exoskeleton after shedding the previous one. The reaction leaves the insects exposed to the elements, where they will die of exposure. Diflubenzuron is not effective for controlling adult grasshoppers, however, because they don't shed an exoskeleton. Results aren't immediate—the pesticide kills insects within 7–10 days with a 28-day residual. If considering using this insecticide, monitor the life cycle of the population first. If composed mostly of winged adults, the pesticide will not be effective and thus use of Dimilin 2L is not advised.

If composed of younger grasshoppers, one proven, effective strategy for using Dimilin 2L is to apply it in intermittent strips across range and pasture rather than broadcasting 100% area coverage. This technique is called Reduced Area and Agent Treatment (RAATS). RAATS allows less material to be used, which saves money. The migrating grasshoppers move into the treated strips, allowing them to be controlled effectively.

Before using any pesticide be sure to read and follow the label instructions. Pesticide formulations change periodically, so labels vary year to year.

Conclusion

Fields at a higher risk of grasshopper damage border rangeland or large pastures in the midsummer months (e.g., early to mid-July), when rangeland grasses go dormant, thus limiting the food resources of grasshoppers. Fields with high-density cropping areas, however, are at a lesser risk. Remember, the difficulty in controlling grasshoppers involves numbers, not body size. Indeed, nymphs are very small when they hatch, but they are the easiest to control. When grasshopper populations reach high numbers, they can cause significant damage to cash crops such as cereals, alfalfa, and grasses. Timely scouting helps producers identify potential problems early. If you miss that window and the population has dangerously increased, using the pesticides mentioned at the correct life cycle stage can help to manage an infestation before significant crop losses appear.

Further Reading

Hewitt, G. B., and J. A. Onsager. 1983. "Control of Grasshoppers on Rangeland in the United States—A Perspective." *Journal of Range Management* 36: 202–7.

Pfadt, R. E. 2002. *Field Guide to Common Western Grasshoppers*. 3rd ed. Laramie: Wyoming Agricultural Experiment Station Bulletin 912. https://www.ars.usda.gov/ARSUserFiles/30320505/GH_pdfs/FieldGde.pdf.

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Wright, R., and J. McMechan. 2017. "They're Back . . . Time to Scout Field Borders for Grasshoppers." Institute of Agriculture and Natural Resources: Cropwatch (University of Nebraska-Lincoln). https://cropwatch.unl.edu/2017/scout-field-borders-grasshoppers/.

ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater—To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

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