More Grass, Fewer Grasshoppers!

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The following is the first in a monthly series discussing ongoing research efforts at the USDA-ARS Northern Plains Agricultural Research Laboratory (NPARL) in Sidney. MT.

In the Northern Great Plains, rangeland grasshopper populations tend to increase with both livestock stocking rates and dry conditions, and they can double, triple, or quadruple with each successive year of drought. During a severe grasshopper outbreak, grasshoppers often remove more vegetation than cattle in the same pasture.

Generally, fewer than four species of grasshoppers contribute significantly to any single outbreak although up to 25 species may be found at a site. The plant community largely determines which of the 400 grasshopper species known in the Western U.S. are found at a given location. However, only about two dozen species are actually considered pest species capable of causing significant economic damage and a few species are even considered beneficial because they eat weeds. Grasshoppers are also a primary food source for many grassland birds.

An ounce of prevention…

In the past, large-scale pesticide spray programs have been the main tools used to combat grasshopper outbreaks on rangeland. Today, increased environmental concerns combined with low livestock and commodity prices have reduced the viability of traditional control methods. In addition, chemical control can actually increase the frequency of outbreaks by reducing the ability of natural enemies to keep grasshopper populations in check. These issues have prompted researchers to look for methods that can be used to prevent grasshopper outbreaks from occurring in the first place, such as habitat manipulation through grazing management. However, any methods developed must be sustainable, affordable, and also improve or maintain the condition of rangeland.

Entomologist Dave Branson samples grasshoppers in a grazing management experiment near Miles City, MT.

But before we can act to prevent or reduce grasshopper outbreaks, we need to consider what factors affect grasshopper populations naturally, and whether they can be modified through management. Although we can't prevent a drought from occurring, we may be able to use grazing management to change the quality of rangeland habitat available for grasshoppers and/or their primary predators and reduce grasshopper outbreaks.

We know many of the worst pest grasshopper species thrive when there is bare soil and little shade from plants, since grasshoppers need energy from the sun to develop and process food. Less vegetation leads to increased soil and air temperatures, accelerating grasshopper egg development, growth of immature grasshoppers and egg production. Since the largest stages of grasshoppers cause the most damage to vegetation, if we can either slow development or reduce survival of grasshoppers, we can reduce vegetation consumption.

Grazing's potential for grasshopper control

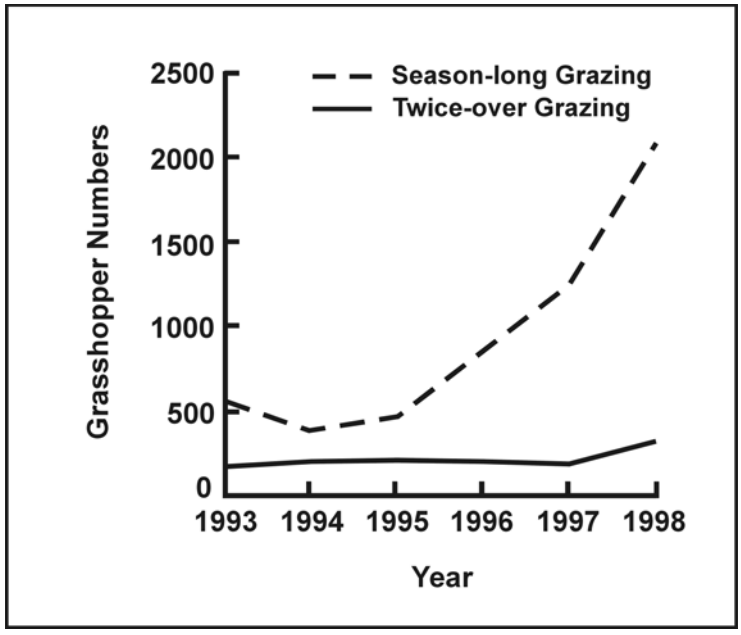
Because grazing management systems differ in how they manipulate the timing, rate, or degree of plant defoliation by livestock, certain types of grazing management may create unfavorable habitats for grasshoppers or spur increases in naturally occurring grasshopper diseases and predators, such as birds, spiders or disease-causing pathogens. For example, varying the timing of grazing from year to year can prevent favoring the same pest grasshopper species for consecutive seasons. Since grasshoppers need energy from the sun to develop and reproduce, reducing bare soil or controlling how much vegetation is removed at critical periods of the grasshopper's life cycle can conceivably decrease grasshopper development and survival rates.

The lesser migratory grasshopper is the most common pest species in the Western US.

Comparing two livestock grazing systems

To test that hypothesis, NPARL researchers have been studying two common grazing systems to compare their impacts on grasshopper populations. The first, season-long grazing (SL), involves a consistent pattern and timing of grazing each year which favors the same species of grasshoppers year after year, aiding in the buildup of grasshopper populations. It typically results in an uneven plant canopy with significant bare ground.

In contrast, the second system studied – twice over rotational grazing (TOR) – involves sequentially rotating livestock through multiple pastures, where the first rotation is shorter than the second. Since the entry pasture is rotated yearly, the timing of grazing does not consistently favor a particular species of grasshopper. The concept is that the grazing cycles appear to leave a consistent canopy height; which, over a number of years, leads to increased grass tillering and reductions in bare ground. Other research by Lee Manske at NDSU-Dickinson Extension Research Center also found increased grass biomass, plant ground cover and cow/calf weight gain following several years under twice over rotational grazing compared to season-long grazing.



Grasshopper populations were much lower under twice-over rotational grazing management.

The results…more grass, fewer grasshoppers

In a study by retired NPARL entomologist Jerry Onsager, twice-over rotational grazing management suppressed grasshopper populations (see graph). During a grasshopper outbreak in 1997 and 1998, grasshopper densities were five to nine times lower and the amount of grass

consumed was six to nine times less in twice over rotational grazing pastures than in season-long grazing pastures.

Early or heavy grazing (evident on right) favors grasshopper development. Later grazing which leaves more grass early in the summer, slows their growth.

For the most common pest species, TOR grazing resulted in slower grasshopper development, lower survival rates, fewer adults, and less time for surviving adults to lay eggs for the next year. Slower grasshopper development also reduces the amount of vegetation consumed by grasshoppers. Grasshopper species hatching late in the summer were major contributors to the grasshopper outbreak in the season-long pastures, but did very poorly under the TOR system. A few species preferring cooler habitats actually did better under TOR, but did not reach damaging densities and are not considered "pest" species. Additionally, preliminary data from NPARL insect pathologist Stefan Jaronski indicates that TOR grazing may lead to an increase in the abundance of grasshopper pathogens.

Although all of these changes are believed to result from the reduction in bare ground, consistent canopy height, and increased vegetation biomass brought about by the TOR grazing management system, more needs to be known.

A number of diseases, predators, and parasites can kill grasshoppers, such as the fungus shown here.

Ongoing research

NPARL scientists are now following up on this research with experiments examining not only if TOR prevents grasshopper outbreaks in other locations, but whether other grazing management systems may also reduce grasshopper problems. Additionally, we are examining the mechanisms leading to reduced grasshopper populations so we can accurately predict when grazing management will be effective. In related research, NPARL scientists are also examining the combined effects of fire and livestock grazing on grasshoppers and rangeland vegetation, as well as the beneficial aspects grasshoppers have on nutrient cycling and rangeland production.

Coming next month

NPARL Research Plant Pathologist Anthony Caesar discusses his work in the use of plant pathogens for biological control of invasive weeds.