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Grasshopper Outlook on Rangelands: 2011

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Grasshoppers are often found to be a significant problem for both farmers and ranchers. Even though grasshoppers are a normal component of a forage ecosystem and generally exert minimal disturbance, problems occur when conditions lead to grasshopper populations that increase to the point where they cause millions of dollars of damage.

Grasshopper outbreaks are the result of a complex combination of factors. Several factors are beyond the control of managers. However, the "pasture microclimate" (the immediate environment where grasshoppers hatch, grow, and reproduce) may be subject to subtle manipulation. Because grasshopper outbreaks are progressive and cumulative, small interruptions or reductions in the rates of metabolic processes may serve to reduce population expansion and consequent damage to vegetation.

Spring weather plays a key role in the severity of outbreaks. Warm temperatures with little rainfall are favorable for the hatching and development of grasshoppers, while cool and wet conditions following hatch are unfavorable to grasshopper growth and development. Surveyed grasshopper populations for 2010 are shown in fig. 1.

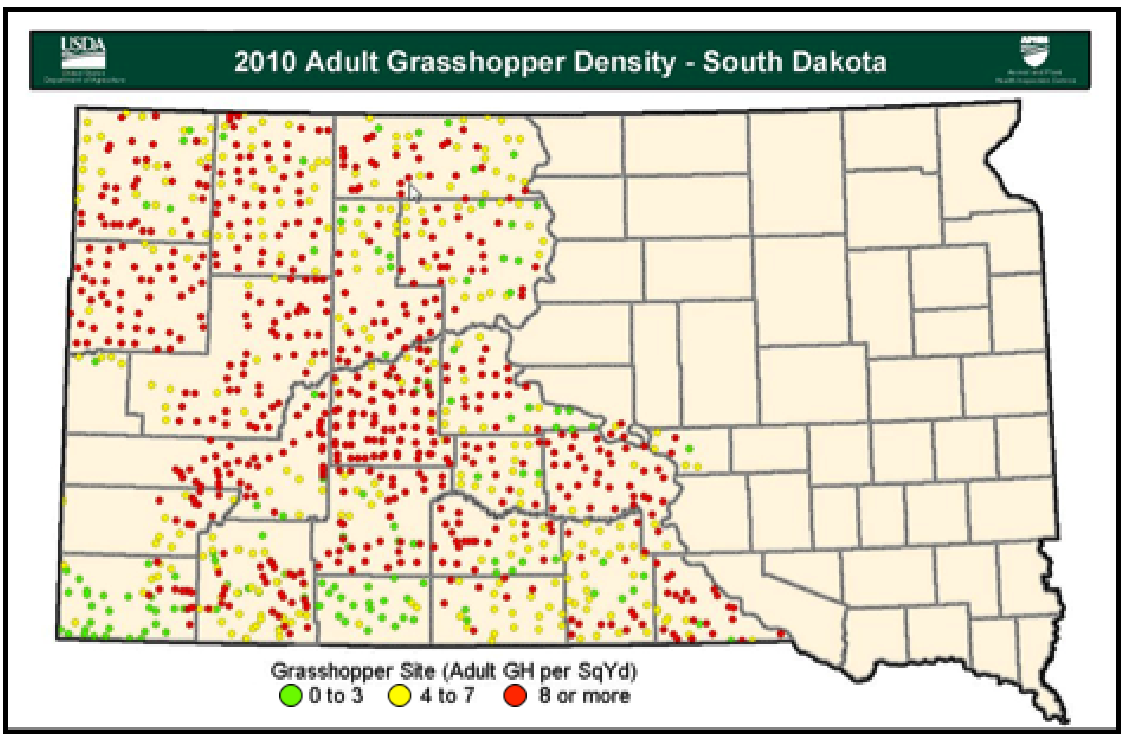

Figure 1. 2010 South Dakota adult grashopper density

Source: USDA, Animal Plant Health Inspection Service, Plant Protection and Quarantine, "2010 Adult Grasshopper Density - South Dakota." August 2010.

When grasshopper levels are determined to be high enough to have a significant impact on forage resources, rational decisions about control methods become primarily financial. Factors affecting the decision to implement control include the value of anticipated forage loss, the availability and value of replacement forage, and the cost of control measures.

How much can grasshoppers consume? Studies done in South Dakota, where grasshoppers were placed on native pasture at a rate of 24 per square yard, resulted in forage disappearance ranging from about 120 to 150 pounds per acre per month, just exceeding 400 pounds per acre for the growing season (Johnson 1991). The average loss from these studies equals 16.7 pounds per acre forage loss per grasshopper per square yard. Research from additional locations, across a number of environments, suggests a range of five to 18 pounds per acre forage loss per grasshopper per square yard (Hewitt and Onsager 1983; Onsager 1984; Davis et al. 1992).

The decision to control grasshoppers can be guided by the value of the crop that is saved and when an insecticide is applied (tables 1, 2).

Table 1. Value in dollars per acre of rangeland forage saved, assuming a loss of 16.7 lbs. of forage per grasshopper and 90% grasshopper control.

Grasshopper density	Dollars per AUM						
#/sq. yd.	$22	$24	$26	$28	$30	$32	$34
5	$2.07	$2.25	$2.44	$2.63	$2.82	$3.01	$3.19
10	$4.13	$4.51	$4.88	$5.26	$5.64	$6.01	$6.39
15	$6.20	$6.76	$7.33	$7.89	$8.45	$9.02	$9.58
20	$8.27	$9.02	$9.77	$10.52	$11.27	$12.02	$12.78
25	$10.33	$11.27	$12.21	$13.15	$14.09	$15.03	$16.97
30	$12.40	$13.53	$14.65	$15.78	$16.91	$18.04	$19.16
35	$14.47	$15.78	$17.10	$18.41	$19.73	$21.04	$22.36
40	$16.53	$18.04	$19.54	$21.04	$22.55	$24.05	$25.55

Values for rangeland grasshopper control (table 1) estimated using the following:

- number of grasshoppers per square yard
- 800 pounds of forage in an animal unit month (AUM)
- 16.7 pounds of forage lost per grasshopper per square yard
- 90% control effectiveness of insecticide applied
- values per AUM of forage

Table 2. Value in dollars per acre of alfalfa hay saved, assuming a loss of 16.7 lbs. of forage per grasshopper and 90% grasshopper control.

Grasshopper density	Dollars per ton						
#/sq. yd.	$60	$70	$80	$90	$100	$110	$120
5	$2.25	$2.63	$3.01	$3.38	$3.76	$4.13	$4.51
10	$4.51	$5.26	$6.01	$6.76	$7.52	$8.27	$9.02
15	$6.76	$7.89	$9.02	$10.15	$11.27	$12.40	$13.53
20	$9.02	$10.56	$12.02	$13.53	$15.03	$16.53	$18.04
25	$11.27	$13.15	$15.03	$16.91	$18.79	$20.67	$22.55
30	$13.53	$15.78	$18.04	$20.29	$22.55	$24.80	$27.05
35	$15.78	$18.41	$21.04	$23.67	$26.30	$28.93	$31.56
40	$18.04	$21.04	$24.05	$27.05	$30.06	$33.07	$36.07

Values for grasshopper control in alfalfa (table 2) estimated using the following:

- number of grasshoppers per square yard
- 16.7 pounds of forage lost per grasshopper per square yard (based on losses from studies in native grasslands)
- 90% control effectiveness of insecticide applied
- values per ton of alfalfa hay

VALUE ESTIMATION OF GRASSHOPPER CONTROL

The cost of applying an insecticide would need to be less than the values shown (tables 1, 2) for the treatment to be cost effective. For example, the cost of controlling grasshoppers on rangeland given a population density of 25 hoppers per square yard at $26 per AUM given the assumptions above needs to be less than $12.21 per acre to be profitable. The cost of controlling grasshoppers in alfalfa fields at 25 hoppers per square yard at $70 per ton given the assumptions above needs to be less than $13.15 per acre. If not, the value of forage saved would be less than the cost to control the grasshoppers.

The difference in cost returns between grasshopper control on rangeland versus alfalfa cropland is that total forage production per acre on rangeland is usually less than cropland. Widespread application on rangeland is more economical with government cost-share arrangements and/or strip/hot spot applications or by using the Reduced Agent and Area Treatment (RAAT) program.

GRAZING MANAGEMENT

An approach that may limit grasshopper development on rangeland is to manage pastures to minimize bare ground and maximize shading. North Dakota research demonstrated that pastures that were grazed rotationally had less bare ground and more shading, which resulted in lower grasshopper populations (Onsager 2000).

The temperature differences between bare ground and shading can be significant. Differences have been found in some cases to exceed 30 degrees F. Grasshoppers, because they are cold blooded, use these temperature differences to regulate their body temperature. They can move in and out of warm spots to maintain an optimum temperature. Optimizing body temperature increases rates of digestion and reproduction, accelerating population growth.

Designing grazing management to reduce grasshopper outbreaks exclusively may not be productive. Outbreaks are difficult to predict. However, grazing management that is beneficial to other grassland functions, which may also diminish the optimal environment for grasshopper multiplication, ought to be given consideration. More than 90 species of grasshoppers (of which three or four are pests) occur in South Dakota. Eradication is neither possible nor prudent.

GRASSHOPPER TREATMENT THRESHOLDS

The High Plains IPM guide suggests that control applied when nymph populations reach 15 to 20 per square yard (which equates to 8 to 10 adult grasshoppers).

Insecticides for use against grasshoppers on rangeland include:

- carbaryl
- malathion
- lambda-cyhalothrin
- *diflubenzuron

* diflubenzuron is an insect growth regulator; as such, to be effective it must be applied when the predominate grasshopper stage is 3rd instar. It is not effective on adult grasshoppers.

Recommendations for grasshopper management and control in western South Dakota can also be found in the High Plains Integrated Pest Management Guide (HPIPM), http://wiki.bugwood.org/HPIPM. Information on grasshopper management on pasture/rangeland can be found at http://wiki.bugwood.org/HPIPM:Range_Pasture. Information on grasshopper management on alfalfa can be found at http://wiki.bugwood.org/HPIPM:Alfalfa. Pesticide label are subject to change, so always read and follow the current label requirements of the pesticide product you intend to use to ensure it can be used legally and effectively for your particular situation.

FEDERAL COST-SHARE PROGRAMS FOR GRASSHOPPERS

The Plant Protection Act of 2000 specifically allows for federal funds to be used only for the protection of federal, state, or private rangeland (USDA, APHIS, PPQ, Plant Protection Act 2000).

Government program cost-sharing grasshopper control is limited to the following:

- federal lands – 100% costs by USDA
- state lands – 50% costs by USDA
- private lands – 33% costs by USDA

(USDA, APHIS, PPQ, PPA 2000)

SD GRASSHOPPER TREATMENT PROGRAM EXAMPLES

In 2010, the Animal and Plant Health Inspection Service (APHIS) conducted control programs in Dewey and Ziebach counties on two separate blocks totaling 74,396 acres on the Cheyenne River Indian Reservation using diflubenzuron applied using Reduced Agent and Area Treatment (RAAT) patterns (Nelson and Reuter, 2000). The RAAT applications consisted of .75 ounce diflubenzuron mixed with both crop oil and water for a 31-ounce total volume that was alternately swathed through an aerial application. With this approach they treated 60% of the two control blocks and protected 74,396 acres by actually treating 44,693 acres. The post-monitoring showed a wide disparity in the percentage of control for these two control blocks, from 50 to 90%.

APHIS research data conducted earlier in Fall River County provided expectations of 90 to 95% control with this strategy (USDA APHIS, PPQ 2010). Work is ongoing to understand the control results. It is known that diflubenzuron functions as a growth regulator that keeps grasshoppers from molting, or maturing (Crompton Uniroyal Chemical 2003). One likely explanation is that the control block in Ziebach County may have had too many grasshoppers in or near the adult life stage for diflubenzuron to be effective, and thus may have contributed to the lower control.

APHIS and Center for Plant Health Science and Technology (CPHST) scientists conducted further grasshopper studies in South Dakota in 2010. These studies looked at improving the diluent mixes and nozzle spray tip angles used in aerial diflubenzuron spray treatments. Their studies also included low volume and ultra-low volume ground applications of diflubenzuron applied through ATV equipment modified and developed by the researchers. CPHST scientists also evaluated the insecticides cyfluthrin and chlorantraniliprole as a potential control options. Published results should be available in March 2011.

At this time, APHIS is projecting 2011 to continue for high grasshopper populations in much of western South Dakota (Helbig 2011). Abundant moisture and cool temperatures early on in 2010 allowed for excellent range conditions and delayed the hatch, which tended to mask much of the grasshopper damage.

Currently, it is unknown what control funding will exist in 2011. Of the $10.7 million dollars available in 2010 through Commodity Credit Corporation (CCC) funds, only $3.2 million were obligated in nine states (Brown 2011).

Control funds in 2010 were available for the following:

- Forage protection in rangeland blocks of 10,000 acres or more.
- Hot spot or incipient areas that have less than 10,000 acres but have high numbers in a definable block.
- Agricultural lands immediately adjacent to federally managed rangeland. Typically this would include crops that are being or are likely to be impacted from grasshoppers moving from the bordering federal-managed rangeland (i.e., trust or Forest Service lands) into privately managed crops. Only the bordering federal rangeland is treated as means to protect the impacted crop. Cropland was not approved for treatment.

(USDA, APHIS, PPQ 2008)

As this growing season progresses, ranchers should keep a close eye on emerging or developing grasshoppers. Helpful contacts include your local Extension office, which can contact state specialists. In addition, the South Dakota Department of Agriculture (605-773-5425) or the USDA-APHIS-PPQ office in Pierre (605-224-1713) can provide information or direct you to resources about grasshopper control and availability of control cost assistance.

WORKS CITED

Brown, Charles L., 2011. National Grasshopper Program Manager, USDA APHIS, PPQ Riverdale, Maryland, Personal Communication.

Crompton Uniroyal Chemical, 2003. Dimiln - Insect Growth Regulator. Pamphlet.

Davis, R.M. M.D. Skold, J.S. Berry and W.P Kemp. 1992. The Economic Threshold for Grasshopper Control on Public Lands. J. Agric. Res. Econ. 17:56-65.

Helbig J. Bruce. 2011. State Plant Health Director, USDA APHIS, PPQ - South Dakota. Personal Communication.

Hewitt, G.B. and J.A. Onsager. 1983. Control of Grasshoppers on Rangeland in the United States – a Prospective. J. Range Mgmt. 36:202-207.

Johnson, P.S. 1991. Grasshopper Destruction of Rangeland Grass. SD St. Univ. Beef Report 1991. 24:96-98.

Nelson, R. and K. Reuter, 2000. Field Economic Evaluation of Operational Scale Reduced Agent and Reduced Area Treatments (RAATs) for Management of Grasshoppers on South Dakota Rangeland, 1997-1999. Center of Plant Health Science and Technology (CPHST). Phoenix Protection Center.

Onsager, J.A. 1984. A Method for Estimating Economic Injury Levels for Control of Rangeland Grasshoppers with Malithion and Carboryl. J. Range. Manage. 37:200-203.

------. 2000. Suppression of Grasshoppers in the Great Plains through Grazing Management. J. Range Manage. 53:592-602.

U.S. Dept. of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USAD, APHIS, PPQ). 2000. Plant Protection Act of 2000, PU 106-224, Section 417,7USC7701 et. seq.

-----. 2008. Grasshopper Guidebook Provisional Edition, January, p. 7-2.

-----. 2010. Internally Prepared Report.

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