4-1-2011

Integrated Pest Management Strategies for Grasshopper Management in South Dakota

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Recommended Citation
http://openprairie.sdstate.edu/extension_extra/327
Historically, grasshoppers have been a chief insect enemy to farmers and ranchers in South Dakota and the United States. Although grasshoppers are a natural component of our ecosystem, with some even being beneficial, in large numbers they can have an economic impact on agricultural commodities.

When grasshoppers reach threatening populations that are economically damaging to our crops and rangelands, we typically use chemicals (insecticide) as the main method of control. However, there are integrated pest management (IPM) strategies that have been developed over the years as an approach to controlling such pests as grasshoppers. These IPM strategies include using biological, cultural, and physical (mechanical) control methods.

When considering initiating an IPM grasshopper-management program, it’s important to first understand the insect’s life cycle, the number of nymphs and adults present, and whether, based on costs, the damage at the present time warrants treatment. It’s also important to know if the grasshoppers in question are considered to be problems or pests. Not all grasshoppers are pests.

**GRASSHOPPER LIFE CYCLE**

There are three stages to a grasshopper’s life cycle: the egg, nymph, and adult. Eggs are deposited by grasshoppers in the soil the previous fall and will start hatching in the spring about 14 days after the soil temperature reaches 60°F. Grasshoppers typically deposit eggs and hatch in areas such as roadside ditches, dry grasslands, and other uncultivated areas with bare patches of soil.

Some species of grasshoppers begin the hatching process as early as late April, but the main hatch normally starts around mid-May. By the first part of June, the five species that are considered damaging to crops in South Dakota either have begun or have nearly completed hatching. Egg hatch will continue for about a 6-week period.

After hatching, the young grasshoppers (nymphs) require on average about 45 days to develop into adults. This process can vary from 40 to 60 days, depending on environmental conditions. Immature grasshoppers have five instars in which their skin is shed to pass to the next instar.

It’s important to know what stage, and what instar, predominates during the growing season. This will determine the appropriate action and chemical selection. Once grasshoppers reach the adult stage, control is more difficult to achieve. Treatments applied at this stage basically are for revenge and are not economical. Scouting and determining the life-cycle stage of a grasshopper can be accomplished through two methods: 1) using a sweep net (recommended) or 2) using a visual estimate.

**Scouting Grasshoppers**

One of the best ways to monitor populations and determine the life cycle stage of a grasshopper is by using a standard 15-inch sweep net. Visual estimates can also be done, but such estimates are not as accurate or effective as those done with a sweep net.

1. **Sweep Net** Estimate grasshopper density using a sweep net by walking through an area while making a
180° (half-circle) sweep through the vegetation. Make approximately 40 sweeps per location. This should be repeated either in three different locations within the field margin or per one mile of right-of-way. Count the number of grasshoppers collected in the 40 sweeps and divide by 10 for the density of grasshoppers in a square yard.

2. Visual Estimates Visual estimates can be used when a sweep net is not available. Begin by slowly walking and visualizing a square-foot area, and count the number of grasshoppers that move within that square foot. Observation counts should be made at several location sites within the field or right-of-way. Divide the number of grasshoppers counted by the number of sites you observed. Then multiply that number by 9 to estimate the density of grasshoppers in a square yard.

Another in-field method using visual estimation is to imagine a 1-square-foot area about 6–10 feet in front of you. You may measure an area at first to improve your ability to visualize the target area. Slowly walk toward your visualized area, counting the number of grasshoppers both in and jumping out of the area. Repeat the procedure 18 times at randomly selected sites within the field at least 50- to 75-feet apart. Try to vary the vegetation in the count area, and be sure to make observation counts on both north- and south-facing slopes. Add up the total grasshoppers counted from all 18 sites and divide that by 2 to get the estimated density of grasshopper in a square yard.

ECONOMIC thresholds
The following guidelines can be adapted to each particular situation. Generally, treatment is considered to be economical when populations reach the threatening level. The following control thresholds are suggestions in South Dakota.

Right-of-Way Treat the right-of-way when grasshoppers reach the threatening level of 50 immature-stage grasshoppers (nymphs) per square yard. Treat before 5% reach the adult stage.

CRP, Wastelands, Grassy Ravines Treat when 35–45 nymphs or 20–40 adults are present per square yard and pose a threat to neighboring cropland or pasture.

Rangelands For rangelands, refer to Extension Extra 5081, “Grasshopper Outlook in Rangelands: 2011.” Economic thresholds on rangelands are harder to estimate because of environmental conditions; therefore, control can be guided by the value of the forage saved when applying an insecticide.

Field Crops/Field Margins In field crops, treat when grasshoppers reach the threatening level: 30–45 nymphs or 8–14 adults present per square yard (table 1). Assess level rating on the basis of growing conditions, stage of crop, and grasshopper numbers.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Nymphs/sq. yd.</th>
<th>Adults/sq. yd.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Margin</td>
<td>Field</td>
</tr>
<tr>
<td>Threatening</td>
<td>50–75</td>
<td>30–45</td>
</tr>
<tr>
<td>Severe</td>
<td>100–150</td>
<td>60–90</td>
</tr>
<tr>
<td>Very Severe</td>
<td>over 200</td>
<td>over 120</td>
</tr>
</tbody>
</table>

* Based on numbers per sq. yd. for crops/field margins

High grasshopper populations may be treated in field borders/margins to prevent movement into crop fields. Consider treatment when economic thresholds for border treatments are reached. Generally, this threshold would be at threatening levels when there are 50–75 nymphs per square yard in the field margin.

IPM STRATEGIES
When looking at implementing IPM as an approach to controlling grasshoppers or other pests, it’s important to remember that there is not any one tactical strategy that is the “cure-all” control option. There are several IPM tactical strategies that can be used, and using multiple tactics in combination provides the best benefit and makes grasshopper-management goals more achievable.

Chemical There are several insecticides in South Dakota that are labeled for the control of grasshoppers on both rangelands and crops. Consideration needs to be given to grasshopper life stage, grasshopper population, and target area when selecting an insecticide product. It’s important to remember when implementing an insecticide control program to read and follow the label.

Grasshoppers are more easily and economically controlled with insecticides when they are in the nymph stage of their life cycle and in hatching areas. The advantage of treating early is there will be fewer acres to treat and less risk, which in return is more economically feasible.
On rangelands, consider using reduced agent and area treatment (RAATs) methods. RAATs can reduce application cost by 50–60%. The bottom line is that 65–70% less insecticide is applied compared to conventional broadcast treatments. RAATs provides up to 85% control of grasshopper numbers (depending upon the rate of growth of the forage, the size of the grasshoppers, and the coverage obtained). RAATs applications can be made with aerial or ground equipment. Currently, diflubenzuron (Dimlin) is the only insecticide that specifically allows a RAATs application.

Carbaryl-based bran baits can be applied in crop pre- or post-emergence, or in adjacent areas with short, dry vegetation. The bait must be applied uniformly, and reapplication may be necessary after rain or heavy dew.

For more detailed information on labeled insecticide treatments in specific crops, please refer to the “High Plains IPM Guide” at http://wikibugwood.org/HPIPM.

When using an insecticide-control program, be sure to consider non-target insects such as honeybees. Some insecticides are considered to be toxic to honeybees and other pollinators. Consider spraying in the evening hours when activity by bees or pollinators is minimal. Also, spraying in the evening will allow the insecticide time to dry on the crop before activity resumes, and never spray in-bloom unless it is necessary. Not all insecticides are harmful to bees and pollinators. Be sure to read the label.

**Cultural**

The cultural IPM strategy uses techniques of modifying the environment to take advantage of the vulnerable timing of the grasshopper’s life cycle to reduce or eliminate populations. This strategy must be used ahead (prevention) of the grasshopper damage to be effective.

The following are ways to modify the environment when using the cultural strategy:

- Make abandoned or weedy areas less attractive to cropland grasshoppers by planting dense grass stands and reducing broadleaf plants.
- Delay fall seeding where grasshoppers are a concern to reduce the potential for damage. This may not be effective if the first heavy frost occurs later in the fall.

- Double the seeding rate on the first and second passes with the drill to allow some plant survival on the field borders.
- Early seeding enables sufficient vigorous crop growth to tolerate grasshopper feeding. Early seeded crops will mature earlier and reduce the risk of late-season grasshopper migration. May not be effective in late-season planted crops.
- Fall cleanup of fields (such as tillage after crop removal and preventing green foliage) to discourage egg laying in fields.
- Trap cropping or planting strips next to crops to attract grasshoppers into a smaller area, making insecticide treatment more efficient and economical.
- Crop rotation—fields planted to late-season crops may attract adult females to lay eggs. Avoid planting crops in fields with a history of heavy egg or grasshopper infestations.
- Early harvest—if grasshoppers are migrating into crops that are close to harvest, consider harvesting the crop early if it has reached physiological maturity (the economic advantage may favor early harvest when compared to the cost of an insecticide treatment).

**Mechanical**

- Tillage
  - Summer fallow—discourage egg laying in the fall. However, tillage may not be a favorable management plan in reduced-till or no-till operations.

**Biological**

This IPM strategy uses natural enemies such as parasites (i.e., insects—specific wasps and flies that use the grasshopper to complete their life cycle), predators (e.g., other insects, birds, mammals, etc.), and pathogens such as viruses, fungi, and protozoan (regarding pathogens: several are natural occurring, while others are introduced or developed).

An example of a biological pathogen is *Nosema locustae*. This is a natural-occurring protozoan that causes disease and death in grasshoppers. The spores are impregnated on wheat flakes and applied to the field. It takes about 3 weeks to infect the grasshoppers. Users of this product report that applying this material early in the life cycle is critical for success. Always read and follow all label directions for use.
CONCLUSION
When using any IPM strategy to control grasshoppers, consideration of grasshopper-management goals is paramount. Remember that there is not one IPM strategy or tactic that stands alone and is a cure-all for grasshopper control. To successfully complete an IPM goal for controlling grasshoppers or any other pest, a combination of tactics must be used together in order to receive the greatest benefit economically.