

# **The control of leafy spurge (*Euphorbia esula*) by the interaction of herbicides and perennial grasses**

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## **Introduction**

Although herbicides play an important part in the control of leafy spurge, alternative methods are available that may be used where persistent herbicides cannot be tolerated. Grass competition has long been recognized as a method of leafy spurge control. The purpose of this research was to determine the potential of perennial grass competition as an alternative to repetitive herbicide treatment for control of leafy spurge.

## **Materials and methods**

This research was conducted near Devil's Tower, Wyoming to evaluate the effects of eleven perennial grass species on leafy spurge. Two applications of glyphosate (Roundup, Monsanto) at 1 quart of product per acre were broadcast with a truck-mounted sprayer delivering 15 gpa at 35 psi before seeding grasses in 1986. The first application was June 2, 1986 and the second application was July 1, 1986. Soils were classified as a silt loam with 1.8% organic matter and pH of 6.3. Pendimethalin (Prowl, American Cyanamid) at 2 quarts and fluroxypyr (Starane, Dow/Elanco) at 1.2 quarts of product per acre were applied on May 16, 1988 with a tractor mounted sprayer delivering 20 gpa at 35 psi. Plots (60 by 90 feet) were arranged in a split plot design with four replications. One half of each plot was tilled and the other half was left untilled. Plots were tilled with a rototiller on August 12, 1986 and grasses were seeded with a John Deere powertill drill on August 12, 1986. Evaluations on percent grass stand, grass yield, and percent leafy spurge control were made each year starting in 1988.

Grasses used in this study were selected on the basis of their ability to establish in low moisture areas and included 'Luna' pubescent wheatgrass, 'Ephraim' crested wheatgrass, mountain rye, 'Sherman' big bluegrass, 'RS1' hybrid wheatgrass, 'Manchar' smooth brome grass, 'Oahe' intermediate wheatgrass, 'Secar' bluebunch wheatgrass, 'Rosana' western wheatgrass, 'Bozoisky' Russian wildrye, and 'Critana' thickspike wheatgrass.

## Results and discussion

Grass stands were 70% or better in 1991 for most grasses in rototilled plots and for all grasses except Sherman and Luna in the no-till plots (Table 1). Mountain rye was least competitive grass and was replaced by intermediate wheatgrass and Kentucky bluegrass, which were present before the study site was seeded (Table 1). In no-till areas, Luna and Sherman maintained adequate stands, while Critana and Oahe stands were reduced to 33% and 43% stand, respectively, by five years after seeding (Table 1).

All grasses provided good leafy spurge control in 1988, but control declined in subsequent years for many of the grasses, particularly in the no-till plots. Leafy spurge control was 80% or greater for all grasses, except mountain rye and bluebunch wheatgrass, in tilled plots in 1991. Leafy spurge control was poor to fair in grass stands in the no-till plots by five years after planting (Table 1).

Bozoisky had the highest crude protein and TDN of all grasses sampled. There were no differences in nutritive value of grasses established in tilled and no-till plots (Table 2).

**Grass characteristics.** Luna pubescent wheatgrass is considered to be better adapted to droughty, infertile, and saline soils than intermediate wheatgrass. Luna was developed in New Mexico by the USDA-SCS (Onsager 1987). This was one of the best varieties in the study because it maintained good grass stands in both the tilled and no-tilled areas and good control of leafy spurge.

Ephraim crested wheatgrass has been the most widely use grass for seeding range-lands of western U.S. and Canada. Crested wheatgrass is an excellent source of early season forage; however, forage quality declines rapidly during the summer and fall. Ephraim was released in 1983 by the USDA-Forest Service, Utah State Division of Wildlife Resources, and USDA-SCS in cooperation with the Utah, Arizona, and Idaho Agricultural Experiment Station. This grass is persistent and drought resistant cultivar that has good sod-forming characteristics. It is recommended for grazing and revegetation of problem sites in low precipitation zones of the Great Plains (Onsager 1987). In this study, crested wheatgrass became well established and suppressed leafy spurge in tilled areas.

Sherman big bluegrass is an early maturing grass with good drought tolerance. It is best utilized in the spring since its nutritive value drops considerably as the summer progresses. This grass established well in tilled areas and in no-till areas. Leafy spurge control decreased in the no-till areas, but remained fairly constant in the tilled areas.

RS1 hybrid wheatgrass is a hybrid developed from a cross between quackgrass and bluebunch wheatgrass. The initial cross was made by D. R. Dewey in 1962. However, over 20 years were required to combine the desired characteristics of the parental species into genetically stable and fertile breeding populations. Two germplasm releases (RS1 and RS2) were made available to plant breeders in 1980. The RS1 release appears to be best adapted to areas receiving 12 to 18 inches of precipitation and responds well to repeated clipping or grazing and appears to be very palatable. This hybrid also has considerable tolerance to salinity (Onsager 1987). This grass established well in tilled areas during this study and stands increased and maintained good leafy spurge control in the tilled plots. The grass failed to adequately establish in the no-till areas.

**Table 1. The control of leafy spurge by the integration of herbicides and perennial grasses from 1988 through 1991 near Devil's Tower, Wyoming.**

| Grass species                   | Grass stand (%) |      |      |      |         |      |      |      | Leafy spurge control (%) |      |      |      |         |      |      |      | Grass yield (lbs/A) |      |      |      |         |      |      |      |
|---------------------------------|-----------------|------|------|------|---------|------|------|------|--------------------------|------|------|------|---------|------|------|------|---------------------|------|------|------|---------|------|------|------|
|                                 | Rototilled      |      |      |      | No-till |      |      |      | Rototilled               |      |      |      | No-till |      |      |      | Rototilled          |      |      |      | No-till |      |      |      |
|                                 | 1988            | 1989 | 1990 | 1991 | 1988    | 1989 | 1990 | 1991 | 1988                     | 1989 | 1990 | 1991 | 1988    | 1989 | 1990 | 1991 | 1988                | 1989 | 1990 | 1991 | 1988    | 1989 | 1990 | 1991 |
| 'Luna' pubescent wheatgrass     | 90              | 90   | 94   | 93   | 70      | 71   | 74   | 76   | 97                       | 93   | 93   | 90   | 84      | 72   | 75   | 69   | 497                 | 2074 | 1102 | 1910 | 274     | 1062 | 727  | 1162 |
| 'Ephraim' crested Wheatgrass    | 83              | 96   | 94   | 84   | 55      | 14   | 14   | 20   | 95                       | 90   | 87   | 89   | 79      | 56   | 45   | 55   | 474                 | 1434 | 836  | 1080 | 218     | 413  | 466  | 564  |
| Mountain rye                    | 18              | 11   | 1    | 2    | 5       | 4    | 0    | 0    | 79                       | 50   | 49   | 64   | 58      | 31   | 20   | 8    | 368                 | 436  | 0    | 0    | 224     | 119  | 0    | 0    |
| 'Sherman' big bluegrass         | 74              | 89   | 89   | 84   | 79      | 83   | 80   | 79   | 96                       | 91   | 90   | 86   | 89      | 78   | 65   | 60   | 594                 | 2297 | 922  | 881  | 336     | 2119 | 762  | 894  |
| 'RS1' hybrid wheatgrass         | 74              | 85   | 95   | 90   | 13      | 10   | 6    | 5    | 94                       | 89   | 88   | 88   | 60      | 33   | 15   | 11   | 519                 | 2886 | 1281 | 1518 | 142     | 619  | 382  | 586  |
| 'Manchar' smooth brome-grass    | 80              | 80   | 78   | 73   | 18      | 23   | 16   | 11   | 92                       | 79   | 78   | 80   | 68      | 40   | 25   | 10   | 294                 | 1263 | 639  | 780  | 152     | 605  | 171  | 260  |
| 'Oahe' intermediate wheatgrass  | 71              | 91   | 93   | 91   | 16      | 53   | 48   | 43   | 97                       | 91   | 86   | 86   | 68      | 51   | 46   | 39   | 652                 | 3173 | 1235 | 2329 | 152     | 2053 | 734  | 1099 |
| 'Secar' blue-bunch wheat-grass  | 64              | 64   | 58   | 75   | 15      | 2    | 3    | 5    | 83                       | 76   | 65   | 76   | 64      | 35   | 24   | 24   | 194                 | 968  | 871  | 1447 | 128     | 169  | 282  | 242  |
| 'Rosana' western wheatgrass     | 76              | 59   | 61   | 74   | 26      | 19   | 18   | 18   | 91                       | 98   | 88   | 85   | 65      | 48   | 34   | 25   | 464                 | 1348 | 729  | 1222 | 174     | 397  | 284  | 122  |
| 'Bozoisky' Russian wildrye      | 83              | 90   | 88   | 88   | 30      | 10   | 13   | 13   | 97                       | 93   | 93   | 94   | 63      | 44   | 41   | 28   | 552                 | 1283 | 564  | 932  | 160     | 220  | 229  | 438  |
| 'Critana' thickspike wheatgrass | 81              | 61   | 64   | 70   | 29      | 15   | 20   | 33   | 94                       | 78   | 78   | 86   | 70      | 29   | 36   | 50   | 484                 | 1587 | 695  | 991  | 210     | 690  | 449  | 431  |
| LSD (P<0.05)                    | 13              | 21   | 23   | 19   | 13      | 21   | 23   | 19   | 16                       | 18   | 21   | 21   | 16      | 19   | 21   | 21   | 151                 | 630  | 335  | 421  | 151     | 630  | 335  | 421  |

Grasses planted August 12, 1986.

Evaluations: Grass stand and leafy spurge control; Sept. 14, 1989, Aug. 8, 1989, Sept. 13, 1990, and June 20, 1991 and grass yield; Sept. 14, 1988, Aug. 8, 1989, Sept. 13, 1990, and Sept. 12, 1991.

**Table 2. Forage quality of eleven grasses planted in a pasture to suppress leafy spurge near Devil's Tower, Wyoming in 1986.**

| Grass species                   | Crude Protein | TDN |
|---------------------------------|---------------|-----|
|                                 | %             |     |
| 'Luna' pubescent wheatgrass     | 4.1           | 43  |
| 'Ephraim' crested wheatgrass    | 4.6           | 45  |
| Mountain rye                    | 3.3           | 45  |
| 'Sherman' big bluegrass         | 3.8           | 40  |
| 'RS1' hybrid wheatgrass         | 4.3           | 42  |
| 'Manchar' smooth brome          | 4.9           | 46  |
| 'Oahe' intermediate wheatgrass  | 3.8           | 42  |
| 'Secar' bluebunch wheatgrass    | 4.7           | 45  |
| 'Rosana' western wheatgrass     | 5.8           | 45  |
| 'Bozoisky' Russian wildrye      | 5.8           | 49  |
| 'Critana' thickspike wheatgrass | 4.4           | 38  |
| LSD (P<0.05)                    | 0.8           | 4   |

Grasses sampled August 8, 1989.

Manchar smooth brome was selected because of its palatability, nutritive characteristics and ease of establishment. Adequate stands were established in tilled areas and, despite a decline in stands, it provided good leafy spurge control.

Oahe intermediate wheatgrass and its pubescent form, pubescent wheatgrass were introduced from Asia as early as 1907. It is a relatively tall grass with a moderate degree of rhizome development. It is more productive, but somewhat less drought resistant, than crested wheatgrass. Because of its large seeds and vigorous seedlings it is one of the easiest range grasses to establish. The grass matures from one to two weeks later than crested wheatgrass and provides more and better quality forage during the summer period (Onsager 1987). In this study, Oahe established excellent stands in the tilled areas, but poor stand established in the no-till areas.

Secar bluebunch wheatgrass is a cool season bunchgrass that is widely distributed on the dry plains and hills of the Intermountain Region and Pacific Northwest. It has excellent nutritional value. High palatability causes this grass to be rapidly depleted under heavy grazing pressure. Secar was released in 1981 by the USDA-SCS in cooperation with the Washington, Oregon, Idaho, Montana, and Wyoming Agricultural Experiment Stations. It is an early maturing, drought resistant cultivar adapted to the lower elevations of the Pacific Northwest and similar environments (Onsager 1987). This grass did not establish very well in the study, but stands and yield were adequate to suppress leafy spurge on the tilled areas.

Rosana western wheatgrass is a rhizomatous, cool-season, perennial grass that is widely distributed in the sagebrush ecosystem and in the Central and Northern Great Plains. Western wheatgrass was developed as a hybrid between thickspike wheatgrass and beardless wildrye. It is resistant to drought and is well suited to heavy alkaline soils, but is a poor seed producer and stands are often difficult to establish from seed. Rosana established good stands in the tilled areas and very poor stands in the no-till areas.

Bozoisky Russian wildrye is a cool-season perennial bunchgrass that has been widely used in the western U.S. and Canada. Once established, it has excellent drought and cold

tolerance. The species is characterized by dense basal leaves that are high in nutritive value and palatable to grazing animals. Forage quality of this grass during the late summer and early fall is better than many other grasses, including crested and intermediate wheatgrass. This cultivar has been significantly more productive and easier to establish on semiarid range sites than other Russian wildryes (Onsager 1987). Excellent stands of Bozoisky Russian wildrye that established in the tilled areas provided the best leafy spurge control.

Critana thickspike wheatgrass is a widely distributed sod forming perennial used primarily for soil stabilization on disturbed range sites. As a forage grass, it is most productive during the early summer when the nutritional value of crested wheatgrass is low. It is similar in appearance to western wheatgrass and is more tolerant to drought, but it is less productive. Critana was released in 1971 by the USDA-SCS in cooperation with the Montana Agricultural Experiment Station. This grass originated from collections made from roadside cuts in north-central Montana and is recommended primarily for revegetation of disturbed range areas and other dry habitats (Onsager 1987). Critana establishment was good in tilled plots, but poor in the no-till plots. It maintained good leafy spurge control and good forage production in the tilled plots.

Luna and Bozoisky appear to be the best overall grasses for competition with leafy spurge. Luna became well established in both tilled and no-till plots. Bozoisky Russian wildrye provided the best leafy spurge control in the tilled plots and best late season nutritive value. These two grasses were seeded August 8, 1989 in another study that was designed to determine how grazing influences the competitiveness of these grasses with leafy spurge.

## Literature cited

Onsager, J. A., editor. 1987. Integrated Pest Management: State-of-the Art in the Sagebrush Ecosystem. U.S. Department of Agriculture, Agriculture Research Service, ARS-50