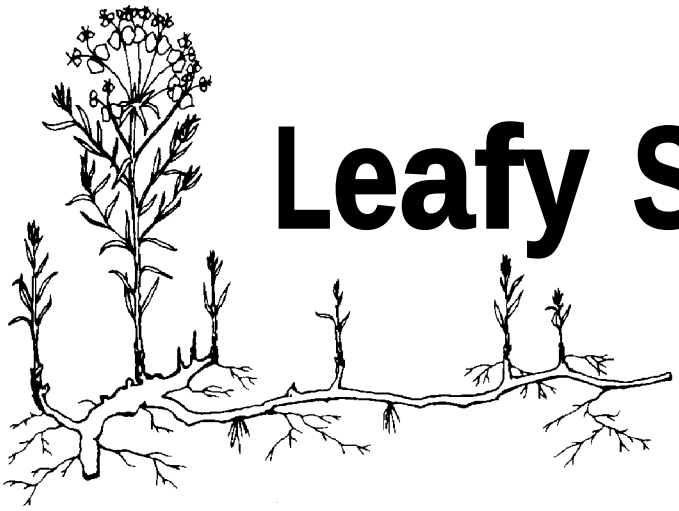

Leafy Spurge *News*

Agricultural Experiment Station
NDSU Extension Service
North Dakota State University, Fargo, ND 58105

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From The Editors Desk

This is the last issue of the year , and the main reason for it is to bring you more of the information that was presented at Medora. In order to get the maximum benefit from this issue I decided not to have the usual Leafy Spurge Honoree, that feature will be resumed next year. By the way, if any of you know of someone who should be so honored, please let me know. In this issue you will find Team Leafy Spurge schedule of events for summer 2000.

As you are aware, postage seems to be going up all the time and it is the most expensive part of getting the newsletter to you. Since many of you have e-mail, the possibility of send you the **Leafy Spurge *News*** by e-mail is being considered. We need to know how many of you would be willing to go that route. Soon we will also have a web site.

Don't forget our new section, ***Letters to the Editor***. So far there have been no takers but I hope that some of you may be willing to send me a letter on your thoughts about leafy spurge; so let's communicate!

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TEAM Leafy Spurge personnel gets new e-mail addresses

TEAM Leafy Spurge co-principal investigator Gerry Anderson, program coordinator Chad Prosser and technology transfer specialist Steve Merritt all have new e-mail addresses. They can now be contacted via e-mail at:

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Mailing addresses and phone numbers remain the same.

TEAM Leafy Spurge Plans Summer 2000 Schedule

TEAM Leafy Spurge, a USDA-ARS Area-Wide Integrated Pest Management program, has scheduled a series of tours, biocontrol training sessions and flea beetle distributions for the summer of 2000.

Last year, TEAM Leafy Spurge packaged "Spurgefest '99," a three-day public awareness event, with demonstration site tours and insect distributions in Ekalaka (Montana), Buffalo (South Dakota) and Sundance (Wyoming). The success of those efforts, said program coordinator Chad Prosser, provided the impetus for this summer's schedule.

"It was a great summer," Prosser said. "We distributed a lot of insects and information, and it was satisfying to see how much interest there is in biological control and Integrated Pest Management."

All told, TEAM Leafy Spurge personnel distributed more than 20 million insects to ranchers, landowners and land managers from 50 counties in seven states.

"We're now going to try and build on the interest we generated last summer," Prosser said. "There won't be a major event like Spurgefest, but we will be conducting tours, insect distributions and biological control training sessions."

The schedule of events includes:

- June 21 - Ekalaka (Montana) - Insect distribution.
- June 22 - Sentinnel Butte (North Dakota) - Insect distribution and tours of TEAM Leafy Spurge research & demonstration sites.
- June 26 - Mandan (North Dakota) - An insect distribution for ranchers & landowners from the Heart River drainage in Morton County.

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Integration of the Flea Beetle, Aphthona Nigriscutis Foudras, and Herbicides for Control of Leafy Spurge, Euphorbia Esula L.

The combined treatment of the biological control agent, *A. nigriscutis* plus the herbicide treatment picloram plus 2,4-D generally provided better leafy spurge control compared to either method used alone. Leafy spurge control from the combined treatment averaged 44% 12 months after application. Leafy spurge with *A. nigriscutis* was oversprayed with picloram plus 2,4-D with a minimal negative impact to the *A. nigriscutis* population. The number of *A. nigriscutis* adults collected in the field was similar regardless of herbicide application date. Leafy spurge root nutrient content was not affected by picloram plus 2,4-D applied in the fall. Soluble and insoluble carbohydrate and soluble protein concentrations in herbicide treated plants were similar to concentrations in the untreated control. Leafy spurge plants harvested within an insect confining screened cage had root nutrient concentrations similar to roots harvested outside the screened cage. Uptake and translocation of ^{14}C-picloram and ^{14}C-2,4-D was similar in plants damaged or unaffected by *A. nigriscutis* larvae. Therefore, the observed increase in leafy spurge control from the combined treatment was likely from the combined effect of herbicide toxicity to root tissue plus *A. nigriscutis* larval feeding on leafy spurge root buds.

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Apthona Flea Beetle Establishment Determined by Soil Composition and Root Growth Pattern

Aphthona spp. flea beetles have been used since 1992 as a control treatment of leafy spurge in North Dakota. The reduction in leafy spurge where biological control was used ranges from excellent to poor depending on location. The fair to poor location results prompted a study on the effects of soil composition and root growth patterns of leafy spurge on flea beetle population levels.

Forty one, four-year-old, *Aphthona* flea beetle release locations were sampled between 1996 and 1998 for soil composition and root growth pattern. The leafy spurge roots were extracted and measurements from the soil surface to the first lateral roots, and the number of filament roots on lateral and tap roots were recorded. The results were compared to adult flea beetle population levels at each location.

To use *Aphthona* spp. for leafy spurge control appears to require a soil composition that will result in root growth close to the soil surface. A silt loam, silt clay loam, clay loam, or loam soil with a ph of 6.8 - 7.9 and organic matter of 6.0 - 9.28 % produced the most adult flea beetles. The fine sand, loam fine sand, or fine sand loam soils with a pH of 6.5 - 7.4 and organic matter of 0.90 - 2.8 % produced the fewest adult flea beetles. Leafy spurge root systems in soil habitats that do not produce sufficient numbers of filament roots and the lateral roots are more than two inches below the soil surface, will result in low *Aphthona* spp. population levels and little impact on spurge stands.

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Sex Ratio Effects on Fecundity and Fertility of a Leafy Spurge Flea Beetle Aphthona Lacertosa

Aphthona spp. flea beetles have been used to control leafy spurge throughout the north central great plains including North Dakota. However, *Aphthona* flea beetles have not been successful at controlling leafy spurge in all infested areas. These failure may be due to a number of factors including climate, soil and vegetative characteristics, or the insects biology. The flea beetles have been collected from field insectaries and redistributed to other leafy spurge sites. Some of these collections have shown a female bias, with as few as 4% males. A lack of sufficient male numbers may be a factor that contributed to the failure of *Aphthona* flea beetles to establish in some of the leafy spurge infestations.

A laboratory study was conducted to determine the impact of sex ratios on the fecundity and fertility of a leafy spurge flea beetle, *Aphthona lacertosa* .

Four sex ratios were established using newly emerged field collected *A. lacertosa* . The number of females remained constant among the experimental treatments, while the number of males was altered to establish the ratios of 0:1, 1:3, 1:1, and 3:1, male:female. The males in a fifth treatment of 1:1 were removed after 24 hr to determine if multiple matings are necessary for continued oviposition. Each treatment was maintained in Plexiglas cylinder cages (9.3 x 4.1 cm). A 4.1-cm diameter piece of felt was placed in the bottom of each chamber for oviposition. In addition, each chamber was supplied with leafy spurge leaves for food and moisture. The experimental chambers were maintained in an environmental chamber (23º C, 12:12 L:D). Each day, for a duration of 30 days, the oviposition pads were examined for eggs. Pads with eggs were placed on moistened patching plaster in a sealed petri dish (4.1cm diameter) and placed in an environmental chamber (23º C, 0:24 L:D) to observe for larval emergence. Also, the number of purged, dead, and prehatched eggs were recorded. Each experimental treatment consisted of 9 replications.

A low percentage of males in a population of *A. lacertosa* may not be a contributing factor to the failure of this species to establish in leafy spurge infested areas. The fecundity of *A. lacertosa* among the three sex ratios of 1:3, 1:1, and 3:1 was not significantly different In addition, fertility did not differ among these three sex ratios. Females not exposed to males, or exposed to males for only 24 hours, oviposited significantly fewer eggs compared to females exposed to males during the 30 day oviposition period.

Table. The effects of sex ratio on the fecundity and fertility of *Aphthona lacertosa*.

M:F sex ratio	Mean total *A. lacertosa* eggs per day				
	Oviposited	Hatched	Dead	Purged	Prehatched
0:1	4.6a	0.04a	4.1a	0.3a	0.04a
1:3	7.2b	0.5b	5.1bc	1.3b	0.2a
1:1	7.5b	0.4b	5.1abc	1.3b	0.7b
3:1	7.5b	0.4b	5.4c	1.4b	0.2a
1:1[a]	4.8a	0.04a	4.5ab	0.2a	0.04a

[a]Male flea beetles were removed after 24 hr.

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Change Detection of Leafy Spurge (Euphorbia Esula) Infestations Using Aerial Photography and Geographic Information Systems

Leafy spurge is a troublesome weed on the northern Great Plains of the United States that herbicides and grazing management have not consistently controlled. Remote sensing and geographic information system (GIS) technology have been used to detect and monitor numerous grassland-related problems. The objectives of this study were to use both technologies jointly to map and quantify the extent, distribution, and spatial-temporal dynamics of leafy spurge within Theodore Roosevelt National Park in 1993 and 1998. The five-year comparison provided a unique opportunity to understand how leafy spurge is impacting the park and identify how infestations are changing over time. The same basic methodology was used in 1993 and 1998 with some modifications resulting from improved data handling capabilities. Only the western 8,090 ha of the park were evaluated for both years because of problems with film and cloud contamination encountered in 1998. Data collected in 1998 were not validated prior to this analysis. Preliminary analysis of the data indicated that leafy spurge had doubled during the 5 year period. Leafy spurge extent was estimated to be 591 ha in 1993 and 1,194 ha in 1998. Most infestations were restricted to drainage channels, creek bottoms, and river bottoms. The extent of leafy spurge increased across all aspects and slopes, however, the rate of increase was slower on south facing aspects and flatter slopes. The faster rate of increase on slopes ranging from 6 to 20 % indicate that leafy spurge is slowly moving out of the relatively flat drainage channels and butte tops unto steeper slopes. The difference in the rate of increase between the north and south facing aspects combined with the slope and proximate to drainage channel data indicate that water is likely the driving variable for leafy spurge establishment in the Badlands. The most impressive finding of the study was that the extent of leafy spurge appeared to have doubled within 5 years. What makes this finding even more impressive is that the increase was accomplished under an aggressive weed management plan. Managers and administrators charged with the stewardship of federal or state lands and ranchers operating on private land must not delay in managing leafy spurge. Leafy spurge will only be controlled with aggressive and consistent application of integrated pest management tools specifically chosen to meet the individual requirements of each situation.

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AFLP Analysis on Individuals from Leafy Spurge Populations Characterized as Resistant or Susceptible to Flea Beetle Biocontrol Agents

Biocontrol agents are becoming a major part of integrated pest management. However, since the pest is a living organisms, selection for resistance to the biocontrol agent will occur. A pest with more genetic variability is expected to evolve resistance mechanisms faster than a pest with less genetic variability. Several species of flea beetles (of the *Aphthona* genus*)* have been employed as biocontrol agents to help control leafy spurge. However, resistance to these beetles has been observed in some populations of leafy spurge. It is not known if the resistance is the result of environmental factors or genetic differences in the resistant populations. Also, the level of genetic variability present in wild populations of leafy spurge is unknown. Knowing the level of genetic variability present in leafy spurge and understanding the mechanisms by which this pest is adapting resistance strategies will aid in predicting the long term success of the flea beetles as a bio-control agent on leafy spurge. We have initiated an analysis of the genetic variability present in wild populations of leafy spurge and have begun to look for specific genetic markers that could be linked to genes involved in resistance to the flea beetles.

Dr. Robert Nowierski, a researcher at Montana State University, provided us with dried leaf material for five individual leafy spurge plants each from 50 different populations. These populations were treated with various *Aphthona* species and Dr. Nowierski has characterized the populations as being either susceptible or resistant to these bio-control agents. We extracted DNA from individual plants and initiated their genetic characterization using the small genome AFLP kit from Gibco/BRL (AFLP Analysis System II). An appropriate number of bands (20 to100) were generated with the EcoRI (AA) and each of the seven different MseI primers tested. These data are consistent with previous studies suggesting leafy spurge has a relatively small genome. Amplification generated an average of 41 bands per primer set of which 10 were major bands. There was an average of 1.6 clearly polymorphic bands between individuals from a single population per primer set. This average compares with three to five polymorphic bands per primer set from two closely related barley varieties (Foster and ND9712). These data are consistent with the hypothesis that the level of polymorphism is very low within a given population of leafy spurge.

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Comparison of Companion Grazing and Single Species Grazing on Leafy Spurge Infested Rangeland

A study was established near Mandan, North Dakota in 1996 to study the effects of companion and single species grazing on leafy spurge infested rangeland. The study evaluated the control of leafy spurge, grazing efficiency, and livestock performance among three grazing treatments; cattle only (CO), sheep only (SO), and cattle and sheep (CS). The research study consisted of three replicated 8 ha blocks. Each of the replicates was subdivided into four 2 ha plots and treated with either a CO, SO, CS, and a non-use control (NU). Treatments were randomly selected within each block. Each 8 ha research block had one plot grazed by two yearling steers (CO), one grazed by ten mature ewes (SO), and one grazed by one yearling steer and five mature ewes (CS). Stocking rates were approximately 3.7 AUM/ha for the CO, SO, and CS treatments, respectively. A significant reduction in leafy spurge stem density occurred after two grazing seasons on the SO treatment. Leafy spurge stem density was reduced from 10.4 ± 0.9 (S.E) stems/0.1 m^2 quadrat in 1996 to 2.5 ± 0.6 (S.E) stems/0.1 m^2 quadrat in 1998, a reduction of 75% after 2 years. No changes occurred in leafy spurge stem density on the CS, CO, and control (NU) treatments after 2 years. Herbage production was similar for graminoids, forbs, shrubs, and leafy spurge on the NU for the growing season of 1996, 1997, and 1998. Leafy spurge degree of disappearance increased on all treatments from 1996 to 1998. Degree of leafy spurge disappearance on the SO went from 76% to 98% and the CS went from 62% to 88% from 1996 to 1998. The CO also had an increase in leafy spurge disappearance with 23% in 1996 to 50% in 1997 and 1998. Graminoid degree of disappearance was similar within and between

grazing treatments. Steer average daily gain (ADG) was not different between treatments (CO and CS) for either years of the study. There was no change in steer ADG between years on the CS. The cattle only treatment, however, had an ADG of 0.80 $\pm$ 0.03 (S.E.) in 1996 and significantly decreased to 0.56 $\pm$ 0.03 (S.E.) in 1998. Ewe ADG was not different between treatments (SO and CS) for either years of the study, similar to the steer performance results. In both SO and CS treatments there was a decrease in ewe ADG between years 1996 and 1998; 0.07 $\pm$ 0.01 (S.E.) to 0.02 $\pm$ 0.01 (S.E.) on the SO and 0.07 $\pm$ 0.01 (S.E.) to 0.03 $\pm$ 0.01 (S.E.) on the CS. Sheep in a single species grazing environment provided a greater control of leafy spurge than companion grazing after the first two years of a ten years study. Companion grazing improved the performance of the steers; however, had no negative or positive impact on sheep performance compared to single species grazing. In these three years, this improvement in steer performance was seen by having a less negative impact on performance versus the reduction in performance as seen on the CO between years.

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Removing the Constraints of Sheep as an Alternative Integrated Pest Management Tool

The history of grazing sheep on leafy spurge infested rangeland goes back to the late 1930's. In 1936 A.K. Bakke stated that sheep will eat leafy spurge if there is an absence of other desirable forbs. Two years later F.W. Christensen and his colleagues reported that sheep will consume leafy spurge and were effective in controlling leafy spurge in southeastern North Dakota. A year later E.A. Helgeson and E.J. Thompson also reported that sheep could be an effective tool in the control of leafy spurge. At this time Helgeson and Thompson suggested that one answer to the invasion of North Dakota grasslands by this noxious weed was to include sheep in a grazing management plan. In 1942 Helgeson and E. J. Longwell quantified that sheep will consume leafy spurge and were effective in controlling leafy spurge in southeastern North Dakota. As late as the 1980's an aerial flight over the Hurdsfield hills area of North Dakota during the height of the leafy spurge flowering season was clear evidence of the impact of sheep on those acreage that had some history of grazing sheep, as opposed to those who did not. Since the early discovery that sheep are effective in controlling leafy spurge, there have been many disagreements in literature concerning the use of leafy spurge by sheep, due to one or more chemicals found in leafy spurge that elicit an aversive response when cattle and sheep consume leafy spurge.

In the past 15 years grazing sheep as a biological control for leafy spurge has become more acceptable. Dahl et al. showed a trend that the use of sheep in a multi-species grazing approach on leafy spurge infested rangeland will be effective in controlling leafy spurge. Lajeunesse et al. also have stated that grazing animals can help control leafy spurge by increasing the competitiveness of desirable plants through time of grazing and selective removal of the foliage. Nelson et al. stated ecological benefit of multi-species grazing, besides natural weed control, would be that some natural resources used for plant growth could be diverted from the less desirable species to the more desirable plants. The principle of multi-species grazing is better utilization of rangeland and to improve livestock production. Therefore the grazing habits of cattle and sheep complement one another and offer economical and ecological benefits. There still are low use rates due to the lack of knowledge on the proper equipment (fences, water, shelters), competition for the same forage as cattle, expertise/knowledge to work with sheep, predation losses, and sheep are too time consuming. The Hettinger Research Extension Center has been working the last 6 years on some of these constraints with a systematic management approach.

According to Sell et al. 72% of the individuals questioned lack the proper equipment such as fencing, watering facilities, and shelter. Sheep can be retained in five to six strand barbed wire fence and woven wire is not needed. By using barbed wire we have cut the fencing cost in half and there is no extra work involved except adding two to three more strands of wire to an existing fence. The same watering facilities used by cattle can also be used by sheep. Adding fill to one side of the stock tank allows the sheep to water. A stock dam with a firm slope can be used, however, if the dam has a soft slope drinking area gravel should be applied to allow sheep to reach the watering area easily.

The next constraint in using sheep as a control method for leafy spurge was the competition for the same forage as cattle see Sell et al. The dietary overlap of sheep and cattle can be high on native and leafy spurge infested rangeland. Our hypothesis is, once the sheep have acquired the taste for leafy spurge, the dietary overlap is small. However, there are still a lot of unknowns that haven't been answered. Does the breed of sheep have an influence on the use of leafy spurge or does the plant community and the level of aversive chemicals found in leafy spurge, in a certain geographical area, have an effect on consumption, and does the age of the sheep grazing leafy spurge infested rangelands have an effect on leafy spurge use?

The concern of predation has grown since the bounty on coyotes and other predators have been reduced or eliminated. Predation can be reduced by using adult ewes and implementing them into a multi-species grazing practice. We have found that by mixing cattle and sheep together the livestock species tend to bond and usually graze and bed down together in the same area. Predation has been reduced to 1 to 2% per year in the last five years using this type of management approach.

Lack of expertise/knowledge and sheep are too labor consuming to use are constraints that have been unanswered currently. The Hettinger Research Extension Center, however, is working on these constraints by developing sheep schools to educate producers in the basics of handling and raising sheep. The constraint that sheep are too labor consuming is presently being worked on to remove the additional burden from the cattle producer. TEAM Leafy Spurge, the Hettinger Research Extension Center, and the Department of Agricultural Economics of North Dakota State University are looking into a sheep co-op program, which will eliminate the expertise/knowledge and time consumption involved in raising sheep for the cattle rancher who is interested in using sheep as an alternative method of controlling leafy spurge.

Additional research that is currently in the process is a 4 year study on alternative management systems of sheep production that will enhance the economics of and utilization of sheep grazing as a control method for leafy spurge. This research is concentrating on designing a fall lambing system and an easy sheep system. The easy sheep management scheme is based on reducing lambing facilities and reducing the workload by letting the ewes lamb-out on the prairie. This research should bring forth some new questions and answer some older ones.

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Leafy Spurge Management with Sheep and Flea Beetles

Leafy spurge (*Euphorbia esula*) is an aggressive, perennial rangeland weed that displaces native vegetation and causes millions of dollars to be lost annually in the agricultural and non-agricultural sectors. Many cultural, chemical, and biological control methods have been evaluated, but herbicides are used primarily. Leafy spurge infests a wide array of habitats and is considered difficult to impossible to control in sensitive shelterbelts and riparian areas where herbicides are very difficult to use. An experiment was initiated in 1993 (1) to determine an optimum sheep stocking rate and grazing duration that is compatible with flea beetle herbivory, and (2) to determine the impact of sheep grazing alone and sheep grazing plus flea beetles on the entire plant community within a defined leafy spurge infested habitat.

The experiment was conducted in a riparian area 25 miles east of Denver, CO. The site is characterized by low organic matter, sandy, gravely soil, with primarily a leafy spurge-western wheatgrass (*Agropyron smithii* Rydb.)-Kentucky bluegrass (*Poa pratensis* L.) understory and a semi-open plains cottonwood (*Populus sargentii* Dode) overstory. A factorial design arranged as a split-plot was used. Main plots were four stocking

rates (two, four, six, or eight sheep/A) by three grazing durations (10, 20, or 30 days). Each plot was 1 acre in size. In 1993, all main plots were split; 500 flea beetles (*Aphthona flava*) were randomized and released onto a single point into one-half of each main plot. There were 12 treatments and one control plot per block. Each treatment was replicated twice and all data were subjected to regression analysis.

Data collected in June, 1998 reflect the results of treatments invoked in 1995 ,1996, and 1997. These data show that 4 or 6 sheep grazing alone for 10 or 20 days were exerting biological control of leafy spurge. Leafy spurge density within these treatments was decreased 57 to 64% while smooth brome cover increased 4- to 7-fold and Kentucky bluegrass cover increased 2- to 3-fold. The June data show that all stocking rates of sheep grazing for 30 days stimulated leafy spurge growth and 30 days of grazing was too long regardless of stocking rate. There was about 1.6 times more leafy spurge cover within all 30 day treatments compared to non-grazed plots. The greatest smooth brome cover in June 1998 occurred where 8 sheep grazed for 10 or 20 days, but Kentucky bluegrass cover was suppressed within these treatments. Data collected in fall 1998 also show that sheep were behaving as biocontrol agents when 4 or 6 sheep grazed per acre for 10 or 20 days. Leafy spurge was effectively suppressed while the cool season grasses all displayed a positive response within these treatments.

There were no functional leafy spurge equations produced from data collected on flea beetle transects in June 1998. However, fall 1998 data indicate that a synergism was apparent between grazing sheep and flea beetles relative to decreasing leafy spurge populations and increasing grass populations. Where 6 sheep grazed for 10 days concurrently with flea beetles, leafy spurge density was decreased 50% while smooth brome, western wheatgrass, and Kentucky bluegrass cover increased 36-, 26-, and 5-fold, respectively.

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Progress Update on Toxic Compounds in Leafy Spurge for Ruminants

The reluctance of cattle to graze leafy spurge is a major reason why this introduced and toxic plant is considered a noxious weed in North America. The toxic and aversive chemicals in this plant are probably toxic to sheep as well as cattle. Although sheep appear to be much less susceptible to the toxic chemicals in leafy spurge, at higher levels of leafy spurge intake these toxins likely affect them also and consequently limit the capacity of sheep to graze and help control leafy spurge. During the last several years, we have been conducting a bioassay-guided chemical investigation of leafy spurge in order to identify compounds in leafy spurge that are toxic and aversive to ruminants. Our bioassays have been food aversion trials with rats and cattle and cytotoxicity tests. Our work is currently focused on identifying toxic compounds within a fraction that elicits feeding aversions in rats and cattle. This fraction contains about 40 compounds. Using high-performance liquid chromatography coupled with high resolution nuclear magnetic resonance, mass spectroscopy, infrared and ultraviolet detection, we have identified a series of cytotoxic compounds in leafy spurge that are called acetogenins. Our investigation of the compounds in the aversive fraction continues and we hope to know soon if there are other types of toxic and aversive compounds in leafy spurge besides acetogenins.

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- June 27 - Bison (South Dakota) - An insect distribution for ranchers & landowners from the Grand River drainage in Perkins County.
- June 27 - Buffalo (South Dakota) - Insect distribution & biological control training session.
- June 29 - Sheridan (Wyoming) - Insect distribution for ranchers & landowners from Sheridan and Johnson counties.

Specific information on times and locations will be available this spring, Prosser said, and also will be posted on the TEAM Leafy Spurge website at www.team.ars.usda.gov.

In addition to the tours and insect distributions, TEAM Leafy Spurge will also be participating in several trade shows, state weed control association meetings and state Extension Service meetings this winter.

"Agriculturally oriented trade shows, weed control association meetings and Extension meetings provide us with a good opportunity to see a lot of people in the same place at the same time," Prosser said. "It's a great way to get information directly to our target audience."

TEAM Leafy Spurge attended the Wyoming Weed & Pest Council annual meeting in November, and will follow up with state weed control association meetings in Montana, North Dakota and South Dakota. Trade shows scheduled include the Marketplace of Ideas (Bismarck, Jan. 6), the Montana Agri-Trade Expo (Feb. 17-19 in Billings) and the Glendive Agri-Trade Expo (Glendive, Feb. 24-26). TEAM personnel will be conducting biological control seminars at Marketplace and GATE.

Prosser said he'd appreciate any information on other events that would provide TEAM Leafy Spurge with good opportunities to distribute information.
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