WEED CONTROL IN SUGAR BEETS

By: Richard Frank 1/

INTRODUCTION:

The shortage of labor for both blocking and thinning sugar beets and removing weeds has led many growers into using mechanical thinners and chemical weed killers. The work at Ridgetown has been concentrated on screening new herbicides and testing the performance of the most promising ones. Mixtures of herbicides have also been tested in order to find a combination which would destroy the widest possible range of annual weeds found in the sugar beet growing area of Southwestern Ontario.

Weed Species and Distribution

Extrapolating from the results of ten locations in the sugar beet area, the following table on the distribution and population density of the major weed species was compiled.

TABLE I. Distribution and densities of the major weed species in sugar beets (Southwestern Ontario)

Weed Species	% Of Land Area Infested	Ave. Population Densities/ 10 Square Feet	Range of Population Densities/ 10 Square Feet
1. Lambsquarters	100	23	4 - 134
2. Redroot pigweed	90	15	0 - 59
3. Foxtail	90	39	0 - 156
4. Lady's thumb	70	5	0 - 16
5. Velvet leaf	55	7	0 - 42
6. Common ragweed	30	6	0 - 49
7. Jimson weed (Thorn apple)	30	12	0 - 94
8. Black Nightshade	20	0.7	0 - 5
9. Wormseed mustard	20	5	0 - 40
10. Wild mustard	20	0.8	0 - 6
11. Wild buckwheat	10	0.5	0 - 5
12. Common purslane	10	0.7	0 - 6
13. Cocklebur	10	0.3	0 - 2
		115.0	

The table reveals that approximately 11-12 weeds per square foot emerge along with the sugar beet crop. Lambsquarters, pigweed and foxtail make up 67% of this weed population and these three weeds occur on 90-100% of the sugar beet area. To be of value to the Ontario grower, therefore, a herbicide or a mixture of herbicides must control these weeds.

1/Biology Specialist - Western Ontario
Agricultural School & Experimental Farm
Ridgetown, Ontario

Selective Herbicides

From a long list of chemicals that have been screened and tested over the past ten years only four have exhibited satisfactory beet selectivity and a propensity to destroy weeds. These herbicides have been Endothal, Pyrazon, Dalapon and TCA; Endothal and Pyrazon have displayed the capacity to control annual broadleaf weeds while Dalapon and TCA have displayed the capacity to control annual and perennial grasses. Endothal has not been widely accepted by the Ontario grower largely because it has failed to control the major broadleaf weed - lambsquarters. Pyrazon, thus, has been received with enthusiasm because it has successfully controlled the major annual dicotyledonous weeds. At rates of 4-5 lbs. active per acre Pryazon has controlled 90% or more of the lambsquarters, pigweed, ragweed, mustard, purslane and lady's thumb, but has failed to control foxtail and velvet leaf and given only partial control of Jimson weed. Reducing the rate to 3 lbs. active per acre has resulted in unsatisfactory control of pigweed and lady's thumb; further reductions have resulted in unsatisfactory control of lambsquarters. TCA at 4-6 lbs. per acre has controlled foxtail almost 100%. Dalapon has not been as successful as TCA in pre-emergent applications, but has been of immense value as a rescue operation where grasses have escaped.

The logical mixture for Ontario conditions has been, therefore, Pyrazon plus TCA; this has been borne out in field use. Experimental plots have revealed that the rate of Pyrazon and TCA cannot be reduced when used together, but rather that the full rates of 4-5 lbs. active Pyrazon plus 4-6 lbs. TCA product be used per acre.

Pyrazon:

In general, pre-emergent applications of Pyrazon have been far superior to post-emergent applications in the control of major weeds. In this respect the timing of the application in 1964 appeared more critical than in 1963. The rainfall pattern and mode of action may explain these differences. In 1963, rainfall was plentiful and followed the pre and early post-emergent applications and weed control was excellent; in 1964, good rains followed the pre-emergent applications, but not the post-emergent applications and only the former were excellent. It would appear that this relatively insoluble material (300 ppm solubility at 68°F.) is root absorbed and must be carried into the root zone by rain in order to be effective. Weeds appear to emerge, become chlorotic, and die in the cotyledon or first true leaf stages. In order to take advantage of as much rain as possible and for ease of convenience, it has been recommended to the Ontario growers that the Pyrazon applications should be made at planting time. To reduce the cost it has been further suggested that the application be made in a band. Pyrazon being a wettable powder, requires to be pre-mixed and applied from a sprayer with an agitator and piston pump and stainless steel nozzles.

Post-emergence applications with Pyrazon in oil-water emulsions have been investigated and found to be highly promising. Weeds like velvet leaf not controlled by a pre-emergence application have been controlled by the oil mixtures. Four pounds active seems to be injurious to plants in the first true leaf stage.

TCA has given satisfactory grass control whether applied at planting time or up to emergence. Since Pyrazon has been recommended for use at planting time, then for convenience, the TCA application has been recommended for the same time. Under some conditions the whole field is sprayed with TCA while only a band is treated with Pyrazon.

Beet Tolerance:

(a) Beet Stands - Over the past three years beet tolerance has been studied and it has been found that Pyrazon at rates of 6 lbs. active or over have reduced beet stands by 10-45%, while rates of 5 lbs. active have had no effect on beet stands. TCA at 10-12 lbs. has reduced stands by 34-43% while rates of 6-8 have had little or no effect on stands.

(b) Beet Growth - In some locations and under some conditions beets have appeared a deeper green where pyrazon has been used. At three out of ten locations this was observed in 1964. The protein level in the leaves of such plants was found to be higher. Investigations are continuing into this phenomena.

(c) Tons of Roots/A. - No rate of Pyrazon so far tested at Ridgetown has affected the yield of sugar beets in spite of considerable reductions in beet stands at the high rates. In many instances the root yields and sugar per acre have been 0-33% higher than yields from beets given the best combination of cultural practices - inter-row cultivation plus hoeing. TCA has likewise not affected the yield of beets in spite of stand reductions. In all tests the seeding rate has been designed to give one seed per inch. Germination has been little more than 40%.

(d) Percentage Sugar and Purity of the Clear Juice - At no time has the sugar percentage been affected. Studies on clear juice purity are in progress and to-date there seems to be no deleterious effects from using Pyrazon.

Soil Residues:

Season long control has been obtained at Ridgetown with the Pyrazon-TCA mixtures. However, soil tests for both herbicides have revealed that while considerable quantities remained after eight weeks, only small quantities occurred after fifteen weeks and none after twenty-two weeks. Neither Pyrazon nor TCA pose a problem in the planting of the next crop in the rotation, but do pose a problem to the next crop if the sugar beet crop is lost from adverse weather conditions, disease or insects

and another crop must be planted. Band application of these chemicals alleviates this situation somewhat when corn or beans can be planted across the bands.

Conclusion:

A combination of Pyrazon and TCA applied on a band over the row at planting time and combined with inter-row cultivation, appears to be the most practical approach to weed control in Southwestern Ontario. This mixture will control the majority of the weed species found in the area and until the spectrum can be broadened, the escaping species must be removed by hoeing in the usual way. Work is proceeding to find a new met method or new herbicides to both broaden the spectrum of pre-emergent weed control and destroy escaping weeds with post-emergent treatment.