Herbicidal Control of Weeds in Sugarbeets[1]

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Annual cost of weed control in sugarbeets in the USA exceeds $20 million. In 1967 more than 1.1 million acres of sugarbeets were planted—approximately 30% of this acreage was planted in nonirrigated areas and 70% in irrigated areas. In the irrigated areas of the central High Plains and intermountain West the weeds most difficult to control in sugarbeets are kochia [*Kochia scoparia* (L) Schrad.] and Russian thistle (*Salsola kali* L.). Other major weeds such as barnyardgrass [*Echinochloa crusgalli* (L). Beauv.], lambsquarters [*Chenopodium album* L.], nightshade [*Solanum spp.*], pigweed [*Amaranthus spp.*], and foxtail [*Setaria spp.*] also are troublesome, and hinder complete mechanization of sugarbeet production.

Use of herbicides for control of weeds in sugarbeets in the central High Plains and intermountain West has progressed appreciably since Deming (3)[3] first incorporated isopropyl *N*-phenylcarbamate (IPC) into the soil as a preplant treatment in Colorado in 1947. The development of such herbicides as 7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid (endothall) (9) and 2,2-dichloropropionic acid (dalapon) (13) in 1952; *S*-propyl butylethylthiocarbamate (pebulate) in 1959 (1); and 5-amino-4-chloro-2-phenyl-3(2*H*)-pyridazinone (pyrazon) in 1962 (5) has contributed significantly to the progress made in controlling weeds in this crop. Today most herbicides in the irrigated areas are applied as preplant treatments and are soil-incorporated. The principal herbicides used are *S*-2,3-dichloroallyl *N*,*N*-diisopropyl-thiolcarbamate (diallate), pebulate, pyrazon, and the mono (*N*,*N*-dimethyltridecylamine) salt of endothall (TD283).

In six states where these herbicides have been applied before planting, either singly or in mixtures, the control of annual weeds ranged from 27 to 89%, with the mean being 68% (4,7, 8,11,12,14). Major differences in soil, climate, cultural methods

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[3] Numbers in parentheses refer to literature cited.

and weed species contributed to these extreme variations. Although these preplant treatments control most grass weeds satisfactorily, 20 to 30% of the annual broadleaf weeds still escape and must be removed from sugarbeets by other means. Furthermore, kochia is controlled only 50 to 60% under ideal conditions. Therefore, field experiments were conducted to evaluate herbicides applied before planting (preplant) and after emergence (postemergence) of the crop for controlling weeds in sugarbeets. The objectives in these experiments were to compare several herbicides, applied as preplant or postemergence treatments and as a combination treatment (preplant plus postemergence), for controlling kochia and other annual weeds in sugarbeets; and to evaluate the performance of a mechanical weeder as a supplement to herbicide treatments.

Materials and Methods

Five experiments were conducted at Fort Collins between 1965 and 1967. The soil texture ranged from loam to clay loam (Table 1). Monogerm sugarbeet seed, size 2, was planted approximately ¾ inches deep each year at the rate of eight seed units per foot of row. The sugarbeet seed was planted simultaneously with the application of the herbicides. Information on dates of planting, evaluation and harvest for these experiments is shown in Table 2.

The plots were 4-rows wide and 45 to 50 feet long. The rows were spaced 22 inches apart. Randomized complete block designs with three replicates in 1965 and five replicates in 1966 and 1967 were used for all experiments.

Table 1.—Results of soil test.

	1965	1966	1967
Soil texture	clay loam	clay loam	loam
pH	7.8	8.0	7.8
Organic matter	2.6	2.5	3.1
Phosphorus (lb P_2O_5/acre 6 in)	121 H[a]	67 M	68 M
Potash (lb K_2O/acre 6 in)	960 H	867 H	1000 H

[a] Fertility level — L = low, M = medium, and H = high.

Table 2.—Dates of planting, evaluation and harvest for the five experiments.

Experiment No.	Year	Planting	Stand of sugarbeets and weeds counted	Harvest
1	1965	April 30	June 9 and August 2	
2	1966	April 4	May 19 and July 7	October 13
3	1966	April 5	May 21 and June 9	October 6
4	1967	April 4	May 9 and June 26	October 12
5	1967	April 3	May 8 and June 9	September 29

A mixture of weed seed which contained foxtail millet [*Setaria italica* (L.) Beauv.], kochia, redroot pigweed [*Amaranthus retroflexus* (L.)] and lambsquarters was sown on the experimental fields each year before planting. These species were present in sufficient numbers to evaluate each year. Weeds were counted twice—4 to 6 weeks and 12 to 14 weeks after planting. For the first evaluation, weeds were counted in four sites in each plot. Each site was 4 inches by 36 inches and centered on the sugarbeet row. For the second evaluation, weeds were counted in 4-inch bands, 45 feet long, on the inner two rows of each plot. All weeds were removed by hand from the treated plots after the second evaluation.

The herbicides —pebulate, 2-chloro-*N*-isopropylacetanilide (propachlor), pyrazon, *S*-ethyl cyclohexylethylthiocarbamate (cycloate), and TD283— were applied singly and as mixtures before planting. The herbicides were sprayed on a 7-inch band at a volume of 19.1 gallons (60 gpa broadcast) aqueous mixture per acre. All herbicides were incorporated 1½ inches deep with a front-mounted, hooded, 4-row, power-driven incorporator. The soil surface was dry and tilth was good. Each experiment was furrow irrigated within 3 to 7 days after planting. Natural moisture for April, May and June was 1.87 and 4.62 inches in 1965 and 1967, respectively, above the 70-year average and 3.19 inches below the long-time average in 1966.

A mixture of pyrazon plus dalapon was applied as a postemergence treatment in Experiments 3, 4, and 5 and benzamidooxyacetic acid (benzadox) in Experiment 5. The herbicides were sprayed on an 11-inch band over the row at a volume of 30 gallons (60 gpa broadcast) mixture per acre. An anionic surfactant, sodium alkyl naphthalene sulfonate, at 0.3% wt/v was included in the spray mixture of pyrazon plus dalapon.

In Experiment 3 the postemergence mixture of 3 lb/A each of pyrazon and dalapon was applied on May 27. Sugarbeets had four true leaves. Foxtail millet was ½ - 1 inches tall, kochia 1 - 5 inches tall, lambsquarters 1 - 2½ inches tall, and pigweed ½ - ¾ inches tall.

In Experiments 4 and 5 the postemergence mixture of 4 lb/A of pyrazon and 2.2 lb/A of dalapon or 2 lb/A of benzadox (Experiment 5) was applied on May 8. Sugarbeets had four true leaves, with the second pair of leaves pea size. Foxtail millet had 2 to 3 leaves and was ¼ - ½ inches tall; kochia was ¼ - ¾ inches in diameter and ½ - ¾ inches tall; and lambsquarters and pigweed had 1 to 2 true leaves and were ¼ - ½ inches tall. In Experiment 5 a mechanical weeder was used on May 8 and 12 in all plots before the postemergence treatments were applied.

At harvest, root yield, number of marketable sugarbeets and sucrose percentage were determined for each plot. Sugarbeets were harvested from 40 feet of each of the inner two rows.

Results

Preplant treatments. The results from the evaluation taken 12 to 14 weeks after planting are shown in Table 3. Results from the evaluation taken 4 to 6 weeks after planting for these same herbicides are not shown, but herbicides applied singly, controlled these weeds better at 4 to 6 weeks than at 12 to 14 weeks after planting in 1965 and 1966. Weed control from the herbicides applied as mixtures was also better 4 to 6 weeks after planting in 1966, but best 12 to 14 weeks after planting in 1967.

Kochia was not controlled satisfactorily by any herbicide treatment. However, the stand of kochia was reduced most by propachlor, TD283, or treatments which included one of these herbicides. The mixture of 3.75 lb/A of pyrazon plus 3 lb/A of propachlor reduced the stand of kochia the most, but this reduction averaged only 55% for the 2-year period. Kochia was very resistant to the thiocarbamate herbicides—pebulate and cycloate.

A mixed population of foxtail, lambsquarters, and pigweed was controlled best by 4 lb/A of cycloate applied singly or by any of the four herbicide mixtures. These treatments reduced the average stand of these weeds for the 2-year period by 77 to 91%.

The stand of sugarbeets over a 2-year period was reduced most by the mixture of 3.75 lb/A of pyrazon plus 3 lb/A of propachlor (18%) and 4 lb/A of propachlor (11%). In 1966 the relative retardation in growth of sugarbeets was greatest in those treatments which contained pebulate or cycloate. Sugarbeets treated with pebulate were retarded 60%, whereas sugarbeets treated with cycloate, singly or in a mixture, ranged between 41 and 45%.

Preplant and postemergence treatments. In 1967 the performance of six herbicide treatments applied preplant was very similar when weed control was assessed in June. However, the advantage of using a herbicide mixture as a postemergence treatment to supplement the control of weeds from herbicides applied before planting is shown in Figure 1. The average reduction in stand of kochia was 49% where herbicides were applied as combination treatments (preplant plus postemergence) compared to 19% where herbicides were applied only before planting. In contrast, the average reduction in stand of foxtail, lambsquarters and pigweed was 96% where herbicides were applied

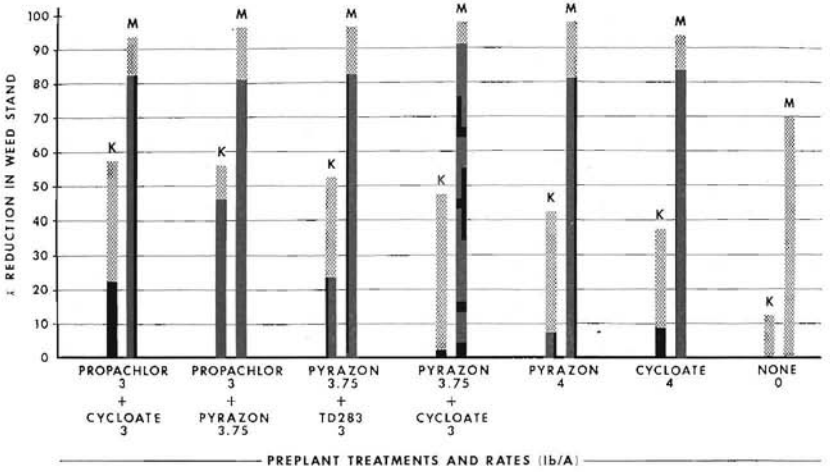

Figure 1.—Weed control from herbicides applied before planting versus a combination treatment of herbicides applied before planting and followed by a postemergence mixture of pyrazon at 4 lb/A plus dalapon at 2.2 lb/A. The solid portion of the bar shows control from the preplant treatment alone; the broken portion shows additional control from the postemergence treatment. K = kochia; M = a mixed population of foxtail, lambsquarters and pigweed.

as combination treatments compared to 84% where herbicides were applied only before planting. The postemergence mixture of 4 lb/A of pyrazon plus 2.2 lb/A of dalapon, applied alone, reduced the stand of kochia by only 13% and the other three weed species by 70%.

In 1966 a postemergence mixture of 3 lb/A each of pyrazon plus dalapon applied in combination with preplant treatments at Fort Collins and Rocky Ford, Colorado, also controlled more weeds than where only the preplant treatments were applied. At Rocky Ford the mixture of pyrazon (3.75 lb/A) plus cycloate (3 lb/A) or pebulate (5 lb/A) applied before planting and followed by a postemergence mixture of pyrazon plus dalapon, controlled 87% and 85%, respectively, of the foxtail, pigweed and Venice mallow (*Hibiscus trionum* L.) population (10). These two preplant treatments, applied singly, controlled only 53% of these weeds. Furthermore, the postemergence mixture, applied alone, controlled only foxtail satisfactorily at Fort Collins. Unsatisfactory control of broadleaf weeds at both locations and of foxtail at Rocky Ford, by this postemergence treatment, is attributed to applying it too late to control the larger weeds effectively.

Table 3.—Weed control 12 to 14 weeks after planting from several herbicides and herbicide mixtures applied preplant between 1965 and 1967.

Treatments		Percentage reduction in weed stand									
Herbicides	lb/A	Foxtail		Lambsquarters		Pigweed		Average		Kochia	
A. Single components		1965	1966	1965	1966	1965	1966	1965	1966	1965	1966
pebulate	5	96	43	94	68	98	88	96	66	3	0
propachlor	4	94	22	74	30	81	0	84	17	67	14
cycloate	4	89	94	88	87	82	85	86	89	3	0
TD283	4.5(4)[a]	93	21	35	0	87	22	72	14	59	32
B. Mixtures		1966	1967	1966	1967	1966	1967	1966	1967	1966	1967
pyrazon + propachlor	3.75 + 3	60	75	98	91	91	77	83	81	65	46
cycloate + propachlor	3 + 3	90	94	97	75	84	80	90	83	50	23
pyrazon + TD283	3.75 + 3	61	83	95	85	95	81	84	83	44	24
pyrazon + cycloate	3.75 + 3	89	96	91	88	51	88	77	91	0	5

[a] Rate in parenthesis applied in 1966.

The application of a thiocarbamate herbicide as a preemergence treatment has increased the susceptibility of broadleaf weeds to several herbicides applied postemergence in soybeans (6). Application of some thiocarbamate herbicides as a preplant treatment seems also to precondition both weeds and sugarbeets to additional injury from a subsequent application of a postemergence treatment (2, 10). This phenomenon was apparent again in 1967, when a mixture of 4 lb/A of pyrazon and 2.2 lb/A of dalapon was applied as a postemergence treatment (Table 4). Retardation in growth of sugarbeets on May 18 was greater in all treatments where herbicides were applied both preplant and postemergence. Furthermore, sugarbeets grown in soil treated with cycloate and then sprayed with a postemergence mixture of pyrazon plus dalapon were retarded about 20% more than sugarbeets treated with the combination treatments which did not include cycloate. By July 14, however, sugarbeets previously repressed by herbicides appeared as large as the untreated controls (Table 4). This early repression had no significant effect on sucrose production, yield of roots or sucrose percentage. (Table 5).

Preplant, postemergence, and mechanical weeding treatments. There were 88 weeds per 100 feet of row in the untreated check where the sugarbeets were only mechanically thinned compared to 81 weeds (8% fewer) in the untreated check where sugarbeets were both mechanically weeded and thinned. Sugarbeets treated with 4 lb/A of cycloate had 20 weeds after being thinned mechanically and 17 weeds after being weeded and thinned mechanically. The number of weeds in the combination treatments that received 4 lb/A of cycloate followed by a postemergence treatment of 4 lb/A of pyrazon plus 2.2 lb/A of dalapon or 2 lb/A of benzadox was similar regardless of the mechanical operations performed. These treatments averaged 10 weeds or 0.1 weed per foot of row. Thus the use of a mechanical weeder did not supplement the control of weeds obtained with herbicides to a practical degree.

A combination treatment of 4 lb/A of cycloate applied before planting and 2 lb/A of benzadox applied postemergence on May 8 controlled kochia effectively (Table 6). Delaying the application of benzadox until May 25 reduced the effectiveness of the combination treatment to control kochia. Data from this experiment and others conducted in 1965 and 1966 confirm that the most effective control of kochia results when kochia is treated early (rosette-like stage), preferably before stem elongation begins. The reduction in the stand of foxtail, lambsquarters, and pigweed in soil treated with cycloate alone, or

with a postemergence mixture of pyrazon plus dalapon was similar to the results obtained in Experiment 4 (Figure 1). Also, date of application of the postemergence mixture of pyrazon plus dalapon did not appear to affect the control of foxtail, lambsquarters, and pigweed.

Cycloate applied at 4 lb/A had no effect on stand but had retarded the growth of sugarbeets 34% when evaluated on May 8. By June 9 the sugarbeets had completely recovered from the cycloate treatment (Table 6). In contrast, sugarbeets grown in soil treated with cycloate, and then sprayed with a postemergence treatment of either benzadox or a mixture of pyrazon plus dalapon were still retarded 37 to 51% on June 9. By July 17, these, too, had recovered and appeared identical to the untreated sugarbeets.

Neither sugar production, yield of roots or sucrose percentage was affected in sugarbeets treated with a combination of 4 lb/A of cycloate, applied before planting, and 2 lb/A of benzadox or a mixture of 4 lb/A of pyrazon plus 2.2 lb/A of dalapon, applied postemergence on May 25 (Table 7). However, sugarbeets treated with cycloate and a postemergence mixture of pyrazon plus dalapon on May 8 produced significantly less tonnage and sugar per acre. This same treatment also produced 1.8 tons of roots and 770 pounds of sugar per acre less than the hand-weeded check in Experiment 4 (Table 5), but this decrease was not statistically significant. Since the control of foxtail, lambsquarters, and pigweed was slightly better on June 9, when the postemergence treatment of pyrazon plus dalapon was delayed until May 25, and since neither sugar production, yield of roots or sucrose percentage was affected, it would seem that the postemergence mixture of pyrazon plus dalapon could be delayed several days, if an application of cycloate has stunted the growth of sugarbeets and was controlling the weeds satisfactorily.

Discussion

Although we were unable to control all weeds, these investigations indicate that practical control of many weeds is possible. Furthermore, several preplant and postemergence treatments were effective and the logical selection of which treatment to use depends on the infestation of weeds present. The advantages and limitations of the most effective treatments in these investigations will now be discussed.

Of the herbicides applied singly as preplant treatments, cycloate was the most effective for controlling a mixed population of foxtail, lambsquarters, and pigweed but least effective

Table 4.—Effects of herbicides applied preplant and postemergence on stand and relative top growth of sugarbeets in 1967.

Herbicides and method of application			Stand[b] reduction	Visual retardation[c]		
Preplant	lb/A	Postemergence[a]	May 9	May 18	June 9	July 14
pyrazon	4	pyrazon + dalapon	..	41	9	1
pyrazon	4	none	9	9	0	1
cycloate	4	pyrazon + dalapon	..	62	39	2
cycloate	4	none	0	29	0	4
pyrazon + propachlor	3.75 + 3	pyrazon + dalapon	..	44	18	1
pyrazon + propachlor	3.75 + 3	none	16	10	0	0
pyrazon + cycloate	3.75 + 3	pyrazon + dalapon	..	67	32	0
pyrazon + cycloate	3.75 + 3	none	8	24	0	2
pyrazon + TD283	3.75 + 3	pyrazon + dalapon	..	46	6	1
pyrazon + TD283	3.75 + 3	none	1	15	4	2
propachlor + cycloate	3 + 3	pyrazon + dalapon	..	64	37	0
propachlor + cycloate	3 + 3	none	1	30	5	2
none	0	pyrazon + dalapon	..	34	7	3
none	0	none	0	0	0	0

[a] A mixture of 4 lb/A of pyrazon, 2.2 lb/A of dalapon and 0.3% (wt/v) of sodium alkyl napthalene sulfonate was applied on May 8.
[b] Values are percentages of untreated sugarbeet stand.
[c] Injury scale: 0 = no retardation in top growth of sugarbeets and 100 = all plants killed.

Table 5.—Effect of herbicides applied preplant and postemergence on sugar production, root yield and sucrose percentage in 1966 and 1967.

Herbicides and method of application			Sugar (lb/A)		Roots (tons/A)		Sucrose (%)	
Preplant	lb/A	Postemergence[a]	1966	1967[b]	1966	1967[b]	1966	1967[b]
pyrazon	4	pyrazon + dalapon	....	7530	....	21.5	....	17.5
pyrazon	4	none	....	7670	....	21.6	....	17.7
cycloate	4	pyrazon + dalapon	....	7170	....	20.3	....	17.6
cycloate	4	none	....	7330	....	21.2	....	17.2
propachlor + cycloate	3 + 3	pyrazon + dalapon	6170	7200	21.0	20.6	14.7	17.4
propachlor + cycloate	3 + 3	none	6450	7060	21.7	20.3	14.9	17.4
pyrazon + propachlor	3.75 + 3	pyrazon + dalapon	6080	8110	20.6	22.5	14.8	18.0
pyrazon + propachlor	3.75 + 3	none	6530	7870	20.9	22.0	15.6	17.9
pyrazon + cycloate	3.75 + 3	pyrazon + dalapon	6090	7660	20.0	21.5	15.2	17.8
pyrazon + cycloate	3.75 + 3	none	6320	7600	20.6	21.7	15.3	17.9
pyrazon + TD283	3.75 + 3	pyrazon + dalapon	5960	7550	19.9	21.3	14.9	17.7
pyrazon + TD283	3.75 + 3	none	5660	7470	18.7	20.9	15.1	17.8
none	0	pyrazon + dalapon	620[c]	7230	2.0[c]	20.2	15.3	17.9
none (hand-weeded)	0	none	6180	7940	20.4	22.1	15.1	17.9
none (weedy)	0	none	470[c]	.....	1.5[c]		15.3	.
LSD (0.05)			730	860	2.1	1.8	0.7	0.7
C. V.			10.9%	9.0%	9.4%	6.8%	3.9%	3.0%

[a] In 1966 pyrazon and dalapon each applied at 3 lb/A. In 1967 pyrazon applied at 4 lb/A and dalapon at 2.2 lb/A.

[b] The F-test was nonsignificant at the 5% level for treatment means.

[c] Significant at the 5% level between treatment and untreated hand-weeded check.

Table 6.—Effect of herbicides applied preplant and postemergence on relative top growth of sugarbeets and on weeds in 1967.

	Herbicides and method of application			Sugarbeets[a]		Percentage reduction in weed stand			
				Visual injury					
	Preplant	Postemergence	lb/A	June 9	July 17	Foxtail	Lambs-quarters	Pigweed	Kochia
A.	Evaluated May 8								
	cycloate[b]	none	0	..	..	68	76	96	24
B.	Evaluated June 9								
	1. Mechanical thinning								
	cycloate	none	0	2	2	98	89	89	13
	cycloate	pyrazon + dalapon[c]	4 + 2.2	51	0	99	97	93	62
	cycloate	benzadox[c]	2	37	1	99	97	92	84
	2. Mechanical weeding and thinning								
	cycloate	none	0	4	0	98	93	90	33
	cycloate	pyrazon + dalapon[d]	4 + 2.2	37	0	100	99	99	37
	cycloate	benzadox[d]	2	49	0	100	97	91	63

[a] Injury scale: 0 = no retardation in top growth of sugarbeets and 100 = all plants killed.
[b] Cycloate applied April 3 at 4 lb/A.
[c] Postemergence treatments applied May 8.
[d] Postemergence treatments applied May 25.

Table 7.—Effect of herbicides applied preplant and postemergence on sugar, root yield and percentage sucrose in 1967.

	Herbicides and method of application			Sugar	Roots	Sucrose
	Preplant	Postemergence	lb/A	(lb/A)	(tons/A)	(%)
A.	Mechanical thinning					
	cycloate[a]	none	0	6770	20.3	16.6
	cycloate	pyrazon + dalapon[b]	4 + 2.2	6100[c]	18.4[c]	16.6
	cycloate	benzadox[b]	2	6640	19.8	16.8
	none	none	0	6780	20.4	16.6
	LSD (0.05)			440	1.7	0.4
	C. V.			5.0%	4.4%	2.0%
B.	Mechanical weeding and thinning					
	cycloate	none	0	6630	19.8	16.7
	cycloate	pyrazon + dalapon[d]	4 + 2.2	6410	19.5	16.4
	cycloate	benzadox[d]	2	6460	19.6	16.4
	none	none	0	6590	20.0	16.5
	LSD (0.05)			610	1.6	0.6
	C. V.			7.1%	5.9%	2.8%

[a] Cycloate applied April 3 at 4 lb/A.
[b] Postemergence treatments applied May 8.
[c] Significant at the 5% level between treatments and untreated hand-weeded check.
[d] Postemergence treatments applied May 25.

for controlling kochia. This herbicide did not reduce the stand of sugarbeets but did retard their growth during the cool, moist conditions of early spring. Later, the sugarbeets appeared to recover, and yield was not reduced. The residual activity of this herbicide is short. It will not persist in sufficient concentration to control weeds germinating late in the season.

Each of the four herbicide mixtures applied as preplant treatments effectively controlled a mixed population of foxtail, lambsquarters and pigweed. The mixture of 3.75 lb/A of pyrazon plus 3 lb/A of propachlor controlled kochia best, but this control averaged only 55%. This mixture also reduced the stand of sugarbeets the most, 18%. However, none of the four mixtures affected yield. These mixtures will persist longer in the soil and thus provide better control of late season weeds.

The most effective control of a mixed population of foxtail, lambsquarters and pigweed was obtained by applying herbicides, singly or as a mixture, as a preplant treatment and following with a postemergence mixture of pyrazon plus dalapon. Combination treatments which included pyrazon in both the preplant and postemergence treatments, however, may result in residues of pyrazon in the soil sufficient to injure succeeding crops. Also, combination treatments which include cycloate as a preplant treatment and a postemergence mixture of pyrazon plus dalapon may retard the growth of sugarbeets early in the season when weather conditions are cool and moist. Yield of roots and

sugar per acre also may be reduced if the postemergence treatment is applied too soon to sugarbeets that show symptoms of retardation from cycloate.

A major breakthrough in these investigations was the discovery that kochia could be controlled by benzadox. The stand of kochia was reduced 84% by a combination treatment which included 4 lb/A of cycloate applied preplant and 2 lb/A of benzadox applied postemergence. This combination treatment also controlled 96% of the stand of foxtail, lambsquarters and pigweed. Although both herbicides stunted the growth of sugarbeets for several weeks, yield was not reduced.

Summary

Kochia was controlled satisfactorily for the first time by 2 lb/A of benzadox applied as a postemergence spray to sugarbeets which were growing in soil treated with 4 lb/A of cycloate before planting. Cycloate does not control kochia.

The control of a mixed population of foxtail, lambsquarters and pigweed by herbicides applied preplant was supplemented by a postemergence mixture of 4 lb/A of pyrazon plus 2.2 lb/A of dalapon.

The application of cycloate, a thiocarbamate herbicide, as a preplant treatment, increased the susceptibility of both sugarbeets and weeds to a postemergence mixture of pyrazon plus dalapon. This combination treatment repressed the foliar growth of sugarbeets for 8 weeks. This early repression had no effect on sucrose percentage, but the combination of 4 lb/A of cycloate applied preplant and 4 lb/A of pyrazon plus 2.2 lb/A of dalapon applied postemergence significantly reduced the yield of roots and sugar per acre in one experiment.

The use of a mechanical weeder, in addition to mechanical thinning, did not supplement the herbicidal control of weeds to a practical degree.

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