Chemical Control of Wolfweed in South Texas

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ABSTRACT

Wolfweed, which is considered undesirable due to its lack of wildlife or agricultural value, forms dense colonies that inhibit the growth of other plants. We hypothesize that herbicide application following a mechanical treatment, such as shredding, will result in better control of this plant. The objective was to evaluate the effectiveness of a combination of the herbicides Picloram and 2, 4-D and shredding on wolfweed control. The study site is located in south Texas, in McMullen County. Treatments were randomly allocated in three blocks on shredded and non-shredded stands of wolfweed. Herbicide used was the combination of Picloram (10.2%) and 2, 4-D (39.6%). Three treatments were evaluated: recommended dose (RD), 1% of the herbicide in water; half of the recommended dose (HD), 0.5% of the herbicide in water; and control (C). A randomized complete block design in a 2x3 factorial arrangement of treatment and three replicates was used to evaluate these treatments. Response variable was percentage of mortality of wolfweed. ANOVA was used for statistical analysis and the Duncan's multiple range test was employed as a means separation procedure. No significant ($P>0.05$) interaction was found between factors. The percentage of mortality in wolfweed after application of the herbicide on the shredded area was similar for RD (19.9%) and HD (16.6%), but different ($P<0.05$) from C (0%). On the non-shredded area wolfweed mortality was similar for RD (52.1%) and HD (46.6%), but different ($P<0.05$) from C (1.8%). These results suggest that using half the recommended dose of this herbicide mixture provide similar control of wolfweed as the recommended dose. Additionally, a higher wolfweed mortality level was obtained when applying the herbicide to non-shredded stands.

KEY WORDS: *Aster spinosus*, wolfweed, herbicide, percentage mortality, shredded

INTRODUCTION

Exotic and native shrubs and trees can be problematic for ranchers in south Texas. Control of unwanted plants can result in increased rangeland production within a few years (Holechek *et al*., 2004). Methods to accomplish this include chemical, biological, mechanical, fire, or by the utilization of different species of animals. Plant control in range management is simply the reduction of unwanted or undesirable plants that have invaded or increased in a plant community (Rollings *et al*., 1988).

The complexity of the rangeland ecosystem and the sophistication of agricultural chemicals used today make interactions of herbicides with the environment a basic concern. That concern over the fate of agricultural chemicals in the environment has long provided the impetus for carefully study of chemical residues, their persistence, and the forces which determine the rates and routes of their dissipation (Scifres 1980). According to Mitchell *et al*. (2004), many ranchers have changed their brush management objectives, because the wildlife habitat interests and concerns are aimed at endangered species and nongame animal. Therefore, ranchers have reduced the broadcast application of herbicides in many of these ranches. The managers are starting to depart from the broadcast herbicide control, since they want to have the ability to pick and choose the particular brush they want to eliminate or control now. One of the greatest restrictions herbicides on rangelands will have to face in the future will be the protection on endangered species. Even with that restriction, herbicides will continue to be an important tool in brush control management in the rangeland for the next one or two decades (McGinity 2004).

The Executive Order (EO) 13112 instructs federal agencies to use relevant programs and authorities to prevent the introduction of invasive species, detect and respond rapidly to control populations of such species, and monitor invasive species populations. Federal agencies are also required to provide for restoration of native species and habitat conditions, conduct research on invasive species and develop technologies to prevent introduction, and provide for environmentally sound control of invasive species. Additionally, federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere (http://ceq.hss.doe.gov/nepa/regs/eos/eo13112.html, accessed March 29, 2010). “Exotic” (alien) species are defined in EO 13112 as any species, including its seeds, eggs, spores, or other biological material capable of propagating that species that is not native to that ecosystem. “Native” species, with respect to a particular ecosystem, are those species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. “Invasive” species are defined as those species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, February 3, 1999, http://ceq.hss.doe.gov/nepa/regs/eos/eo13112.html, accessed March 29, 2010). Within this definition, invasive species also includes those native species that readily invade and dominate disturbed areas (e.g. Wolfweed).

Wolfweed (*Aster spinosus* Benth.) is a perennial native forb that is readily found throughout the Southwestern United States and more locally along the Nueces River floodplain. It has several common names and scientific names. Other common names include: Devil-weed aster, Mexican devil-weed, and spiny aster. Other scientific names include: *Leucosyris spinosa*, *Chloracantha spinosa*, and *Erigeron ortegae* (Everitt *et al*., 1999; Everitt *et al*., 2007; USDA-NRCS). Wolfweed is a perennial plant that spreads by rhizomes and, consequently, occurs primarily in clumps or continuous stands rather than as individuals. The stems are slender, erect, and bright green. Stem height ranges from 0.5 to 2 meters, but usually averages 1 meter. Dense stands develop in which stem densities exceed 100 stems per square meter. Short thorns, variable in size and number, occur on mature stems. The stems are responsible for photosynthetic activity, since leaves are present for only a brief period in the spring. The oblong leaves are as long as 8 centimeters near the base of stems, but smaller, tapered leaves occur in the upper canopy (Mayeux *et al*., 1979; Everitt *et al*., 1999).

Wolfweed grows on a variety of slightly saline mineral soils, ranging from clay to sand. This plant grows best under periodic flooding regime, and is therefore localized to river bottoms and floodplains. It also forms dense colonies in different habitats, but it is more common in low, moist sites. It is a problematic weed on many rangelands in south Texas where soils have heavy clay content and high water holding capacity (Everitt *et al*., 2007). Wolfweed is highly undesirable due to its lack of wildlife or agricultural value, except to possibly provide dense cover to hogs and white-tail deer (*Odocoileus virginianus*). Dense colonies of this plant can actually serve as a barrier to other animals such as quail (*Colinus virginianus*) and turkey (*Meleagris gallapavo*).

The dense colonies of wolfweed are very hardy and thrive in low lying areas that have been abused by past management practices. These colonies are very difficult to control by fire because they lack sufficient fuel to carry or sustain a fire. Additionally, they are green throughout most of the year. Mechanical treatments such as annual shredding used in conjunction with herbicidal applications show the best promise for control.

The objective study was to evaluate the effect the herbicides Picloram and 2, 4-D and shredding on wolfweed control. We hypothesize that herbicide application following a mechanical treatment such as shredding will result in better control of this plant.

MATERIAL AND METHODS

The study was conducted on Escondido Ranch (28°05' N; 98°43' W), located in McMullen County, 25 km north of Freer, Texas, USA. The ranch encompasses 6,800 acres of south Texas brush country. The herbicide used was a combination of Picloram (10.2%), which is a systemic herbicide used for general woody plant control, and 2,4-D (39.6%), which is also a systemic herbicide commonly used in the control of broadleaf weeds. Three treatments were evaluated: recommended dose (RD), 1% of the herbicide in water; half of the recommended dose (HD), 0.5% of the herbicide in water; and control (C). A randomized complete block design in a 2x3 factorial arrangement of treatments and three replicates was used to evaluate these treatments. The response variable was the percentage of mortality of wolfweed. An analysis of variance (ANOVA) was used for the statistical analysis and the Duncan's multiple range test was used for means separation. SAS was used to perform the statistical analysis (SAS 2000).

RESULTS AND DISCUSSION

No significant ($P>0.05$) interaction was found between factors. Percent mortality of wolfweed was higher ($P>0.05$) in non-shredded compared to shredded areas in autumn. These results agree with Scifres *et al*. (1981), where they evaluated the response of whitebrush (*Aloysia lycioides* Cham.) to two different herbicides and concluded that shredding this plant before the application of either herbicide usually did not improve whitebrush control. On the contrary, Mutz *et al*. (1979) and Mayeux *et al*. (1979), reported that herbicide applied in the spring shortly after shredding increases the effectiveness of control of this plant. In our case, since the shredding was conducted in autumn when the plant was not actively growing, the response of wolfweed in terms of regrowth was not very aggressive in terms of leaf production; therefore, the lower effectiveness of the herbicide in the shredded areas may have been due to the lack of photosynthetically active tissue for the herbicide to be absorbed. Leaf presence would have increased total absorptive area of the plant and thus improved spray interception

(Mayeux *et al*., 1979). The percentage of mortality of wolfweed on the shredded area resulted similar (P>0.05) for RD (19.9%) and HD (16.6%), but different (P<0.05) from C (0%). A similar results were obtained in the non-shredded area mortality resulted similar for RD (52.1%) and HD (46.6%), but different (P<0.05) from C (1.8%) (Table 1). The effectiveness of reduced doses of herbicides on control or suppression of weeds, and profitability has been reported before by Klingaman *et al*. (1991). When working with imazethapyr rate and time of application on weed species common to the Mississippi Delta soybean production area, they found percent mortality was similar when they applied the recommended rate (70 g/ha) of herbicide imazethapyr, as compared to a dose below labeled rate on common cocklebur (*Xanthium strumarium* L.), smallflower morningglory (*Jacquemontia tamnifolia* L.), and smooth pigweed (*Amaranthus hybridus* L.) if applied to 3 true-leaf or smaller weeds. This indicates that early application is critical for low imazethapyr rates to be effective. Similar results have been reported by Belles *et al*. (2000), obtaining that 50 percent of the dose of the herbicide PP-604 consistently had over 85 percent control of the weed wild oat (*Avena fatua* L.) in barley (*Hordeum vulgare* L.). In another study, Zhang *et al*. (2000), analyzed published data on the use of below labeled doses of herbicides in order to determine the efficacy and risk of controlling weed at reduced herbicide rates. They mention that utilizing below label doses might be effective since registered doses are set to guarantee adequate control over a wide range of weed species, growth stages, and weed densities. They also found that combining reduced doses of herbicides with other management practices can increase the odds of successful weed control. Dieleman and Mortensen (1998), suggest that reduced doses might be a good strategy if the objective is to place the desired plant at a competitive advantage over the weeds, rather than a total weed control. Herbicides applied at lower doses will have a fit in specific situations as they might allow increased profits to be realized by growers and minimize the risk to the environment (Blackshaw *et al*., 2006).

Table 1. Mortality of *Aster spinosus* on shredded and non-shredded areas on Escondido Ranch.

Treatment	***Non-Shredded***	***Shredded***
	Mortality of wolfweed (%)	
RD	52.1 a*	19.9 a
HD	46.6 a	16.6 a
C	1.8 b	0 b

* Values with different letter within columns are different (P<0.05)

These results suggest that using half the recommended dose of the herbicide combination of Picloram (10.2) and 2,4-D (39.6%) will control wolfweed at similar rate as the recommended dose 1% of the herbicide in water. Utilizing half of the recommended dose will result in a significant economical benefit. The economic results are a cost savings for the producer, with additional environmental benefits of reductions in residues and herbicide leaching into groundwater, or contamination through water runoff. Economically, the application of the reduced dose resulted in a reduction of

$5.13 per acre, as compared to the recommended application rate which is a very significant reduction when commercial applications are conducted.

According to these results, there is no need to use a shredder on wolfweed prior to the application of the herbicide in autumn, since a higher percentage of mortality can be obtained when applying the herbicide on non-shredded stands. This is an additional cost savings of shredding, which according to production budgets and comparable area costs, results in an additional cost savings of $14 per acre.

CONCLUSION

The best result for reducing wolfweed population in autumn may be obtained with the use of 0.5% in water of Picloram (10.2%) and 2,4-D (39.6%) herbicides applied to non-shredded stands. Similar results were obtained with the reduced and the recommended dose, therefore, a considerable reduction in the cost of the treatment was obtained in addition to the biological result.

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