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CC204 Revised 1969 Weed Control in Sugar Beets

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WEED CONTROL IN SUGAR BEETS

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Weed control is one of the last steps in complete mechanization of sugar beet culture.

Problem Weeds and Losses from Weeds in Sugar Beets

Crabgrass and barnyardgrass are largely confined to the central Nebraska area, while kochia and black nightshade are most prevalent in the Panhandle. Varied infestations of green foxtail, redroot pigweed, and lambsquarters cover the entire sugar beet area in Nebraska.

Some buffalobur, sunflower and marshelder can be found in most fields. Wild buckwheat can be found in some fields in the Panhandle and Pennsylvania smartweed in some fields in central Nebraska. Bristly foxtail is increasing in the central area.

Kochia is the most difficult annual weed to control in sugar beet fields because of morphological features and germination habit. Sugar beets and kochia belong to the same plant family (Goosefoot).

Lambsquarters also belong to the Goosefoot family but can be controlled with herbicides. Every year there are fields which must be abandoned because of severe infestation of kochia or other weeds throughout the sugar beet area in Nebraska.

Wyoming has shown that one green foxtail plant per sugar beet lowered yield 5.9 T/A or 26%, while one redroot pigweed per eight beets lowered yield 3.7 T/A or 16%. One redroot pigweed per two sugar beets lowered yield 11.9 T/A or 53%. It is evident that redroot pigweed was more competitive than foxtail. These weeds and sugar beets were seedlings at the same time.

In Nebraska, if weeds are allowed to grow the first two months, 680 lb/A of weeds (dry weight) will reduce sugar beet yield 1 T/A. If weeds are allowed to grow until harvest, each 350 lb/A of weeds reduces yield 1 T/A.

By delaying thinning and in-the-row weeding for two months, 15% of the yield could be lost in weedy fields (Table 1). More yield could be lost if labor thinned beets below optimum harvest stands of 100-120 beets per 100 feet of row.

(over)

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Allowing green foxtail, redroot pigweed and lambsquarters to grow in the row all season reduced yields 53%. During the same period the best herbicide treatment, without hand labor, reduced yields 6%. This shows a tremendous advantage for herbicides.

A herbicide is also advantageous when labor is used to thin sugar beets. In 1968 it cost $17.50/A for hoe trimming plus $9 for each additional weeding. This would be a minimum of $26.50 for non-herbicide treated fields (Table 2). The cost of labor in a field where herbicides have been used is largely dependent upon good cultural practices.

Cultural Weed Control

Farmers can improve weed control in sugar beet fields by other methods besides herbicides. Weed control in all crops of a rotation is important. Selection of the correct hybrid or variety for each crop, using certified seed, maintaining adequate plant populations, using narrow rows, and the sequence of crops in a rotation are helpful weed control practices.

Colorado has shown that there are fewer weed problems when beets follow beans than when beets follow corn.

Other helpful suggestions for obtaining maximum weed control are:

Sugar beets planted on fall-plowed land are less troubled by weeds than beets on spring-plowed land. Care should be exercised in fall plowing fields that will blow readily. Seedbeds or fall-plowed land should be as shallow as possible to avoid bringing up weed seed from greater depths.

Sugar beets should be planted early (April 1-15) to take advantage of the growing season and early labor. A rough rule of thumb is that beet roots grow a ton/A a week.

Once you have the beets planted and growing, do not neglect them. Use moisture resistance blocks to determine the proper time to irrigate. Delayed irrigation may retard beet growth and allow weeds to emerge before beets have shaded the rows.

A well-prepared seedbed is an asset for herbicides and mechanical thinning. Plant 6-10 seeds per foot and be prepared to irrigate.

A good way to develop irrigation furrows at planting time is to use spear-point shovels ahead of the furrow formers. The furrows will be helpful when irrigating the crop and also will serve as a guide in steering the tractor when close-to-the-row cultivation is done.

Several mechanical thinners are available for thinning sugar beets. Thinners remove 10 to 50% of the weeds depending on rate of beet stand reduction needed.

Timely operation of a properly adjusted tractor-mounted cultivator is essential for clean beet fields. Cultivation tools should be kept sharp and worn parts should be replaced. With proper selection and use of cultivation tools, it is possible for close-to-the-row cultivation and, in some instances, in-the-row cultivation to remove weeds and mulch the plants.

Farmers should be acquainted with the latest in-the-row cultivator tools such as Bezzerides, Sinner Weeders, C & M Weeders, rotary hoes and flextine harrows. The flextine harrow is effective on grass with poorly developed root systems.

Cultivation reduces wind erosion, aerates the soil, controls weeds and provides furrows for irrigation. Improper cultivation may reduce stand, prune roots and leaves, compact the soil, bring up more germinable weed seed to the surface, and transplant weeds close to the row.

Generally, under favorable conditions, 70-80% weed control can be obtained with herbicides. Good cultivation practices can improve results tremendously (Table 3).

Many farmers do not cultivate close enough to the row. An additional 10 to 50% of the weeds can be eliminated by proper use of the mechanical stand thinner and in-the-row weed reduction tools. Naturally it takes less labor to remove weeds from a well-cultivated field.

Early beet emergence generally means cleaner fields, greater yield and a more favorable labor supply. Early season labor is more plentiful than labor during the peak demand period. The peak labor period occurs when a majority of the fields are ready to be worked. Delays at this time due to weather and poor management cause the acre requirement to be increased because the crop and weeds do not stop growing.

Farmers should not delay beet planting if soil is too wet for soil incorporation of herbicides. They should plan to spray postemergence if needed and take advantage of early labor.

Preplant herbicides can be used again when soil is dry enough to incorporate and these fields will be more attractive to labor during the peak thinning period. Herbicides make it easier for the farmer to obtain labor (Nebraska Economic Department Survey).

To do a good job of weed control, farmers must anticipate their weed problems. Chemical weed control should be employed in connection with good cultural practices.

Do not depend on the herbicide to solve all your weed problems. Sometimes a herbicide will not control all species of weeds so the proper herbicide combination must be selected that will control the species of weeds present (Table 4).

An untreated area should be left to determine the amount of weed control and crop injury.

A herbicide that carries over from one year to the next must not be used in the rotation, especially the year before sugar beets. Two examples are Atrazine and trifluralin.

Atrazine may injure sugar beets, small grain, alfalfa and beans.

Trifluralin may injure sugar beets, small grain, corn or sorghum in the rotation in the western third of Nebraska.

Carryover of Atrazine has been reported in the soil two years after application. An application of Atrazine at 3 lb/A on corn in 1966 reduced sugar beet yields 11.2 T/A in 1968 at Alliance and 0 T/A at North Platte. However, in the North Platte area, Atrazine carryover has been reported two years following application.

Normally Atrazine kills beets shortly after they emerge. However, sometimes beets die over an extended period. So caution should be used in thinning beets on fields previously treated with Atrazine.

Beware of 2,3,6-TBA (Trysben 200 or Benzac 1281) and picloram (Tordon) in crop rotations containing beets or beans.

To maintain weed-free fields, weeds must be kept from going to seed along field borders and in fence rows, irrigation ditches, roadsides and waste areas.

Herbicides for Sugar Beets

Dalapon (Dowpon), pebulate (Tillam), propachlor (Ramrod), pyrazon (pyramin), cycloate (Ro-neet), TCA, TD 273 (Herbicide 273), TD 282 (Herbicide 282), TD 283 (Herbicide 283), and benzadox (Topcide) are herbicides commonly used for weed control in sugar beets in Nebraska.

Some of these herbicides cannot be used in all sugar beet producing areas. Weed species controlled by these herbicides are given in Table 4.

Most herbicides are effective for 4 to 8 weeks so it is essential that weeds germinate soon after application. Better control will be obtained if all weeds germinate at the same time.

Moisture (rain or irrigation water) sufficient for good germination must be available within a week after beets are planted for best weed control. Therefore, be prepared to irrigate sugar beets, especially in western Nebraska.

At Alliance the probability of receiving .60 to .80 inch of rain during the first part of April is about 27 and 20% respectively.

At Gothenburg, the probability of receiving the same amount of rain for the same period is 26 to 20%.

The chances increase to 44 and 34% at Alliance and 57 to 47% at Gothenburg, respectively, for the third week in May. It would be unwise to delay planting until May just to have a more favorable chance for rain.

Herbicides are not completely effective but herbicides reduce weed population so less labor is required to remove remaining weeds. Herbicides can be applied preplant and soil-incorporated, preemergence, postemergence or layby.

Performance depends upon using the proper rate and correct method of application for the particular herbicide selected. Herbicide performance can be improved by timely use of a mechanical thinner, rotary hoe and/or flextine harrow (Table 5).

Applying and incorporating herbicides before sugar beets are planted is the most satisfactory method for weed control. This method may change when better preemergence and postemergence herbicides are developed (Table 1 and 6).

Some herbicides are volatile. These must be incorporated into the soil to prevent loss. Preplant incorporation also improves the effectiveness of herbicides in several ways. First, the herbicide is placed near the weed seed, where it can be taken up promptly when weeds begin to grow. Susceptible weeds will be killed.

Second, the chances of poor weed control are reduced if rainfall does not occur within a few days after herbicide application, because less volatilization and photo decomposition of the herbicide will occur when incorporated than on surface applied.

Third, there is less chance of loss from wind that may blow treated soil or granules from band treated areas.

The incorporator should be hooded and power driven to obtain best results. Most incorporators are for band applications. Check the machine in the field. The width of the band and the width of the hood on the incorporator should be the same. Alterations in the hood should be made if the blades spread the treated soil wider than the hood.

Farmers who want to use herbicides on limited acreage should consider overall or custom application or timely postemergence herbicide application in a band.

The roller harrow has worked successfully for incorporating herbicides in the soil (Table 7). Roller harrowing should not be done parallel to the row since sometimes the herbicide distribution is not uniform. There can be too much herbicide moved over the row, causing excessive beet injury, or too much moved out of the row, allowing weeds to grow in the row.

To lessen risk of losing a stand of sugar beets on sandy soils (more than 45% sand) or soils low in organic matter (less than 1%), consider postemergence herbicide application (see Table 8 and 9).

Great Western Sugar Co. is determining particle size and organic matter content for sugar beet growers. Farmers considering planting less than six seeds per foot of row should be aware that under certain conditions some stand loss by herbicides can be expected. They should know how the herbicide reacts on their farm before reducing seeding rates below six seeds/ft.

Pyrazon + dalapon applied postemergence and cycloate applied preplant soil incorporated are probably the safest herbicides at this time. Where weeds did not influence root yields, treated plots have yielded the same as hand weeded plots (Table 10). However, if too much stand is lost due to herbicides the yields would be lower.

When frost and wind have killed sugar beets on herbicide treated fields, do not re-treat. Work the ground shallowly and replant. The replanted beets will have more weeds so plan to spray postemergence with the appropriate herbicides.

Preplant and Preemergence Herbicides

Pebulate (Tillam) is formulated as a liquid or granule by Stauffer Chemical Co. Pebulate must be incorporated into the soil to a depth of two inches immediately after application. Shallower incorporation will give poorer weed control because pebulate is volatile and will quickly dissipate.

Do not apply and incorporate pebulate into wet soil. Pebulate is adsorbed more readily to dry than wet soil; also wet soil hinders mechanical incorporation. Pebulate should control green, yellow and bristly foxtail, barnyardgrass, crabgrass and redroot pigweed. Some control of lambsquarters and black nightshade may be expected but this herbicide does not control kochia. Late germinating weeds are not controlled adequately. Some early injury to beets may occur but as long as an adequate stand remains the yields will not be reduced (Table 10).

The application rate varies from 2 to 4 lb/A. Use the 2 lb/A rate on light soil and the 4 lb/A on heavy soils. Do not use on sandy soils or soils low in organic matter.

Cycloate (Ro-Neet) is formulated as a liquid or 10% granules by Stauffer Chemical Co. Cycloate is quite similar to pebulate in performance. In 1963 to 1967, weed control with cycloate gave results as good as or better than pebulate. Cycloate has given better control of lambsquarters and buffalobur than pebulate. (See pebulate section).

Sugar beets may be slightly more tolerant to cycloate than to pebulate. Incorporation requirements are not as great with cycloate as pebulate (Table 7).

Herbicide 282, (or Herbicide 283), a herbicide manufactured by Pennsalt Chemicals Corp., is the di-(N,N-dimethyltridecylamino) salt of endothall. Herbicide 282 does not leach as readily as disodium endothall and is less susceptible to bacterial breakdown. Herbicide 282 will control most weeds, including kochia, and has performed better in the Nebraska Panhandle than in central Nebraska. In central Nebraska, Herbicide 282 should be used only on fields where kochia may be the major weed problem.

This herbicide gave inadequate weed control in 1965 at North Platte and Mitchell, probably because of too much rain.

Suggested rates are 2 to 3 lb/A. Use the 2 lb/A rate on light soils. Herbicide 282 may be applied preplant or preemergence. It should not be incorporated deeper than one inch. Incorporation is necessary where beets are furrow irrigated for germination.

Herbicide 282 is particularly effective for broad-spectrum control when combined with pyrazon, depending on soil conditions (see section under pyrazon). Beet tops cannot be used for livestock feed.

Pyrazon (Pyramin) is formulated as an 80% wettable powder. It is manufactured by Amchem products. Pyrazon controls many broadleaf weeds including redroot pigweed, lambsquarters and black nightshade. It does not control kochia adequately.

Pyrazon is generally mixed with a grass killer such as Herbicide 282 for preplant and preemergence applications or dalapon for postemergence applications. Some farmers have had difficulty with pyrazon + Herbicide 282 clogging nozzle screens and tips. The pyrazon + Herbicide 282 combination has been unsatisfactory in central and west south central Nebraska (Table 7). This combination should be used in areas where it has been successful in the past.

Pyrazon gives longer residual control of broadleaf weeds than most sugar beet herbicides. Application should not be made on fields with less than 1% organic matter. In 1965 stand losses were reported where pyrazon was applied preplant on sandy soils or soils low in organic matter in the Panhandle. Stand loss was almost 100% on areas of a field containing 0.6% organic matter but absent

in the same field on sites that contained 1.1% organic matter. If beet stand is not adequate on pyrazon treated fields and it is too late to replant, destroy the beets and plant sorghum or corn. Do not plant beans in the treated area.

Suggested preplant and preemergence rates are; 2.4 lb/A pyrazon on light soils; 3 lb/A pyrazon on medium textured soils; and 3.75 lb/A pyrazon on heavier soils. Do not use on sandy soils or soils low in organic matter. Incorporation depth should not exceed one inch. Preemergence applications can be made where beets are not furrow irrigated for germination. In combination with pyrazon, apply Herbicide 282 at 1.6, 2, and 2.5 lb/A with the respective pyrazon rates shown above.

TCA is manufactured by Dow Chemical Co. It is used preemergence for control of green and yellow foxtail and other annual grasses in central Nebraska. Rates vary from 6 to 9 lb/A. Use 6 lb/A on light soils and 9 lb/A on heavy soils. TCA works best in moderately moist soil. Rainfall is necessary for activation.

Poor results were obtained in 1966 in central Nebraska (Table 7), probably due to lack of adequate spring rain. Too much rain may cause excessive leaching and beet injury has occurred on light soils. Beet tops from fields treated with TCA cannot be fed to livestock.

Propachlor (Ramrod) is made by Monsanto Co. as a 65% wettable powder and 20% granular. It received FDA clearance for use on sugar beets in 1968. The tops can be fed to livestock. Results in Nebraska have not been encouraging because leaching has resulted in poor control and too much beet injury. The label for the area west of the Mississippi River is restricted to preplant soil incorporation. Preplant may not be as effective as preemergence application in Nebraska, especially in west central Nebraska.

Propachlor works best in drier soil and on grasses. It will give some broadleaf weed control, including kochia. A combination of propachlor and pyrazon has been effective but often results in too much injury (Table 6). Rates should be about 2 + 2 to 3 + 3 + 3 lb/A. The dosage varies, depending upon soil type. There should be 1.5% organic matter or more in soils treated with propachlor.

Effectiveness of pyrazon is questionable on higher organic matter (3.5%) and heavier soils. Trial use is suggested and only on loam or heavier soils until suitable rates and combinations can be developed.

Postemergence Herbicides

Pyrazon may be applied postemergence during the period between weed emergence and the two-leaf stage of the weeds (less than 1/2 inch tall). This will be about 2 to 3 weeks after planting if sufficient moisture is available for sugar beets and weed germination. The stage of broadleaf weed growth is very critical in obtaining effective control. Rainfall or irrigation 2 or 3 days after application may be beneficial. This was true in 1966. Some preemergence weed control can be expected. Use pyrazon postemergence at 4 lb/A with dalapon (a grass killer) applied at 2.25 lb/A. It will be up to 14 days before weeds show signs of dying, depending on temperature and rainfall. A surfactant may be used with this combination to insure better weed control but there may be slightly more beet injury. Consult local field man for the surfactant and rate to use. Do not spray pyrazon postemergence on beets previously treated with pyrazon.

Dalapon (Dowpon) is made by Dow Chemical Co. Dalapon is used postemergence for the control of foxtail (green, yellow and bristly), field sandbur, barnyardgrass and crabgrass. Apply from emergence until the 6-leaf stage of the sugar beets. Use 2 to 4 lb/A, depending upon the size of the grass specie and weather conditions. Poor results may be expected when grassy weeds are under stress such as drought or cold weather. Dalapon may injure sugar beet plants when temperatures are high (above 85° F.).

Dalapon may be mixed with pyrazon as shown under the pyrazon suggestions. Precautions should be taken when spraying pyrazon + dalapon when temperatures are over 85° F. Severe injury has been reported in California when sprayed during hot temperatures (100° F.). In Nebraska severe damage occurred when sugar beets in the 4-leaf stage were sprayed when temperature was 75° with 73% RH and temperature reached 91° in the afternoon with 36% RH. Pyrazon + dalapon at 4 + 2.25 lb/A plus superior spray oil at 1 gpa was used. Possibly if rates of pyrazon and oil had been reduced less damage would have occurred.

Herbicide 273 is made by Pennsalt Chemical Corp. Results with this herbicide have been variable. It should be applied postemergence when the weeds are small (less than one inch) and sugar beets are in the 4 to 6-leaf stage. Herbicide 273 should not be applied later than 40 days after the beets have emerged. Some injury to sugar beet plants may be expected but the damage is quickly outgrown. Beet tops cannot be used for livestock feed.

Weeds most susceptible to this herbicide are Pennsylvania smartweed, wild buckwheat and foxtail. Barnyardgrass, field sandbur and redroot pigweed have intermediate susceptibility. Kochia, lambsquarters and black nightshade are more tolerant. Suggested rates are 1.0 to 1.5 lb/A. Use the light rate on more susceptible weeds.

Pyrazon + dalapon (Pyramin Plus) is a commercially available mix made by Amchem Products. It has 4 lb. pyrazon, 2.2 lb. dalapon and .5% surfactant. Sugar beets should be sprayed just after the second pair of true leaves emerges (pea size). With the addition of the surfactant in the mix too much injury may occur if sprayed earlier. Read remarks under pyrazon and dalapon above.

Benzadox (Topcide or S-6173) is a new herbicide made by Gulf. It is specific for kochia. Control of other weeds should not be expected. Rates should be 1 1/2 to 2 lb/A. Best control is obtained when kochia is sprayed in the rosette stage. Control with benzadox drops off rapidly after kochia begins to elongate. Spray after temperatures are over 55° F. for more effective control. Some beet injury may occur if spraying is done under high temperature and high relative humidity. There may be more injury if another herbicide has been used previously. Benzadox should be used on a trial basis until more information is obtained.

Programing Applications

During 1966, 1967 and 1968 preplant application of cycloate (Ro-neet) and postemergence spraying of pyrazon + dalapon has given season-long weed control at Mitchell and North Platte. Weed species present were green foxtail, redroot pigweed, lambsquarters and black nightshade. There is possibility of moderate to severe injury, if beets have not recovered from injury by cycloate, especially if temperatures are in the upper 80's when the postemergence chemical is applied. This treatment should give sufficient control to allow electronic machine thinning.

Layby Herbicides

This term should be understood by users of herbicides. Layby herbicides are applied after the beets have emerged, usually after blocking and thinning or at time of layby. The two herbicides listed below should not be applied preplant soil incorporated or preemergence because they may cause too much sugar beet injury. Layby herbicides will only kill germinating weeds; they will not kill established weeds. Therefore, the field must be weed free before applying the herbicide.

The herbicides are applied broadcast and incorporated into the soil. The most successful equipment for incorporation have been power-driven tillers operating between the rows at 2-4 inch soil-depth. The rolling cultivator should be used twice in opposite directions. Flextine harrowing will help incorporate the herbicide in the row if operated across the rows. Cultivation prior to spraying is helpful in loosening the soil so that more soil can be moved into the row during incorporation. If ditching occurs after application, weeds may germinate in the ditch because treated soil is moved from the furrow.

The value of layby applications has not been investigated sufficiently in Nebraska. Under adequate stands, the weeds that emerge 10-12 weeks after planting rarely lower yields. Controlling late weeds in fields that have had their canopy destroyed by hail or disease could be important.

Also, weed species present may influence use of layby herbicides. Some weeds cause more trouble at harvest than others. However, where stands are thin or spotty, benefits may be obtained with a layby herbicide. Possible benefits under these conditions would be: cleaner fields, easier harvest, reduced weed seed production and increased root yields.

Trifluralin (Treflan) is made by Elanco Products Co. Trifluralin must be incorporated 2-4 inches deep immediately after application. It may be sprayed over sugar beet plants without injury. Care should be made so the incorporation equipment does not damage the sugar beet roots. Some root damage from Trifluralin has been observed. Trifluralin is suggested for trial use only until sufficient information is obtained on the feasibility of layby treatments.

EPTC (Eptam) is made by Stauffer Chemical Co. The application can be made postemergence and immediately incorporated at time of the last cultivation or (in Colorado) by metering into the irrigation water in sufficient time to allow the EPTC to move through the field. Trial use only until sufficient information is obtained on the feasibility of layby treatments.

Remember - These are the herbicide tools available in 1969. Use them judiciously. Herbicides are an aid to good cultural practices - not a substitute for them. Be sure to read the label.

Table 1. Sugar beet yield losses due to weeds on untreated check and the best herbicide treatment in Nebraska from 1961 through 1967.

Year	Herbicide	Application method	Percentage weed control	Month after planting weeds removed	Percentage yield loss	
					Weedy Check	Herbicide
1961	Pebulate	ppi[a]	79[b]	2	15	5
1962	Pebulate	ppi	54[b]	3	20	8
1963	Pebulate	ppi	66[b]	1.75	15	5
1963	Cycloate	ppi	66[b]	1.75	15	5
1964	Pyrazon + dalapon	post[a]	81	5	41	8
1965	Pebulate	ppi	84	4	70	10
1966	Cycloate	ppi	92	5	56	11
1966	TD283 + pyrazon	ppi	83	5	56	11
1967	TD283 + pyrazon	ppi	92	4.5	47	0
1967	Pyrazon + dalapon	post	89	4.5	47	+3

[a] ppi is preplant soil incorporated.
post is postemergence.

[b] Kochia present.

Table 2. Wage rates when employed on a piecework basis for the hand labor operations in sugar beets in 1968 (from ASCS determination of wage rates) ($1.50/hr rate).

	Hand labor operations	Rate per acre
A.	Trimming--removing either weeds or excess beets with hoe only	$ 12.00
B.	Hoeing--removing weeds and excess beets with hoe only	14.50
C.	Hoe trimming--removing weeds with a hoe and by hand and removing excess beets with hoe only	17.50
D.	Weeding--removing weeds with hoe and by hand following either A, B or C above	9.00

Table 3. Hypothetical example on the effect of close cultivation on weed stands with and without a herbicide that gave 80% control. a/

Width across row	Percent of area cultivated	No. of weeds remaining in row assuming 100 weeds per given area	
		No herbicide	Herbicide
6 inches	0	100	20
3 inches	50	50	10
2 inches	67	33	5
1 inch	83	17	2.5

a/ assuming a 6-inch wide herbicide band with 80 percent control.

Table 4. Susceptibility of weeds commonly found in sugar beet fields in Nebraska to several herbicides used for weed control in sugar beets.

Herbicide	Annual grasses						Annual broadleaf							
	Sugar beet tolerance[a]	Barnyard-grass	Crabgrass	Foxtail app.	Field sandbur	Volunteer corn	Black nightshade	Kochia	Lambs-quarters	Redroot pigweed	Pennsy. smartweed	Wild buckwheat	Buffalo-bur	Marsh-elder
Preplant soil incorporated														
TD 283	fair[b]	good[b]	poor	good	?	poor	fair	fair	fair	good	good	good	fair	?
Propachlor	fair	fair	fair	fair	fair	poor	poor	poor	poor	poor	?	poor	poor	?
Pebulate	good	ex	ex	ex	ex	poor	fair	poor	fair	good	?	?	fair	?
Pyrazon	good	fair	fair	fair	fair	fair	ex	poor	ex	good	fair	fair	good	fair
Cycloate	good	ex	ex	ex	ex	poor	good	poor	good	good	?	poor	good	fair
Preemergence[c]														
Propachlor	fair	good	good	good	good	poor	fair	fair	poor	fair	?	poor	poor	?
Pyrazon	good	vari	vari	vari	vari	poor	good	poor	good	fair	fair	fair	good	fair
TCA	fair	ex	ex	ex	ex	fair	poor	poor	poor	poor	poor	poor	poor	poor
Postemergence[c]														
Dalapon	good	good	good	ex	good	fair	poor	poor	poor	poor	poor	poor	poor	poor
TD 273	fair	poor	poor	poor	poor	poor	poor	fair	fair	fair	good	good	?	?
Benzadox	fair	poor	poor	fair	poor	poor	poor	good	fair	poor	poor	fair	poor	poor
Pyrazon + dalapon	good	good	good	ex	good	fair	ex	poor	good	good	fair	fair	good	fair
Layby[c]														
EPTC	ex	ex	ex	ex	ex	poor	good	fair	good	ex	?	?	?	?
Trifluralin	good	ex	ex	ex	ex	poor	poor	ex	ex	ex	?	?	poor	poor

[a] Sugar beet tolerance rating is based on: Excellent-no beet injury; Good-some loss of stand and stunting can be expected but should not affect yield where proper rate and timing have been used; Fair-occasionally stand losses or sometimes stunting will be severe, proper rate is more critical.

[b] Control expected is based on: Superior-no hand labor or cultivation needed; Excellent-with timely cultivation no hand labor is needed; Good-timely cultivation and minimum labor required; Fair-timely cultivation and hand labor are needed; poor-no control expected so depend entirely upon cultivation and hand labor; Variable-control varies depending upon climatic conditions, performs best under wet conditions.

[c] Preemergence-after beets are planted and before weed emergence. Postemergence-after beets and weeds have emerged. Layby-after beets have been thinned and free of weeds.

Table 5. Effect of in-the-row tillage and herbicides on sugar beets at North Platte and Mitchell in 1966 and 1967.

Treatment	lb/A	In-the-row-tillage		
		None	Rotary hoe	flextine harrow
		Roots - T/A		
None	-	9	13	9
Pebulate	3	16	18	18
TD 283 + pyrazon	2 + 3	20	20	20
Cycloate	3	17	22	17
Pyrazon + dalapon	4 + 2	17	20	19
Herbicide Average		17.5	20.0	18.5

Table 6. Comparison between preplant soil incorporation and preemergence herbicides used to control weeds in Nebraska on Bridgeport loam at Mitchell and North Platte, Nebraska, during 1966, 1967 and 1968.

Treatment	lb/A	Application method	Stand loss of beets			Percentage control about 6 weeks after planting					
						broadleaf weeds[a]			annual grasses[b]		
			1966	1967	1968	1966	1967	1968	1966	1967	1968
Check	-	preplant	0	4	1	0	28	0	0	14	0
Check	-	preemerge	0	1	0	0	7	0	0	6	0
Propachlor	3	preplant	32	9	20	94	64	58	70	51	66
Propachlor	3	preemerge	26	16	48	85	78	90	72	72	83
Pyrazon	4	preplant	18	24[c]	0	74	99	96	24	91	82
Pyrazon	4	preemerge	12	9[c]	33	38	97	90	0	93	62
Pyrazon + propachlor	3 + 3	preplant	37	23[c]	22	92	99	94	80	96	45
Pyrazon + propachlor	3 + 3	preemerge	40	19[c]	50	72	97	98	82	92	90
Pyrazon + TD283	3 + 2	preplant	28	24[c]	28	91	99	96	81	95	86
Pyrazon + TD283	3 + 2	preemerge	30	9[c]	44	83	93	92	68	85	90
Cycloate	3	preplant	18	27	9	88	99	96	78	99	90
Cycloate	3	preemerge	8	25	4	65	96	86	40	95	80

[a] Broadleaf weeds were largely redroot pigweed and lambsquarters

[b] Annual grasses were mostly green foxtail

[c] Only North Platte data, pyrazon and pyrazon mixtures eliminated 87% of the sugar beets at Mitchell. Plots at Mitchell were on a recently leveled bench, soil borders on "No Go" and "Transitional" soils. (Table 9).

Table 7. Effect of several herbicides on weeds and sugar beets one month after application when applied preplant and soil incorporated with rotary tiller and roller harrow at Lexington, Nebraska in 1966 on a Hall silt loam.

Herbicide	Rate lb/A	Method of incorporation	% Beet stand reduction	Beet injury	Percentage weed control				
					Redroot pigweed	Barn-yard-grass	Crab-grass	Mean	Herbicide Average
	None	Roller harrow	0	0	0	0	0	0	0
1. Check	None	Rotary tiller	0	0.8	0	0	0	0	
	3	Roller harrow	8	1.6	59	70	60	63	63
2. Propachlor	3	Rotary tiller	8	1.8	61	71	60	64	
	4	Roller harrow	5	0.8	60	63	71	63	63
3. Propachlor	4	Rotary tiller	5	0.8	64	58	68	63	
	5	Roller harrow	6	1.8	68	80	74	74	80
4. Propachlor	5	Rotary tiller	30	2.2	86	89	82	86	
	3	Roller harrow	11	2.1	77	84	86	82	88
5. Pebulate	3	Rotary tiller	12	1.9	93	93	92	93	
	4	Roller harrow	10	2.0	82	83	79	81	88
6. Pebulate	4	Rotary tiller	10	2.2	95	96	92	94	
	3	Roller harrow	6	1.0	90	96	94	93	94
7. Cycloate	3	Rotary tiller	9	1.5	91	96	96	94	
	4	Roller harrow	15	2.0	93	88	92	91	93
8. Cycloate	4	Rotary tiller	15	1.8	96	92	96	95	
	6	Roller harrow	5	1.2	15	28	8	17	13
9. TCA	6	Rotary tiller	5	1.2	5	15	5	8	
	6	Roller harrow	2	0.6	42	41	42	42	46
10. TD283	6	Rotary tiller	2	0.8	52	48	50	50	
	2.5+ 3.75	Roller harrow	0	0	0	0	0	0	0
11. TD283 + pyrazon	2.5+ 3.75	Rotary tiller	0	0	0	0	0	0	

Table 8. Nebraska Panhandle soil texture and organic matter data on fields planted to sugar beets during 1967.[a]

	Percentage				
	Total fines	Sand	Silt	Clay	Organic Matter
Alliance	55	45	33	22	1.54
Upper North Platte Valley					
North Side	45	55	29	16	1.11
Light Soils	33	67	20	13	.77
South Side	61	39	38	23	1.55
Lyman - Heavy soils	68	32	41	27	1.72
Panhandle average	52	48	32	20	1.34

[a] Data supplied by Dr. E. F. Sullivan and W. C. McGuffey, The Great Western Sugar Company.

Table 9. Preplant and preemergence herbicide usage based on soil texture and organic matter for fields to be planted to sugar beets in the Nebraska Panhandle. [a]

NEBRASKA

BUFFER SOILS	IDEAL SOILS	TRANSITIONAL SOILS	NO GO SOIL
% ORGANIC MATTER	% ORGANIC MATTER	%ORGANIC MATTER	%ORGANIC MATTER
2.5 _____ 1.7	1.7 _____ 1.3	1.3 _____ 1.0	1.0 or less
TF[b] Sd St C	TF Sd St C	TF Sd St C	TF Sd St C
75 25 42 33	65 35 40 25	55 45 35 20	35 65 17 16
↑ ↑	↑ ↑	↑ ↑	↑ ↑
65 35 40 25	55 45 25 20	40 60 24 16	24 76 13 11
Pyrazon + TD282	Pyrazon + TD282	Pyrazon + TD282	NO PREPLANT OR
Rate: 3.75 + 2.5 lb/A	Rate: 3 + 2 lb/A	Rate: 2.4 + 1.6 lb/A	PREEMERGENCE
Cycloate	Cycloate	Cycloate	HERBICIDE
Rate: 3.5 to 4.0 lb/A	Rate: 3.0 to 3.5 lb/A	Rate: 2 to 3 lb/A	
Lyman and	South Side of Upper	North Side of Upper	
South Side of Upper	North Platte Valley	North Platte Valley	
North Platte Valley	and Alliance Area		

[a] Table supplied by Dr. E. F. Sullivan and W. C. McGuffey, The Great Western Sugar Company.

[b] TF = % total fines, Sd = % sand, St = % silt, and C = % clay.

Table 10. Effect of herbicides on sugar beet root yields in absence of weeds at Mitchell and North Platte, Nebraska from 1961-1967.

Year	Herbicide	lb/A	Roots T/A	
			Herbicide	Hand weeded
1961	Pebulate	8	21.2	22.0
1962	Pebulate	4	17.2	17.5
1966	Pebulate	3	23.5	22.8
1966	Cycloate	3	23.7	22.9
1966	TD283 + pyrazon	2 + 3	22.5	22.9
1966	Pyrazon + dalapon	4 + 2	23.2	22.9
1967	Pebulate	3	18.8	19.2
1967	Cycloate	3	20.6	19.2
1967	TD283 + pyrazon	2 + 3	21.2	19.2
1967	Pyrazon + dalapon	4 + 2	19.4	19.2
Average			21.1	20.8