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Clover Response to Selected Postemergence Herbicides

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Summary

Four herbicides were applied postemergence to 'Kenland' red clover (*Trifolium pratense* L.), 'Hubam' sweetclover (*Melilotus alba* Desr.), 'Dixie' crimson clover (*Trifolium incarnatum* L.), 'Yuchi' arrowleaf clover (*Trifolium vesiculosum* Savi.), 'Koala' subclover (*Trifolium brachycalycinum* Katzn. and Morley), and 'Circle Valley' medic (*Medicago polymorpha* L.). Treatments were 2,4-D amine at 0.75 and 1.5 lb active ingredient (ai)/acre, Butyrac 200 (2,4-DB) at 1.0 and 2.0 lb ai/acre, Basagran (bentazon) at 0.75 and 1.5 lb ai/acre, and Kerb (pronamide) at 1.5 and 3.0 lb ai/acre. Kenland red clover was severely injured (60 to 73%) by 2,4-D amine, causing a significant total reduction in clover dry-weight production per acre at the 1.5-lb ai/acre rate. Hubam sweetclover was severely injured (14 to 90%) by all herbicides. However only 2,4-D amine and Butyrac reduced first-harvest sweetclover yields. Dixie crimson clover was moderately injured by 2,4-D amine (11 to 48%) and Butyrac. Both of these herbicides significantly reduced clover yield at the first harvest. Yuchi arrowleaf was injured by 2,4-D amine and the high rate of Butyrac. The 1.5-lb ai/acre rate of 2,4-D caused significant yield reductions to the first harvest and to total Yuchi arrowleaf production. Koala subclover was one of the most tolerant legumes, for which only the high rate (1.5 lb ai/acre) of 2,4-D amine and Kerb caused significant injury. Koala subclover yields reflected the excellent control of spiny sowthistle (*Sonchus aspen* [L.] Hill) and clasping-leaf coneflower (*Dracopis amplexicaulis* [Vahl] Cass.). Circle Valley medic was moderately injured by 2,4-D amine (45 to 56%), while the high rate of Butyrac resulted in slight injury (20%).

Introduction

Clovers are used in mixtures with ryegrass (*Loluim multiflorium* Lam.) and small grains during winter and spring months for livestock grazing. Weed problems in clover pastures often do not cause concern until the weeds have emerged. These weeds compete with clover for moisture, nutrients, and light. Most of the postemergence herbicides cleared for use on pastures and rangeland are toxic to clovers (Smith 1975; Conrad and Stritzke 1980; Smith 1986; Grichar et al. 1991; Grichar et al. 1992).

Butyrac and Kerb are postemergence broadleaf herbicides cleared for use on forage legumes. However, they have not been fully evaluated on all cool-season annual clovers species. Work by Evers (1983) and Grichar et al. (1991, 1992) indicates that some herbicides cleared for soybeans and peanuts might also be used on clover species without causing injury.

Kenland red clover is well adapted to well-drained clay and clay loam soils with a pH of 6.5 to 8.0. Red clover is not as tolerant to close, continuous grazing as are some of the other clovers and therefore should be grazed rotationally. Hubam sweetclover is best suited to loam or clay alkaline soils in a small-grain mixture or for soil improvement. Dixie crimson clover is adapted to most soils in the southeastern United States and has the best early forage production. Yuchi arrowleaf is best adapted to well-drained loam and sandy soils with a pH of 6 to 7. Koala subclover is best adapted to soils ranging from a fine sandy loam to a clay with a pH from 6.5 to 8. Koala has limited cold tolerance and is best adapted south of Interstate 10 (Evers 1992). Circle Valley medic is an annual medic similar to common burclover, which is found in many areas of the state. The annual medics are early maturing and can produce much early forage.

Research on the annual medics was initiated recently in Texas, so little information on managing medics is available at this time. The introduced annual medics have poor cold tolerance and a growing area similar to Koala subclover (Evers 1989).

Herbicide testing began in fall 1986 in Lavaca County to identify the best postemergence broadleaf herbicides to use without injuring clovers. This report discusses the third year (1992) of a study of some commonly used broadleaf herbicides for legume species.

Procedure

Postemergence applications of 2,4-D amine, Butyrac 200, Basagran 4E, and Kerb 50W were evaluated for phytotoxicity to Kenland red clover, Hubam sweetclover, Dixie crimson clover, Yuchi arrowleaf clover, Koala subclover, and Circle Valley medic. Henbit (*Lamium amplexicaule* L.), spiny sowthistle

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and clasping-leaf coneflower (brown-eyed Susan) were the dominant weed species at the test site. Control of these weed species were rated where weed populations were uniform enough to warrant adequate evaluations.

The test was established 29 Oct. 1992 on a Denhawken-Elmendorf clay loam soil with a pH of 8.2. Clovers were seeded into a prepared seedbed at the rate of 12 lb/acre with a John Deere grain drill equipped with a Tye seedbox for small seed. Herbicides were applied on 6 January, 69 days after planting (DAP). All clovers were 2 to 4 in. tall except for Kenland red clover and Koala subclover, which were 1 to 2 in. tall. Weed size varied from 3 to 4 in. tall.

A small-plot, compressed-air bicycle sprayer equipped with three SS11002 nozzles spaced 18 in. apart was used to apply the herbicides in 20 gal water/acre at 22 lb/sq in. pressure. Soil moisture at the time of application was excellent for vigorous weed and clover growth. Experimental design was a randomized complete block for each clover species, replicated four times with a plot size of 6 by 25 ft.

Two harvests from each clover species were taken except for Koala subclover, which was harvested only once because of extremely slow early season growth. Two quadrates (16 by 16 in.) were taken at random from each plot. These samples were hand-separated and then dried to determine clover percentage and yield. Immediately after quadrates were cut, plots were harvested with a flail mower. Visual injury ratings were made 20 and 104 days after treatment (DAT).

Results and Discussion

Temperature and moisture were favorable for good growth of most clovers during the season. Kenland red clover injury 20 DAT with 2,4-D was 60% or greater (Table 1). No other herbicides caused significant injury. The high rate of 2,4-D reduced yield 95% at the first harvest and 58% at the second harvest, which translates into a 62% yield reduction for the season. Henbit control was 65% or less with all herbicides, while control of coneflower and sowthistle was poor with Kerb.

Hubam sweetclover was sensitive to all herbicides except for the high rate of Kerb (Table 2). No explanation can be given for the significant injury to this clover with the low rate of Kerb while the high rate caused no such problem. Injury from other herbicides varied from 38 to 90% when rated 20 DAT. There was no significant yield difference at the first harvest between the control and the low Basagran rate and Kerb. Clover yield was drastically affected by 2,4-D and Butyrac. By the second harvest, these clover plots had recovered only slightly from the initial herbicide injury. Henbit control ranged from 61 to 93%.

Dixie crimson clover was moderately sensitive (24 to 48%) to 2,4-D and slightly sensitive (11 to 30%)

Table 1. Response of Kenland red clover to postemergence herbicides and weed control.

			Weed control			Clover yield		
Treatment	Rate lb ai/acre	Clover injury† 20 DAT‡	Henbit 20 DAT	Coneflower 104 DAT	Sowthistle 104 DAT	5 Mar.	13 Apr.	Total
		%				lb dry wt/acre		
Check	—	0	0	0	0	100	1035	1134
2,4-D Amine	0.75	60	45	99	97	72	917	921
2,4-D Amine	1.50	73	58	100	100	5	431	434
Butyrac 200	1.00	4	39	100	100	67	1185	1251
Butyrac 200	2.00	8	55	100	100	45	1169	1214
Basagran 4E +Dash (1 qt/acre)	0.75	6	63	95	100	82	958	1040
Basagran 4E +Dash (1 qt/acre)	1.50	3	58	98	100	73	1237	1309
Kerb 50W	1.50	3	65	59	63	149	718	866
Kerb 50W	3.00	4	43	75	68	82	728	810
LSD (0.05)	—	12	39	19	21	102	399	391

† Index: 0 = no control or injury; 100 = complete control or injury.
‡ DAT: days after herbicide treatment.

Table 2. Response of Hubam sweetclover to postemergence herbicides and weed control.

Treatment	Rate lb ai/acre	Injury or control† 20 DAT‡ Clover	Injury or control† 20 DAT‡ Henbit	Clover yield 23 Feb.	Clover yield 13 Apr.	Clover yield Total
		%		lb dry wt/acre		
Check	——	0	0	429	382	811
2,4-D Amine	0.75	84	73	0	110	110
2,4-D Amine	1.50	90	61	0	0	0
Butyrac 200	1.00	43	73	0	44	44
Butyrac 200	2.00	74	86	0	82	82
Basagran 4E +Dash (1 qt/acre)	0.75	45	78	324	575	899
Basagran 4E +Dash (1 qt/acre)	1.50	38	78	90	396	487
Kerb 50W	1.50	49	90	262	554	816
Kerb 50W	3.00	14	93	397	160	557
LSD (0.05)		30	25	188	391	479

† Index: 0 = no control or injury; 100 = complete control of injury.
‡ DAT: days after herbicide treatment.

Table 3. Response of Dixie crimson clover to postemergence herbicides and weed control.

Treatment	Rate lb ai/acre	Weed control† Clover injury 20 DAT‡	Weed control† Henbit 20 DAT	Weed control† Coneflower 104 DAT	Weed control† Sowthistle 104 DAT	Clover yield 5 Mar.	Clover yield 13 Apr.	Clover yield Total
		%				lb dry wt/acre		
Check	——	0	0	0	0	2183	1619	3802
2,4-D Amine	0.75	24	73	100	97	1420	2122	3541
2,4-D Amine	1.50	48	75	100	94	548	1104	1652
Butyrac 200	1.00	11	73	100	100	1625	1039	2664
Butyrac 200	2.00	30	85	100	100	1333	2093	3426
Basagran 4E +Dash (1 qt/acre)	0.75	1	84	100	100	2185	1747	3931
Basagran 4E +Dash (1 qt/acre)	1.50	4	73	100	100	1921	1516	3437
Kerb 50W	1.50	3	88	98	97	2005	1581	3586
Kerb 50W	3.00	0	96	98	93	2258	1271	3529
LSD (0.05)	——	11	19	2	5	450	1081	1152

† Index: 0 = no control or injury; 100 = complete control or injury.
‡ DAT: days after herbicide treatment.

to Butyrac (Table 3). First-harvest yields were significantly reduced with both rates of 2,4-D and Butyrac. There were no yield differences at the second harvest, while total clover production was reduced 43% with the high rate of 2,4-D. Weed control was greater than 90% for coneflower and sowthistle, while henbit control ranged from 73 to 96%.

Yuchi arrowleaf clover injury was greatest with 2,4-D (36 to 79%), while the high rate of Butyrac resulted in moderate (18%) injury (Table 4). Only the

2,4-D and Butyrac significantly reduced arrowleaf clover yields below the control. By the second harvest, all herbicide-treated plots had recovered compared with the untreated check. Overall clover production was reduced by the high rate of 2,4-D.

Koala subclover showed significant injury with 2,4-D and the low rate of Kerb when rated 20 DAT (Table 5). Because the subclover grew poorly early in the season, only one harvest was made (168 DAT). Therefore, the clover grew out of any early season injury of 2,4-D. Although showing no significant differences in yield, Koala subclover production in the control and Kerb plots were only half that of the other treatments. Lower clover yields from Kerb treatments can be attributed to poor coneflower and sowthistle control (60 to 78%).

Table 4. Response of Yuchi arrowleaf clover to postemergence herbicide and weed control.

Treatment	Rate lb ai/acre	Clover injury† 20 DAT‡	Clover yield 24 Feb.	Clover yield 19 Apr.	Clover yield Total
		%	lb dry wt/acre		
Check	—	0	662	894	1556
2,4-D Amine	0.75	36	150	1262	1412
2,4-D Amine	1.50	79	13	413	426
Butyrac 200	1.00	4	208	958	1166
Butyrac 200	2.00	18	219	989	1208
Basagran 4E +Dash (1 qt/acre)	0.75	0	507	955	1457
Basagran 4E +Dash (1 qt/acre)	1.50	5	335	1072	1407
Kerb 50W	1.50	6	459	1519	1978
Kerb 50W	3.00	0	505	1287	1791
LSD (0.05)		18	358	606	707

† Index: 0 = no injury; 100 = complete injury or death.
‡ DAT: days after herbicide treatment.

Table 5. Response of Koala subclover to postemergence herbicides and weed control.

Treatment	Rate lb ai/acre	Weed control† Clover injury 20 DAT‡	Weed control† Henbit 20 DAT	Weed control† Coneflower 104 DAT	Weed control† Sowthistle 104 DAT	Clover yield 15 Apr.
		%				lb dry wt/acre
Check	—	0	0	0	0	654
2,4-D Amine	0.75	39	63	100	88	1050
2,4-D Amine	1.50	51	58	98	91	1234
Butyrac 200	1.00	25	55	99	96	1114
Butyrac 200	2.00	16	51	100	100	1023
Basagran 4E +Dash (1 qt/acre)	0.75	1	53	99	100	1351
Basagran 4E +Dash (1 qt/acre)	1.50	10	63	100	100	1161
Kerb 50W	1.50	35	63	78	60	497
Kerb 50W	3.00	5	74	78	66	685
LSD (0.05)	—	30	25	9	19	550

† Index: 0 = no control or injury; 100 = complete control or injury.
‡ DAT: days after herbicide treatment.

Table 6. Response of Circle Valley medic to postemergence herbicides and weed control.

Treatment	Rate lb ai/acre	Medic injury† 20 DAT‡	Henbit control 20 DAT	Clover yield 5 Mar.	13 Apr.	Total
		%		lb dry wt/acre		
Check	—	0	0	2001	1523	3524
2,4-D Amine	0.75	45	89	397	1583	1979
2,4-D Amine	1.50	56	89	0	897	897
Butyrac 200	1.00	6	89	1261	1132	2393
Butyrac 200	2.00	20	86	822	1554	2376
Basagran 4E +Dash (1 qt/acre)	0.75	5	91	1614	1160	2774
Basagran 4E +Dash (1 qt/acre)	1.50	5	96	1285	1433	2718
Kerb 50W	1.50	0	98	2100	1091	3191
Kerb 50W	3.00	1	93	1490	1185	2676
LSD (0.05)	—	16	11	544	671	891

† Index: 0 = no control or injury; 100 = complete control or injury.
‡ DAT: days after herbicide treatment.

Circle Valley medic experienced significant injury from 2,4-D and the high rate of Butyrac (Table 6). First-harvest yields were reduced by 2,4-D, Butyrac, and the high rates of Basagran and Kerb. By the second harvest, all herbicide treatments had recovered. The 2,4-D treatment reduced total clover production 44 to 75% compared with the untreated check.

In an overall comparison of all clovers, Hubam sweetclover was the most sensitive to all the herbicides evaluated. Dixie crimson clover and Koala subclover were the least sensitive to 2,4-D. Basagran and Kerb were the least phytotoxic postemergence herbicides, causing only temporary injury to sweetclover. Only Butyrac and Kerb are approved by the EPA for use on forage legumes.

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