Effect of Herbicides on Yield, Plant Vigor and Weed Control in Berseem Clover

Because berseem clover is grown as an annual, growers may opt for a higher seeding rate and omit use of herbicides entirely. However, an early forage harvest may be necessary to control weeds in a herbicide-free system.

By Gil F. Stallknecht,[1] David M. Wichman,[2] Lee Thompson[3] and Todd Keener[4]

Introduction

Production of the annual legume berseem clover has been limited primarily to the southern regions of the U.S. where it is grown as a winter annual for use as a plow-down cover crop or as a forage harvested for either green-chop silage or hay. In southern regions, production practices do not call for herbicide applications due to the vigorous growth of the clover and high seeding rates (20 lb or greater per acre). Since berseem clover grows less rapidly in northern environments and suggested seeding rates are lower, weeds could be more of a problem. We determined the effect of selected herbicides on the production of berseem clover in Montana.

[1]*Superintendent, Southern Agricultural Research Center, Huntley;* [2]*Research Agronomist, Central Agricultural Research Center, Moccasin;* [3]*Ag. Research Technician, Southern Agricultural Research Center, Huntley; and* [4]*Research Specialist, Northwestern Agricultural Research Center, Kalispell.*

Materials and Methods

Four herbicides which have been successfully used in alfalfa production were evaluated for weed control and effect on vigor and yield of berseem clover. EPTC (Eptam), 2,4-DB ester (Butyrac 200), and sethoxydim (Poast) are labelled for use on legumes, but bromoxynil at present is not labelled for use on clovers. The herbicides were applied by hand-held sprayers to either 10x30 or 10x15 foot plots, with four replications organized in a complete randomized block design. EPTC was applied as a pre-plant soil-incorporated treatment at 48 and 64 oz ai/acre. Two broadleaf herbicides, Bromoxynil (Buctril) and 2,4-DB ester, were applied post-emergence when the berseem clover was in the third trifoliate stage of growth. Bromoxynil was applied at 3.0 and 4.0 oz ai/acre, and the 2,4-DB was applied at 8.0 oz ai/acre. Sethoxydim, a grass herbicide, was applied at 4.5 oz ai/acre or at 3.0 oz ai in combination with Bromoxynil at 3.0 oz ai/acre to the berseem clover at the third trifoliate stage of growth. Check treatments consisted of an untreated control and two hand-weeded treat-

ments. The hand-weeded treatments consisted of a single weeding when the Berseem clover was at the third trifoliate stage of growth, and two hand-weedings, once at weed emergence and again when the Berseem clover was at the third trifoliate stage of growth. The herbicide trials were conducted at the Northwest Agricultural Research Center, Kalispell, in 1988; Southern Ag. Research Center at Huntley, in 1989; and at Central Ag. Research Center at Moccasin, in 1988 and 1989.

Results

Effect of Herbicides on Yield

Berseem clover yields were significantly suppressed by a heavy infestation of weeds in the untreated plot. The predominant weeds were wild oats (*Avena fatua*), field pennycress (*Thlaspi arvense*), and shepherds–purse (*Capsella bursa-pastoris*).

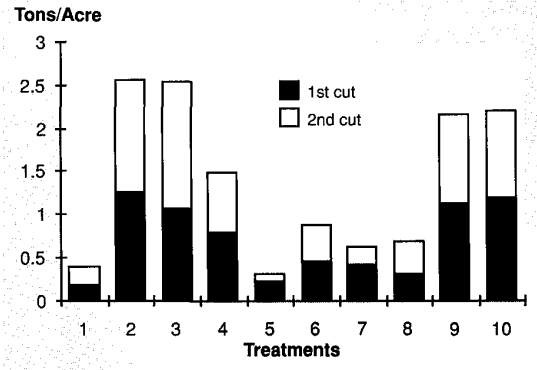
Northwest Ag Research Center, Kalispell. EPTC at 48 and 64 oz ai/acre was considerably more effective in controlling wild oats than Sethoxydim. Broadleaf weed populations in the trial were minimal except where the EPTC and Sethoxydim reduced wild oat competition, allowing broadleaf weed growth.

Berseem clover yields were significantly suppressed by a heavy infestation of wild oats (Figure 1). For most treatments, it was not possible to discern if yield loss was due to herbicide damage or competition from wild oats. Berseem clover forage yields were not reduced by EPTC when compared to the yields of the hand weeded check; however, plants did exhibit stunting during the initial growth stages. Berseem clover yields were significantly reduced at first and second harvests in the Sethoxydim, Sethoxydim/Bromoxynil combination, Bromoxynil, and 2,4-DB treatments (Figure 1). Among the treatments mentioned above, yields were highest for the Sethoxydim/crop oil application due to partial wild oat control. The Sethoxydim+ Bromoxynil tank mix was the only treatment which did not provide some yield advantage over the untreated check. The extremely low clover yield in the untreated control was caused by a heavy population of wild oats, which inhibited growth.

Central Ag Research Center- Moccasin. Weed control results in 1988 at Moccasin were similar to the results obtained at Kalispell. Effective broad spectrum weed control was not accomplished, which reduced clover yield. As at Kalispell, the two EPTC rates were most effective in controlling weeds, while 2,4-DB achieved the next best weed control (Figure 2). In accord with the Kalispell results, the Bromoxynil and Sethoxydim treatments were least effective in weed control.

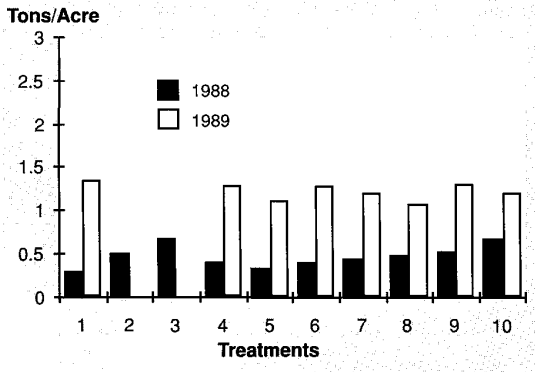
Low clover yields in 1988 were due in part to the heavy weed populations present, while the high yields in 1989 reflect the weed free growing season (Figure 2). The predominant weeds in 1988 were wild oats (*avena fatua*), fanweed (*Thlaspi arvense*), Russian thistle (*Salsola kali*), and cutleaf nightshade (*Solanum triflowrm*), and field pennycress (*Thlaspi arvense*). In 1988, with the exception of EPTC at 64 oz ai/acre, clover yields for all herbicide treatments were lower compared to the hand-weeded check. As in the Kalispell data, the injury rating (Figure 4)

Figure 1: Herbicide Effects on Dry Matter Yield of Berseem Clover at Kalispell 1988



LSD (0.05) 1st cut = 0.42, 2nd cut = 0.39

Figure 2: Herbicide Effects on Dry Matter Yield of Berseem Clover at Moccasin 1988 and 1989



LSD (0.05) 1988 = 0.167, 1989 = 0.218

Treatments:

1. Untreated control
2. Hand-weeded once
3. Hand-weeded twice
4. Sethoxydim + crop oil (4.5 oz ai/a)
5. Bromoxynil+Sethoxydim + crop oil (3+3 oz ai/a)
6. Bromoxynil at 3.0 oz ai/A
7. Bromoxynil at 4.0 oz ai/a
8. 2,4-DB Ester at 8.0 oz ai/a
9. EPTC at 48.0 oz ai/a
10. EPTC at 64.0 oz ai/a

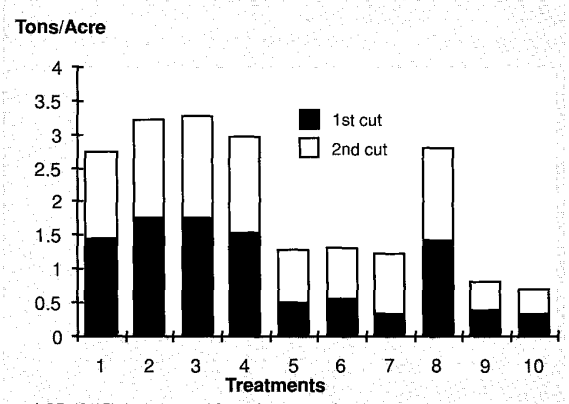
is correlated with high weed population which competed with clover growth and development.

The 1989 data reflect a more accurate evaluation of herbicide injury since few weeds were present in the trial. Berseem clover yields were significantly reduced by the Bromoxynil/Sethoxydim tank mix and by 2,4-DB herbicide, while yields were not significantly affected by other herbicide treatments.

Southern Ag Research Center - Huntley. All herbicides provided excellent weed control at Huntley. The predominant weeds were redroot pigweed (*Amaranthus retroflexus*), common lambsquarters (*Chenopodium album*) and barnyard grass (*Echinochloa crusqalli*). EPTC, at 48 and 64 oz ai/acre, controlled both broadleaf and grass weeds. The broadleaf herbicides Bromoxynil and 2,4-DB effectively controlled broadleaf weeds present in plots. The tank mix of Sethoxydim and Bromoxynil controlled both broadleaf and grass weeds, while Sethoxydim alone provided complete grass weed control.

In contrast to results at Kalispell and Moccasin, both EPTC rates severely inhibited germination and emergence of clover at Huntley, thus significantly reducing clover stand and yield (Figure 3). Sethoxydim and 2,4-DB herbicides did not reduce yields, while all Bromoxynil applications significantly reduced clover yields. Bromoxynil caused severe seedling leaf burning and ultimately reduced yields. Sethoxydim and 2,4-DB did not affect forage yields at Huntley.

Figure 3: Herbicide Effect on Dry Matter Yield of Berseem Clover at Huntley 1989



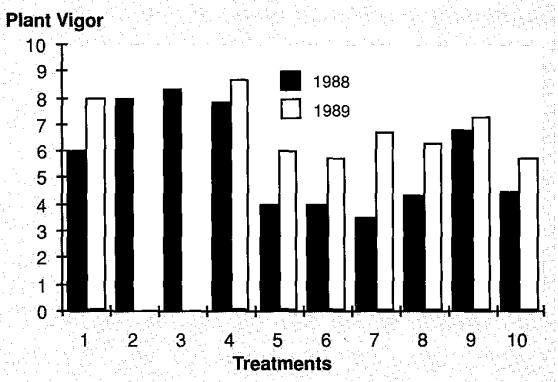
LSD (0.05) 1st cut = 0.33, 2nd cut = 0.36

Effect of Herbicide Applications on Plant Vigor

The effect of herbicide injury as expressed by plant vigor was determined by visual observations. An arbitrary rating system of 1 to 10 was used, in which a 0 rating equalled all plants dead and a 10 rating equalled most vigorous growth.

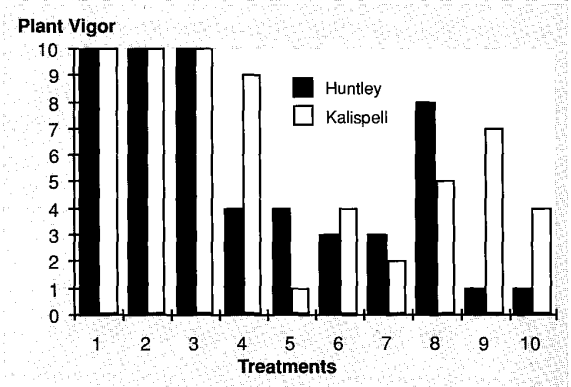
The effect of herbicide treatments on berseem clover vigor for the Moccasin site is depicted in Figure 4, and in Figure 5 for the Kalispell and Huntley sites. Bromoxynil was the most injurious to Berseem clover seedlings among the ten herbicide treatments. Sethoxydim was least injurious followed by 2,4-DB, and EPTC. While vigor ratings

Figure 4: Herbicide Effect on Plant Vigor of Berseemover at Moccasin 1988 and 1989



LSD (0.05) 1988 = 1.49, 1989 = 2.06. Vigor readings taken after post-application, 15 days in 1988 and 29 days in 1989.

Figure 5: Herbicide Effect on Plant Vigor of Berseemover at Huntley and Kalispell



LSD (0.05) Huntley = 1.4, Kalispell = 1.5. Vigor readings taken after post-application, 37 days at Huntley and 17 days at Kalispell.

Treatments:

1. Untreated control
2. Hand-weeded once
3. Hand-weeded twice
4. Sethoxydim + crop oil (4.5 oz ai/a)
5. Bromoxynil+Sethoxydim + crop oil (3+3 oz ai/a)
6. Bromoxynil at 3.0 oz ai/A
7. Bromoxynil at 4.0 oz ai/a
8. 2,4-DB Ester at 8.0 oz ai/a
9. EPTC at 48.0 oz ai/a
10. EPTC at 64.0 oz ai/a

vary in degrees among locations, the effects of the respective herbicide treatments on clover vigor were similar for all locations. The vigor rating also correlates to yield results presented in Figures 1, 2, and 3. Sethoxydim was least injurious followed by 2,4-DB, and EPTC.

Summary

Not all herbicides reduced yields at all test sites. Eptam applications were particularly injurious at Huntley, but there were no significant differences observed at Moccasin. Under certain circumstances, EPTC reduced seedling growth but clover plants recovered from early symptoms. Bromoxynil and 2, 4-DB caused epinasty (twisted plant) growth symptoms which clover eventually also outgrew. The combination Bromoxynil/Sethoxydim was the most phytotoxic herbicide treatment across all three locations. The crop oil in conjunction with Bromoxynil may have caused increased phytotoxicity more than interaction of Sethoxydim and Bromoxynil. Results from the 1988-89 herbicide trials conducted at Kalispell, Huntley and Moccasin suggest that of the herbicide treatments evaluated, EPTC at 3 lb ai/acre would be the herbicide of choice for overall weed control and minimum plant injury. The severe EPTC injury effect observed at Huntley appears to be an exception which is difficult to explain.

While EPTC, 2,4-DB and Sethoxydim are labelled for use on legumes, buctril is not yet labelled for use on clovers. Because berseem clover is grown as an annual, growers may opt for a higher seeding rate and omit use of herbicides entirely. However, an early forage harvest may be necessary to control weeds in a herbicide-free system.