GRASSHOPPERS: Today, and Forever

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Someone has said that the last two living animals upon this earth will be the coyote and the grasshopper. Both are well adapted for living in the rangeland environment, and both have been cussed and discussed by livestock operators since cattle and sheep appeared on the scene in the middle 1800's. Grasshopper plagues and the resulting damage to crops and rangeland in the western United States have been reported for the last 150 years. Early attempts at control were not too successful, but, with the use of poisoned baits at the turn of the century, some control was achieved. With the development of the chlorinated hydrocarbon insecticides in the early 1950's, it appeared at last that grasshoppers would no longer be a problem since control programs consistently reported kills of 95-100%. However, pesticide residues found in non-target species forced use of the chlorinated hydrocarbons to be discontinued. Since the early 1960's, the main pesticides that have been utilized for grasshopper control on rangeland are malathion and carbaryl. Both give excellent control under ideal conditions, which are not always present when treatments are applied. Thus, in recent years, ranchers and range managers have been forced to tolerate larger grasshopper populations.

While grasshopper plagues and swarms of the past have nearly disappeared and severe destruction of rangeland forage on a wide-scale has become infrequent, grasshopper densities of economic importance still occur each year. The grasshopper is still considered the most important invertebrate pest on western rangelands. For example, in 1979, grasshoppers occurred in outbreak numbers over large areas in the western United States and 7.2 million acres were sprayed in cooperative federal-state-rancher control programs.

Some 600 species of grasshoppers are found in the United States but only about 12 species occur frequently in high densities on rangeland and 12 additional species occasionally occur in high densities. Usually 1 or 2 economic species are dominant in a population and make up 50-75% of the individuals present; however, 25-30 species may be found at any one location. Some of these species prefer forbs, some prefer grasses, and some are mixed feeders. Many of them compete with livestock, and they all contribute to reducing the available forage. However, grasshoppers also are a source of food for prairie nesting birds and small mammals. They have also been classified as litter producers as they waste about half as much forage as they consume.





Stages of development for Melanoplus packardii Scudder showing instars 1-5 and the adult stage.

Biology

Most grasshopper species of economic importance lay eggs in the fall and hatching takes place in the spring over a period of several weeks. Thus any population may contain individuals of several species in different stages of development. Most common rangeland species pass through 5 nymphal instars before the final molt to the adult stage. This takes about 35-50 days. Most adults live at least 3 weeks but their life may be prolonged under ideal conditions. The last 2 instars (4th and 5th) and the adult stage are most important in the terms of forage losses for 3 reasons:

1. Grasshoppers consume and waste the most forage during this time.

2. At the time when grasshoppers develop to these stages, the rangeland plants are becoming mature and any plant material consumed or destroyed will not be replaced.

3. The probability of widespread mortality due to adverse weather or fungus disease becomes less.

Habitats

Grasshoppers are found on most of the 650 million acres of rangeland west of the Mississippi River, but major forage losses usually occur in only 17 of the 22 western states. Five states (Minnesota, Iowa, Missouri, Arkansas, and Louisiana) generally do not have consistent problems with grasshoppers on rangeland. Grasshoppers are of greatest economic concern on areas dominated by grasses and forbs where the

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A Perspective," J. Range Manage. (In press) on which this article is based. The authors wish to thank Martha Wilson for the illustrations.

provides choice habitat for many economic species.

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Potential Forage Losses

Grasshoppers do have the potential to cause losses on all of the 650 million acres of rangeland. However, the impact of grasshoppers is tied directly to the available forage and grazing demands for forage established by the ranch manager. The actual prediction of forage losses in any given season is difficult because of the great variability of available forage from year to year. The actual forage loss will depend upon grasshopper density, species, and local weather patterns. An estimated seasonal loss of 12 lb per acre will occur



Competition.

at a density of 1 grasshopper/yd². This loss may be less for small species or more for larger species; however, most rangeland populations contain a mixture of sizes and 12 lb/acre is a good average.

The average seasonal density of grasshoppers on all western rangeland is difficult to determine. Densities of 30-40 grasshoppers/yd2 are not uncommon and yet a large percentage of the rangeland has densities of less than 1/yd2. Results of early (1936-1962) surveys by personnel of the Bureau of Entomology and Plant Quarantine showed the average density of grasshoppers on rangeland to be 3.84 grasshoppers/yd2. At this rate the loss per acre would be 46 Ib of forage. Thus, the potential loss on all the 650 million acres of western rangeland would be about 15 million tons. Grazing reports on range ecosystems by the US Forest Service in 1972 indicate that about 56 million tons of herbage were harvested by livestock in 1970. Assuming direct competition, at least 21% of the consumed forage was utilized by grasshoppers. Another approach to estimate forage lost to grasshoppers involved the use of forage values. Production data for cattle and sheep in the United States in 1977 were used to determine that the average value of forage produced in 1977 was \$26.84/ton. Thus the loss due to grasshoppers on 650 million acres would be about \$403 million, assuming a loss of 15 million ton. The total value of 148.8 million AUM's as reported by the Forest Service (1972) was calculated to be about \$1.34 billion. Since forage worth \$403 million was destroyed by grasshoppers, 23% of the total forage value was devoted to the production of grasshoppers. These estimates of forage lost to grasshopper feeding which were derived from different premises indicate that 21-23% of available forage on western rangeland is destroyed by grasshoppers.

The economics of grasshopper feeding should not be evaluated only in terms of forage consumed and destroyed. Additional costs associated with grasshopper infestations could include reduced weight gains by livestock due to the reduction of available forage, purchase of replacement forage, relocation of livestock to areas where forage is available, forced sale of livestock at low market prices, and degradation of range condition in the case of heavy infestations.

Grasshopper Control

Grasshopper control programs on rangeland usually have 2 main objectives:

- 1. To protect or save range vegetation
- 2. To prevent grasshopper movement into crops

Control should always be initiated as soon as possible following the completion of hatching but preferably before the majority of species enter the 4th instar. Later treatments cannot recover forage that has already been lost but they may prevent egg laying and thus reduce grasshopper numbers in subsequent seasons. However, a study by Blickenstaff et al. (1974) showed that the benefits from control may not always extend beyond the year of application.

The Animal and Plant Health Inspection Service (APHI-S/USDA) is responsible for cooperative grasshopper control programs on western rangeland. During a 24-year period (1956-1979), at least 33 million acres have been sprayed for grasshopper control, for an average of 1.38 million acres-/year. This, however, does not include all of the areas that have been economically infested (8 or more grasshoppers/yd²). The acreage containing economic infestations has always exceeded the acreage treated. For example, in 1979 grasshoppers were especially abundant and caused severe damage in most of the 17 western states. A total of 7.2 million acres were treated by APHIS. However, information on the acres economically infested in 9 states (Colorado, Idaho, Nevada, North Dakota, Oregon, South Dakota, Texas, Utah, and Wyoming) showed that only 30% received treatment by APHIS. Information is not available on the acreage treated by individual or corporate land owners. It appears that most control programs are conducted on about 394 million acres (61% of the western range) where the forage is worth \$1-\$3/acre. On 207 million acres (32% of the western range)



Moving on!

the forage is worth 55¢/acre or less and control cannot be justified. On 46 million acres (7% of the western range) forage is worth \$8/acre and it is doubtful that control programs would be necessary on such highly productive acreage because conditions would not be favorable for grasshoppers and forage would be available for both grasshoppers and livestock when grasshoppers are abundant.

Summary

Western rangeland does indeed provide a most favorable habitat for many grasshopper species that compete with livestock and wildlife for available forage. An estimated 21–23% of this forage is destroyed each year by grasshoppers. Control programs over the years have met with various degrees of success; however, the acreage of economic infestations has always exceeded the acreage treated. Control programs are usually conducted on about 400 mil-

lion acres where the forage is worth \$1-3/acre but cannot always be justified on an additional 250 million acres.

It appears that some forage will always be available for the support of grasshopper populations. For some time to come, rangeland will be an integral part of the "good life" that is prized by many people. Livestock, wildlife, and grasshoppers will continue to harvest the available forage and will still call the wide-open-spaces home. Yes, grasshoppers have been, still are, and will continue to be part of the western scene for a long, long, time.

Literature Cited

Blickenstaff, C.C., F.E. Skoog, and R.J. Daum. 1974. Long-term control of grasshoppers. J. Econ. Entomol. 67:268-274. Anonymous. 1972. The nation's resources—forest-range environ-

mental study. Forest Resource Rep. No. 19, 147 p.

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Microbes Protect Cattle from Toxic Plant Poisoning

Sickness and death resulting from cattle eating certain poisonous plants may be reduced in future by feeding trace amounts of chemical agents that induce microbial detoxifying action in the rumen. At the Lethbridge and Kamloops Research Stations, we have identified both microbial and chemical agents that help to detoxify nitrotoxin and nitrite in the rumen of cattle. This research makes possible the development of chemicals that induce microbial detoxifying action in the rumen for protection of cattle in areas subject to nitrite and nitrotoxin poisoning.

Estimates indicate that 2 to 5 percent of all range cattle are affected annually by nitrotoxin from grazing timber milkvetch in southern British Columbia and nitrite poisoning from various sources in western Canada is also a problem.

The ability of rumen microorganisms to provide a "first line of defence" by modifying toxic dietary substances has been confirmed by many researchers. A rapid rate of degradation of toxic substances in the rumen means increased microbial detoxification and less likelihood of poisoning. Conversely, lower rates of degradation could signify a rumen microbial condition that predisposes the animal to poisoning. Exploitation of this "first line of defence" may provide a practical approach for prevention of nitrite and nitrotoxin poisoning. At the Lethbridge and Kamloops Research Stations, we have demonstrated the detoxification of nitrite and nitrotoxin by ruminal microorganisms and we have identified the microorganisms responsible for detoxification.—Weekly Letter, Lethbridge Research Station.

Improper Plowout Concern

The Colorado Section of the Society for Range Management joined several other organizations by expressing their concern about the improper plowout of short grass rangelands in eastern Colorado. The Section's Board of Directors passed a resolution addressing this improper land use conversion at their recent summer meeting at Hesperus, Colorado.

The Society recognizes the increase in market values resulting from changing range to cropland will be expensive to the public over time. The plowout will result in increased flooding and wind and water erosion which will require costly maintenance and replacement of public facilities. The dust and sediment will reduce forage production and damage wildlife habitat on the remaining grasslands.

William Laycock, President of the Colorado Section, said the Society for Range Management will assist concerned individuals and organizations to better inform the public and elected officials about problems created by plowing rangelands on sites not suitable for cultivation. They will also provide governmental bodies technical range information to help in the drafting and passage of legislation to properly control plowout of grasslands.

1982 Progress Report-Research in Rangeland Management

This 20-page report may be obtained by writing to William C. Krueger, Department of Rangeland Resources, Oregon State University, Corvallis, Oregon 97331.

It covers five subjects:

- 1. Herbicidal Control of Sagebrush and Rabbitbrush.
- 2. Soil-Plant Relationships of Sagebrush subspecies.

3. Hydrological Response following Rangeland Improvement Practices.

4. Effects of Defoliation on Improved Pastures.

5. Effect of Grazing Management on Diet and Weight Gains of Sheep Grazing Annual Grass—Clover Pasture.

This special report is published by the Agricultural Experiment Station, Oregon State University in cooperation with the Agricultural Research Service, U.S. Department of Agriculture.