Suppression of Grasshopper Population Numbers with Biologically Effective Grazing Management

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Rangeland pestiferous grasshopper populations tend to increase when grassland habitat conditions are favorable for the development of the insect from egg to adult. Periodically, favorable habitat for rangeland grasshoppers develops in grasslands, and high numbers of grasshoppers are produced. These outbreaks cause major problems for the regions in which they occur. On traditionally managed grazinglands in the Northern Plains, grasshopper populations tend to reach high outbreak densities when plant canopy height and ground cover are reduced and herbage production is low. These conditions occur as a result of grazing-management-caused problems or during years with hot temperatures and low precipitation (Onsager 1996, 2000). The grasshopper population outbreaks can occur as the outward expansion of a "hot spot" or as an escalation of low to high numbers across an area (Lockwood, Brewer, and Schell 1996).

Problems with high numbers of grasshoppers can be reduced by improving grassland habitat to be unfavorable for these pests. Habitat condition on grasslands can be modified by biologically effective grazing management practices that increase the amount of vegetation cover, thereby reducing grasshopper numbers and suppressing population outbreaks.

Grazing management strategies that repeatedly remove most of the vegetation on grasslands reduce plant density and herbage biomass production. Areas with open vegetation canopy and spots of bare ground are favorable grasshopper habitat. With reduced vegetation canopy cover and enlarged areas of bare ground, the amount of solar radiation that reaches the soil surface increases, as does the airflow over the ground. The reduced vegetation structure results in higher air and soil temperatures and lower humidity in grasshopper habitat.

Grassland habitat with open vegetation canopy and areas of bare ground provides ideal basking sites, where grasshoppers warm themselves in the early morning sun to speed metabolic rates and increase growth rates (Belovsky et al. 2000). Patches of bare ground also are favored egg-laying sites. Higher soil and air temperatures accelerate grasshopper egg development, growth and maturation of young insects, and egg production of adult females. In addition, habitat with intense sunlight and low humidity near the soil discourages the growth of important pathogens that cause grasshopper diseases. As a result, mortality rates of immature grasshoppers decline and greater numbers of the insects survive into adulthood.

Many traditional management practices produce habitat favorable for grasshopper population outbreaks. Common practices that help grasshopper populations increase to problem levels include beginning grazing before plants have reached the third-leaf stage; grazing spring and summer pastures or haylands during the fall; and management treatments such as seasonlong, deferred, and repeat seasonal grazing that leave little residual vegetation following defoliation periods.

Onsager (2000) listed three attributes of grazing management that deters grasshopper outbreaks in the Northern Plains: (1) deliberate variation from year to year in the time and intensity of defoliation periods, (2) controllable preservation or enhancement of shading canopy during critical portions of grasshopper life cycles, and (3) reduction or elimination of bare soil.

A joint research project was conducted in western North Dakota by Dr. Lee Manske, NDSU, Dickinson Research Extension Center, Dickinson, ND, and Dr. Jerry Onsager, retired research entomologist, USDA-Agricultural Research Service, Sidney, MT, to evaluate and compare the grassland habitat conditions and grasshopper population numbers on a seasonlong grazing treatment and a twice-over rotation treatment (Manske and Onsager 1996, Stelljes 1996).

The twice-over rotation grazing treatment had denser basal cover, less bare ground, and greater herbage biomass than the seasonlong treatment. The grass basal cover on the twice-over rotation treatment was 25.2% greater than that on the seasonlong treatment (Manske 1995, 1996). The average percent of ground not covered by vegetation was lowest on the twice-over rotation treatment, followed by the seasonlong treatment, and greatest on the nongrazed treatment. The twice-over rotation treatment had 31% less open area in the vegetation canopy than the seasonlong treatment (Manske 1995). Herbage production was greater on the twice-over rotation treatment than on the seasonlong treatment. The twice-over rotation treatment produced an average of 33% to 45% more herbage during each growing-season month than did the seasonlong treatment (Manske 1995, 1996).

Onsager (2000) followed grasshopper numbers for five growing seasons on native rangeland areas managed with a seasonlong treatment or the twice-over rotation treatment. The average number of grasshopper days per square meter was 748 on the seasonlong treatment, considerably greater than the average of 229 on the twice-over rotation treatment. During the last two years of the study, a local grasshopper outbreak (figure 1) with an average density of 22.6 adult grasshoppers per square meter occurred on the seasonlong treatment. This population outbreak did not occur on the twice-over rotation treatment, which maintained an average of only 3.9 adult grasshoppers per square meter.

The seasonlong treatment decreased the vegetation cover and promoted grasshopper population increases. The twice-over rotation treatment enhanced the vegetation cover and suppressed grasshopper population increases.

The twice-over rotation system is effective in grasshopper management because the grazing treatment properly times defoliation to lead to greater plant density and herbage production and fewer open areas in the vegetation canopy cover. These plant community characteristics develop because the biologically effective twice-over rotation system coordinates grazing with grass growth stages and removes a small amount of leaf material from grass plants between the third-leaf stage and the flowering stage. This timed defoliation stimulates plant processes and soil organism activity that enhance plant growth, and the resulting greater herbage biomass production leads to grassland habitat conditions unfavorable for grasshopper population increases.

Areas with habitat unfavorable to grasshoppers are those on which plant density is increased so that only a few small spots of bare ground occur and on which adequate herbage biomass remains after grazing periods so that the vegetation canopy is nearly closed. The improvement in the vegetation characteristics of rangeland managed with the twice-over rotation system reduces the amount of sunlight reaching the ground, increases the humidity, and lowers the temperature within the grasshopper habitat. In these grassland habitat conditions, grasshopper metabolic rates and growth rates slow and disease increases mortality rates among grasshoppers. These changes negatively affect the growth and survival of immature grasshoppers in the nymphal stages and result in reduced grasshopper numbers and in suppression of local grasshopper population outbreaks (Onsager 2000).

Producers can suppress potential grasshopper population outbreaks by implementing biologically effective grazing management that minimizes habitat favorable to the insects. Three management practices can be used to develop grassland habitat unfavorable for grasshopper outbreaks: (1) delaying the start of grazing until grasses have reached the third-leaf stage (early May for crested wheatgrass and smooth bromegrass and early June for native rangeland), (2) grazing native rangeland with a twice-over rotation management system that coordinates rotation dates with plant growth stages, and (3) grazing complementary forage types during the fall rather than grazing spring and summer pastures or haylands late in the season.

Implementing improved cultural management practices is not a quick fix to a major problem. Grazing management strategies that produce habitat unfavorable for grasshopper population outbreaks are a long-term solution to grasshopper problems and take three or more years to show substantial results. Pastures that are grazed using traditional management practices and that have had problems with increased grasshopper numbers need a change of management treatments to biologically effective grazing management practices that stimulate plant mechanisms and ecosystem processes to increase plant density and vegetation canopy.

The twice-over rotation system is a biologically effective grazing management treatment that has the three attributes needed to deter grasshopper outbreaks in the Northern Plains. The twice-over rotation grazing system: (1) deliberately varies the time and intensity of defoliation from year to year, (2) controllably enhances vegetation shading canopy during critical portions of grasshopper life cycles, and (3) reduces and almost eliminates bare soil areas. The twice-over rotation system can be used in the Northern Plains to successfully manage grasshopper population numbers.

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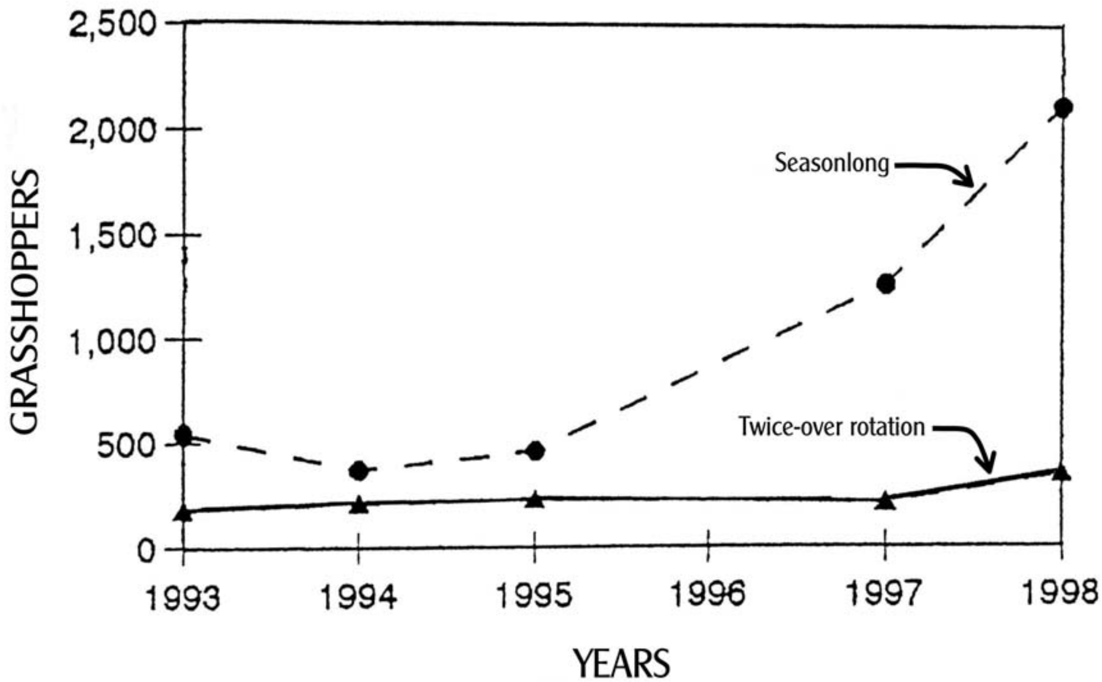

Fig. 1. Grasshopper population outbreak occurring on the seasonlong treatment during 1997 and 1998 but not occurring on the twice-over rotation treatment. Grasshopper abundance reported as grasshopper days per square meter, data from Onsager 2000.

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