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Cultural Management Practices as Tools to Help Reduce Grasshopper Populations

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Summary

Cultural management practices of grazing and mowing can be used to manipulate grass growth and development beneficially when timed during appropriate phenological growth stages. The resulting changes in the vegetation help reduce grasshopper populations.

Grasshopper populations have a history of periodic outbreaks. Whether small or large scale, these grasshopper outbreaks are extremely detrimental to the region in which they occur. They are economically costly to individual land owners and to society as a result of both lost or destroyed forage and expense of treatment. If cultural management practices could be used to reduce the frequency and the intensity of periodic outbreaks, the negative effects of grasshoppers would be less devastating and costly.

There are two theories of how pest insect outbreaks occur. The *eruptive outbreak* starts from a "hot spot" and expands into larger areas. The *gradient outbreak* starts with low numbers throughout the area and escalates with an increase in the number of insects when conditions are right (Lockwood, Brewer, and Schell 1996). Grasshopper populations in arid regions, as in the intermountain sagebrush-bunchgrass range of Idaho (Fielding and Brusven 1996), are limited by food supply. The periodic outbreaks occur when above-normal precipitation years support above-normal forage production. In semi-arid regions, as in the northern Great Plains, food supply generally does not limit grasshopper outbreaks. Rather, the periodic outbreaks tend to be associated with drought conditions or heavy grazing intensity (Onsager 1996).

Both grazing management practices which repeatedly remove most of the vegetation canopy, and drought conditions which reduce plant density and herbage biomass production favor pest grasshopper species and permit population numbers to increase to problem levels. Canopy removal by drought or heavy grazing increases the amount of solar radiation which reaches the soil surface and increases airflow over the ground. Canopy removal increases both soil and air temperatures and decreases relative humidity in the grasshopper microhabitat. All of these conditions are favorable to pest grasshopper species because sunlight and low humidity discourage important grasshopper pathogens and because higher temperatures accelerate grasshopper egg development, nymphal growth and maturation, and adult female egg production. Canopy removal also can affect basking sites, which provide for early morning thermoregulation; perching sites, which provide for avoidance of high midday temperatures; and favored egg-laying sites, which are patches of bare soil (Onsager 1996).

The basic premises that we are working with to help reduce grasshopper populations are: (1) that most of the rangeland pestiferous grasshopper species are favored by vegetation with an open canopy and numerous patches of bare ground, and (2) that some cultural management practices can be used to modify the vegetation structure in order to produce microhabitats less favorable for grasshoppers. The changes in the vegetation that will negatively affect grasshopper populations are increases in live plant basal cover, decreases in open areas in vegetation canopy cover, and increases in plant biomass. Improvements in these vegetation parameters will yield lower temperatures, higher relative humidity, and reduced irradiation within the grasshopper microhabitat. These changes in the grasshopper microhabitat will negatively affect nymphal growth and survival and will result in reductions in the population.

Many of the areas which have histories of grasshopper population buildup are cool-season domesticated grass hay fields and pastures. These "hot spots" are most likely a result of relatively sparse vegetation with open canopy and numerous dry, bare soil areas. Some commonly used management practices perpetuate these favorable habitat areas for grasshoppers. Mowing crested wheatgrass in late June and July after the flowering stage promotes the bunch growth form of crested wheatgrass and produces relatively low basal cover (23.3%) and large amounts of bare soil, ranging from 21.9% to 50.9% of the area (Manske 1995b); these conditions provide habitat for grasshoppers.

Mowing the hay fields before the flower stage will cause these areas to become less favorable for grasshoppers by stimulating tiller production, increasing basal cover, and reducing the bare ground areas. As a bonus, the harvested hay will be of better quality and the pounds of protein harvested per acre will be greater. Another method to improve crested wheatgrass hay fields is to graze them lightly in the early spring for a few years to stimulate tillering and increase basal cover.

A very common management practice that favors grasshoppers is the double-use treatments of grazing and haying of crested wheatgrass during the same year; this practice significantly decreases crested wheatgrass basal cover and increases percent open ground not covered by vegetation canopy (Manske 1995b). Areas of crested wheatgrass that have had high grasshopper numbers in the past should not have double-use in the same year. Mowing crested wheatgrass after the flower stage and applying double-use treatments on crested wheatgrass during the same year reduce basal cover and increase bare areas and are very favorable for increases in pest grasshopper numbers.

Spring grazing of crested wheatgrass between the 3rd leaf stage and flowering stage stimulates tiller production, which increases basal cover and decreases bare ground areas significantly greater than mid season mowed and double-use treatments (Manske 1995b). Twelve years of spring grazing of crested wheatgrass pastures at the Dickinson Research Extension Center have resulted in very high percent basal cover (44.8%) and very low percent open ground (6.5%) (Manske 1995b).

Grazing management on native range can be used to modify vegetation structure and density to be less favorable as grasshopper habitat. The twice-over rotation grazing treatment increases basal cover, reduces bare ground, and increases herbage biomass compared to long-term nongrazed and seasonlong grazing treatments. The plant basal cover of the twice-over rotation treatment was 30.2% greater than the nongrazed treatments and 6.0% greater than the seasonlong treatments (Manske 1995a) in a study near Watford City, ND. In a study near Dickinson, ND, the grass basal cover on the rotation treatment was 25.2% greater than the seasonlong treatment (Manske 1996). The average percent of ground not covered by vegetation was lowest on the twice-over rotation treatment (4.8%), followed by the seasonlong treatment (7.0%), and greatest on the nongrazed treatment (12.1%) (Manske 1995a). The amount of herbage biomass remaining after each grazing period was greatest on the twice-over rotation treatment. The twice-over rotation system produced an average of 295 lbs/acre and 362 lbs/acre greater herbage biomass for each sample period than did the long-term nongrazed and seasonlong grazing treatments, respectively, during a study near Watford City, ND, (Manske 1995a), and produced an average of 140 lbs/acre and 233 lbs/acre greater herbage biomass for each sample period than did the long-term nongrazed and seasonlong grazing treatments, respectively, during a study near Dickinson, ND, (Manske 1996).

Preliminary interpretation of grasshopper population data indicates that there were between 69% and 79% fewer grasshopper nymphs and between 71% and 96% fewer adult grasshoppers on the twice-over rotation pastures than on the 5.0 month seasonlong pastures (Kemp and Onsager 1993, Kemp and Onsager 1994, Onsager 1995, Onsager 1995). The population of the species that is generally considered to be the number one grasshopper pest, the migratory grasshopper *(Melanoplus sanguinipes*), was reduced by 66% to 75% on the twice-over rotation pastures compared to the seasonlong pastures (Stelljes 1996).

Conclusions

The findings emerging from a joint research project conducted by Dr. Lee Manske, NDSU, Dickinson Research Extension Center, Dickinson, ND, and Dr. Jerry Onsager, USDA-ARS, Sidney Agricultural Research Laboratory, Sidney, MT, indicate that cultural management practices that increase basal cover, reduce bare ground areas, and increase herbage biomass can be used to help reduce grasshopper population numbers (Manske and Onsager 1996). Grazing crested wheatgrass in the spring (1 May -1 June) increases grass density and reduces the number and size of bare areas; these improved conditions have negative effects on development and survival of grasshopper nymphs and reduce the number of grasshoppers. Grasshopper problems on native range can be reduced by managing the areas with twice-over rotation grazing systems. Areas that historically have chronic infestations of grasshoppers should be managed intensively with appropriate cultural practices in order to improve the grass plant basal cover and herbage biomass and to reduce the bare soil areas. Long-term benefits from cultural management practices should help to reduce both the frequency and the intensity of periodic grasshopper outbreaks and to reduce the devastating and costly effects experienced by regions which suffer from periodic grasshopper outbreaks.

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