Grasshopper Monitoring and Control in British Columbia

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Of the estimated 60 species of grasshoppers found in British Columbia, two species are of economic importance in most outbreak situations. These are the clear-winged grasshopper, *Camnula pellucida*, and the migratory grasshopper, *Melanoplus sanguinipes*. Other species, such as the two-striped grasshopper, *Melanoplus bivittatus*, and the redlegged grasshopper, *Melanoplus femurrubrum*, have also been recorded causing problems in B.C. Rangelands are under constant threat from grasshopper outbreaks during which grasshoppers compete with livestock for available forage. It is important that grasshopper outbreaks be detected early and any control actions be taken at the correct time and on an economic basis.

Biology of Grasshoppers

Economic species of grasshoppers overwinter in pods of 20 to 30 eggs laid in the soil the previous year. These pods are very resistant to cold and drying. Depending on site and weather, the eggs hatch during May and June and the young hoppers (nymphs) begin feeding and growing. Over the next 4 to 6 weeks they will pass through five stages (called instars) at which times they shed their skins in order to grow. Fully winged adult hoppers emerge from the final instar and begin mating about a week later. Only adult hoppers are able to fly and reproduce. During outbreaks when suitable forage is scarce, adults will swarm over large areas in search of food. Swarming will cease when females begin laying eggs. Each female can lay two to three egg pods per week until she dies due to freezing temperatures.

Clear-winged grasshoppers tend to lay their eggs in concentrations or beds around sloughs and draws in rangelands. Egg beds will also be found in unbroken sod along roadsides, fences and pastures.

Migratory grasshoppers and other *Melanoplus* species tend to scatter their egg pods on drier hillsides and in weedy areas, especially where the sod has been disturbed and vegetation is sparse, such as stubble fields, road allowances, over-grazed and weedy pastures.

Weather conditions play a very important role in the survival of hoppers and development and intensity of outbreaks. Outbreaks are usually preceded by 2 to 3 years of above average temperatures during the summers and falls. Warm, snow-free falls allow hoppers more time to feed and lay eggs and allow more complete egg development for faster and more even hatching the next spring. A late spring and cool summer delays nymphal development so that fewer adults are available to lay eggs. Cool, wet conditions during hatch will increase nymphal mortality; in August and September, such conditions will slow down egg laying. An early fall will cause many females to die before laying their full complement of eggs.

Damage and Action Thresholds

Grasshoppers feed on a wide variety of grassy and broadleaf plants, and if preferred hosts are lacking, will attack trees and shrubs. The amount of damage or crop loss is directly related to the number of grasshoppers present. Clear-winged grasshoppers prefer sedges and grasses, including cereals. Migratory grasshoppers and related species feed on both grassy and broadleaf plants, hence their preference for weedy areas.

Research has found that over the season, 12 to 24 grasshoppers per square metre in bluegrass pasture eat as much forage as one cow per acre. A population of one grasshopper per square metre destroys about 11 kg of forage per hectare per month (10 lbs/acre/month). When weather conditions promote adequate forage production to compensate for grasshopper feeding, they are not a serious threat and numbers can increase unnoticed. However, when conditions adversely

affect forage production, grasshoppers become serious competitors to livestock for food. Loss of desirable forage species has also been reported, especially if stocking rates are not adjusted to accommodate grasshopper feeding. Infestations can also spill over into adjacent cultivated forage and cereal crops causing extensive losses if left uncontrolled.

Table 1 lists grasshopper infestation ratings as indicated by nymph and adult counts and the possible action required.

Table 1. Nymphs and Adults per Square Metre

Rating	Field	Roadside	Control Action
Normal	0 - 3	0 - 6	not required
Light	4 - 6	7 - 12	usually not required
Moderate	7 - 12	13 - 24	may be required
Severe	13+	25+	required

For rangeland, use the values under Roadside to establish infestation rating. The quality and quantity of the forage (AUM value), cost of alternative or supplemental forage sources and cost of control (product and application) should be considered when deciding whether control is justified.

Monitoring Grasshopper Populations

It is important to locate the egg beds or infestations as early as possible so that grasshopper development, abundance and spread can be closely monitored. As part of the process to decide whether or not to take action against a grasshopper infestation, essential information to be considered is 1) grasshopper abundance, 2) predominant species of grasshoppers present, 3) stage of grasshopper development (size), and 4) range condition.

1) Grasshopper abundance

By observing where grasshoppers are laying eggs in the late summer and fall, time will be saved the following spring in locating hatching nymphs to begin monitoring the population. A sweep net (a mesh or cloth bag attached to a hoop with a long handle) is useful in collecting the small (4 to 5 mm long) nymphs. It is important that infested sites be monitored weekly for the first 3 weeks (longer if hatching is delayed), then every other day. Inspections should be made during the warm part of the day when the hoppers are most active and easier to spot.

Inspections involve walking through the pasture in a 'W' pattern and counting the number of grasshoppers in each of 20 one-square-foot areas spaced 15 to 20 paces apart. At a minimum, stop at 4 points along each leg of the W. For each stop, select a square foot area well ahead of you and, as you approach and step down, count the number of grasshoppers within or jumping out of that square foot. Walk into the field, not just along the margin where the hoppers may be more abundant due to movement in from adjacent areas. Total the number of hoppers counted and divide by 2 to get the number of hoppers per square metre.

This sampling procedure should be repeated at enough locations in the pasture to give a good indication of the grasshopper situation throughout the pasture and the location of hot spots.

2) Grasshopper identification

Newly hatched clear-winged grasshopper nymphs are black in colour with a distinctive white band around the thorax (body section right behind head). Adults are yellowish to brownish in colour, about 21 to 32 mm long, with clear wings mottled with rounded brown spots. They have two stripes beginning at the thorax and converging at the tip of the wings.

Migratory grasshopper nymphs have black bands on the top of their thorax. Adults are grayish to reddish-brown on top, yellow beneath, and a little larger than clear-winged adults. The front wings have no stripes but have small black square patches rather than the rounded brown spots of clear-winged adults. The thorax has a pale stripe along each upper edge and black bands on the sides.

Two-striped grasshopper nymphs are green to yellowish-brown in colour. Adults are much larger than the preceding species (up to 40 mm long), and are distinguished by having two pale stripes extending back from the eyes to the tip of the wings.

Redlegged grasshoppers are grey-green to yellow brown above and yellow beneath. The last segment of the hind leg is red.

A 2nd or 3rd instar migratory grasshopper (*Melanoplus sanguinipes*). Wing buds are starting to develop on the side (indicated by the arrow).

Adult migratory grasshopper (*Melanoplus sanguinipes*). Arrows show the rows of spots and reddish legs, indicative of the species.

A 5th instar two-striped grasshopper (*M. bivittatus*) nymph; identifiable by the two prominent stripes on the thorax.

A clearwinged grasshopper (*Camnula pellucida*) adult; identifiable by the blotchy spots on the hindwings.

3) Stage of development

As previously mentioned, grasshoppers grow by shedding their skins periodically, and their current stage of development (instar) can be roughly determined by their size (length). By monitoring the growth of the hoppers, application of chemicals can be properly timed against the most susceptible stages and before significant damage has occurred. Grasshoppers are best controlled when most are about 6 to 10 mm long. At this time most eggs will have hatched. However when egg hatch is prolonged by cool weather, additional treatments may be necessary if numbers warrant. As grasshoppers get larger they require more chemical to control and forage loss increases.

4) Range condition

Grasshoppers should be controlled when they are so numerous that the cost of controlling them is less than or equal to the expected value of the crop or forage losses. Therefore it is important to assess the condition (quality and quantity) of the plant stand as part of deciding whether or not it is economic to apply a chemical or other treatment. Under hot, dry conditions and poor plant growth, fewer hoppers will cause economic losses compared to conditions that favor plant growth. However if the forage is worth little, chemical control may not be justified because the cost is greater than the value of the crop saved.

Pest Management

Various options are available to manage grasshopper populations and minimize crop losses. Use of any one or combination of options (integrated pest management) is dependent on compatibility with the crop and production system.

1) Natural control

As previously mentioned, weather plays a major role in grasshopper population increases and decreases. There is little one can do to influence the weather, however knowledge of its

relationship to grasshopper populations is useful in anticipating potential changes in grasshopper abundance. Grasshoppers are attacked by a number of natural enemies such as other insects and several disease organisms, as well as many birds and rodents. Next to weather, natural enemies probably have the greatest influence on localized grasshopper abundance. Two diseases, *Nosema locustae* and *Entomophaga grylli*, are commonly observed in B.C. during outbreaks. Dead nosema-infected grasshoppers turn brown and are fed upon by other grasshoppers, helping to spread the disease. Grasshoppers killed by *Entomophaga* are easily seen clinging to the stems of grasses and other plants. Research is underway on development of biological control products containing these disease-causing organisms, as well as the disease organisms *Beauvaria bassiana* and *Metarhizium anisopliae* strains.

2) Cultural control

Cultural control methods involve the application of crop management practices that discourage or delay the development of grasshopper populations or facilitate the chemical control of outbreaks. For pastures, research has shown that natural grass stands have fewer grasshopper outbreaks than tame grass pastures because of greater plant diversity and fewer economic species of grasshoppers. By not over grazing, pastures will have less broadleaf plants to attract *Melanoplus* species. Cultural methods used to control grasshoppers in cultivated crops include seeding as early as possible (crop gets a jump on the hoppers), crop rotation (seeding less favored crops in infested fields), tillage (eliminate food plants in spring and fall) and seeding traps strips (concentrate hoppers for more economical chemical control).

3) Chemical control

When natural and cultural controls fail to prevent outbreaks, the only option left to protect crops is to apply an appropriate chemical control product when and where necessary. By following the monitoring methods previously described, areas requiring treatment can be identified and treated in a timely fashion.

Before applying any chemicals, carefully read the label for mixing and application instructions, and any precautions such as interval before grazing or harvesting.

Registered insecticides include:

Alfalfa, Range, Pasture: EcoBran*, Cygon/Lagon, Malathion, Matador/Warrior, Sevin, Dibrom, Coragen, Nolobait**

Canola: EcoBran*, Decis, Cygon/Lagon, Lorsban/Pyrinex/Nufos, Matador/Warrior, Malathion, Ripcord/Mako, Sevin, Nolobait**

Cereals: EcoBran*, Decis, Lagon, Lorsban/Pyrinex/Nufos, Matador, Malathion, Ripcord/Mako (wheat and barley only), Sevin, Coragen, Nolobait**

*EcoBran is a spreadable bran bait containing Sevin (carbaryl) that requires a special truck or ATV mounted applicator for proper application. The product should be applied for very young grasshoppers.

**Nolobait is a spreadable bran bait containing *Nosema locusta*, a microbial organism that when eaten, causes disease in grasshoppers of all ages, resulting in death. This product optimally should be applied for very young grasshoppers.

Refer to the Canadian pesticide label for details on appropriate use of these or any insecticide.

For more information:

- Grasshoppers - Their Biology, Identification and Management - U.S. Department of Agriculture
- Grasshopper species to watch for, on the Canadian Prairies and Northern Great Plains - University of Lethbridge
- Controlling Grasshoppers - Frequently Asked Questions - Alberta Agriculture & Rural Development