# Managing Grasshoppers in Montana's Rangeland and Cropland

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Grasshoppers are common pests in Montana particularly in the central and eastern regions. During 2010 - 2012, however, Montana has been facing a potential outbreak in size not witnessed since the mid 1980's. Managing grasshoppers during severe outbreaks can be challenging. Ranches may have to consider alternative sources of forage. At severe outbreak levels even repeated insecticide applications may not salvage spring planted crops that are surrounded by grassland.

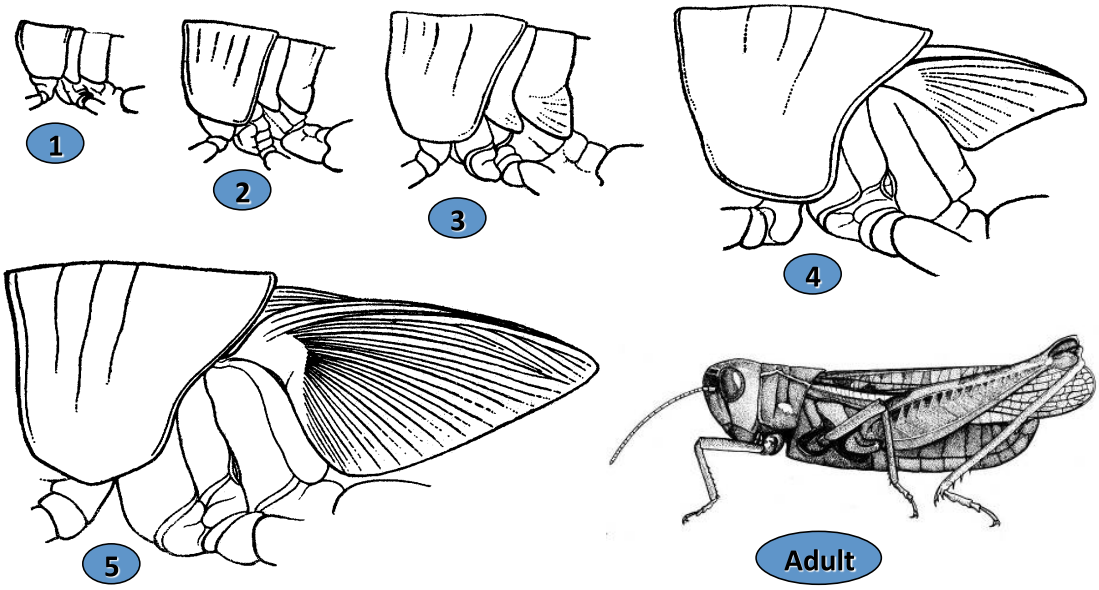
Rangeland: A total of 15-20 grasshopper nymphs per square yard is considered an economic threshold for treatment. At these densities grasshoppers can result in 200 – 500 pounds of lost forage per acre of rangeland, depending on their duration and conditions such as precipitation. Reduced Agent and Area Treatment strategies (RAATs) can be used to control grasshoppers in rangeland. USDA research has demonstrated that RAATs, a "skip pass" approach that also uses lower rates of insecticide, can achieve 80 to 95% control (compared to 85-99% control with complete blanket coverage at the full insecticide rate) at a lower cost. RAATs can be applied by ground or air. The insecticide dimilin is most commonly used in large-scale grasshopper spray operations. Dimilin is an insect growth regulator that is only effective against juvenile insects that are molting. It is NOT effective against adult insects that no longer molt, so timing is critical. Ideally the majority of grasshoppers should be in the 3$^{rd}$ instar stage during treatment. Commercial honeybee colonies are often placed on ranchland. A benefit of dimilin's mode of action is that it is relatively safe to adult honeybees.

Spring Wheat: Grasshoppers are notorious for their ability to move into cropland from surrounding grassy areas; cropland surrounded by grass is particularly at risk. The treatment threshold for immature nymphs is different from thresholds for adults, and also depends on whether the grasshoppers are within the field or around the edges. The attached High Plains IPM Guide contains a table for thresholds in spring and winter planted wheat. Crop protection is typically achieved by applying a boarder treatment of insecticide to keep the grasshoppers from entering the crop. A border width of 150 feet surrounding the crop may be adequate for control, but if grasshopper densities are high, control may require up to a 1/4 mile border treatment where ground applied RAATs can be considered. Under extreme pressure, control may be difficult and multiple border treatments may be required. Border areas and crop margins should be monitored after treatment to ensure that grasshoppers do not re-enter the field. Insecticide baits can also be effectively used but USDA research has found that the effectiveness of insecticidal baits can depend on grasshopper densities. Baits are not recommended when grasshopper densities are higher than 30-40 per square yard.

Winter Wheat: Emerging winter wheat can be particularly vulnerable to damage by grasshoppers. The larger adult stage grasshoppers are more difficult to control and can move into emerging winter wheat fields from surrounding grassy areas. Treatment thresholds for emerging winter wheat are lower, 3-7 per square yard within the field, or 11-20 per square yard around the margin probably requires treatment. Border treatments applied as insecticidal sprays or seed treatments are the main recommendation for protecting emerging winter wheat. Typically, spraying 150 feet beyond the edge of the crop or 1-2 passes with treated seed around the perimeter of the field is a sufficient border. Adult grasshoppers are more difficult to control, and the higher end of the label rate is recommended. If grasshopper populations are very high they are difficult to control, borders up to ¼ of a mile and repeated applications may need to be considered. When applying border sprays, *timing* is important. Border sprays beyond the edge of the crop need to be applied just before the wheat emerges; if it is applied too early there may not be enough residual, it is applied too late, the damage may have already occurred. Systemic seed treatments eliminate the timing concern, but systemic insecticides require feeding to be active, but damage should be slowed considerably. Commonly used insecticides are listed in the attached High Plains IPM pest notes.

Treatment Thresholds: The number of insects that require treatment to prevent economic damage can depend on factors such as the weather, crop health and crop stage. For example, damage to rangeland by the same density of grasshoppers is more severe during drought periods. Fewer grasshoppers can cause economic damage to crops if they are feeding at sensitive developmental times. In some cases grasshoppers in spring wheat crops can clip the developing heads, for example. One research study reported that grasshoppers in lentil fields during flowering feed preferentially on the flowers and developing pods, and a treatment threshold of only 2 per square yard was recommended. Therefore treatment thresholds should be used as a sound guide tempered with experience and observations of damage.

Additional information can be found on the USDA ARS Sidney grasshopper website, http://www.sidney.ars.usda.gov/grasshopper/. The High Plains IPM Guide website, http://wiki.bugwood.org/HPIPM, provides detailed information on sampling, thresholds and management. RAATs brochures and management guides are provided as attachments below.

Staging Grasshoppers: Most grasshoppers have five juvenile stages (nymphs) called instars, one through five. In most cases only the mature grasshoppers have fully formed wings and can fly. During each instar stage the immature wing buds continue to grow. The first become easily visible in the 3rd instar stage. In addition to size, the developing wing buds are a useful feature to help stage grasshopper to time insecticide sprays on rangeland.

# Developmental stages