EFFECT OF ENVIRONMENT ON WEED CONTROL IN SUGARBEETS

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Pyrazon plus TCA has proven to be an effective combination for pre-emergence control of annual broadleaf and grass weeds in sugarbeets. In many cases control has approached 100 per cent, however, there are certain environmental conditions under which control has not been completely effective and in some instances not adequate. In some fields as little as 2 lbs. per acre of pyrazon in combination with 6 or 8 lbs. of TCA has provided over 90 per cent control. In other instances it has required 3 or 4 lbs. per acre of pyrazon to obtain the same level of control and in other areas pyrazon at 4 or 6 lbs. in combination with TCA provided no more than 35 or 40 per cent control of annual weeds. Soil properties, particularly the amount of silt, clay and organic matter play an important role in determining the rate of pyrazon needed for effective weed control.

Table 1 shows varying degrees of weed control from a number of rates of pyrazon and TCA. It is evident from Table 1 that a range in soil types will provide a wide range in control. In certain cases as indicated by control on a sandy clay loam with 23 per cent organic matter 2 lbs. per acre of pyrazon in combination with TCA provided 97 per cent control, whereas, in the last column on a soil not too different, control was only 41 per cent and it required 6 lbs. of pyrazon to reach control over 90 per cent.

In Table 2 some direct comparisons are made on the influence of soil properties particularly the clay and organic matter content and the relative amount of pyrazon required to obtain near 100 per cent control. Each of the soils in Table 2 are compared on a paired basis in that each pair was in close proximity with respect to the macroenvironment. In Table 2 as the per cent clay increases or as the percent organic matter increases, it requires proportionately more pyrazon to reach the effective control or to reach nearly 100 per cent control. It should be noted that in the last comparison even though the soil type is not too different from the first comparison ineffective control was obtained. One point to be made about Table 2 is the fact that the first comparison was planted April 13, the second comparison two weeks later and the last comparison near the middle of May. This then points to another factor and that is, the effect of date of application with respect to effective control.

The response of weed control with respect to application date is shown in Table 3. Comparisons in 1966 or in 1967 were made in the same field and with the same rate of TCA, 6 lbs. per acre. The only variable here is 3 lbs. per acre or 4 lbs. per acre of pyrazon. In comparing the control received in 1966, it is shown that early plantings, those the first two weeks in April, 3 lbs. per acre of pyrazon provided very effective control and near the 100 per cent level, whereas, a delay in planting to the first week in May the control from 3 lbs. per acre was considerably less and, in fact, control from 4 lbs. per acre did not reach the level that 3 lbs. per acre provided early in April. Further, the same comparisons can be made with respect to planting date in 1967. It is readily obvious from the May 5 or May 13 planting that ineffective control was obtained with 4 lbs. per acre of pyrazon and it would have required higher levels to reach an effective control rate at that late date of application.

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Table 4 contains some relationships between the percentage of clay and application date with respect to the degree of control obtained from varying rates of pyrazon. The data on Table 4 is taken from a large number of field studies where applications were made at more than 30 locations and the soils were grouped as to per cent clay and application dates. The soils included in this study contained organic matter levels between 2.5 and 5 per cent. In an evaluation of organic matter in this range there was no significant difference with regard to organic matter level. The per cent clay and the application date masked any effects that varying levels of organic matter between 2.5 and 5 per cent had with regard to control. The figures listed in Table 4 show the rate of pyrazon that would be necessary to provide 100 per cent of broadleaved weeds under the varying percentages of clay content and application date. The area inside the broken line is not generally considered satisfactory for sugarbeets, that is, 40 per cent clay and beets planted May 31 would not provide a very economical beet crop. The area of concern then is from 10 to 30 per cent clay and beets planted between April 1 and May 15. The present pyrazon label allows for only 4 lbs. of active ingredient to be applied per acre pre-emergence, so this means that in areas where the percentage of clay is 20 to 30 per cent and beets are planted May 1 or later that the grower must take less than 100 per cent weed control since he can only use 4 lbs. per acre.

Table 4 shows that as the date of application is prolonged later into the season or as the percentage clay in the soil increases that rate adjustments must be made to provide effective control. As the per cent clay increases from 10 to 20 or with a 10 per cent increase in clay the pyrazon needs to be increased 1/2 lb. per acre and as the application date is delayed two weeks the rate of pyrazon for any given level of clay must be increased approximately 1 lb. per acre to reach the same level of control. It should be kept in mind in all cases where pre-emergence application of pyrazon plus TCA are made, rainfall is necessary to move the herbicide into the upper layer of soil so that it is in proximity with germinating weed seeds.

Certain other combinations of herbicides might be used in sugarbeets to provide more effective control on later planted beets or on heavier soil types. One possibility is shown in Table 5 where a combination of pyrazon and propachlor (Ramrod) has been compared to pyrazon plus TCA on a number of soil types on beets planted the first two weeks in May. The combination of pyrazon and propachlor is effective on annual broadleaved and grassy weeds, particularly on the later planted beets where pyrazon plus TCA has proven to be less effective. As can be seen from Table 5 direct comparisons across a number of soil types would indicate that this combination might be used in later planted beets, however, on the heavier soil types again control is not effective particularly late in the season.

There has been considerable interest in post-emergence applications of herbicides for sugarbeets. Research at Michigan State has shown that generally control from post-emergence treatments is less effective than that obtained from pre-emergence applications. As is shown in Table 6, a combination of pyrazon and dalapon applied when the beets are in the 2 to 4 leaf stage and the weeds are in the same stage of growth has given effective control of broadleaf weeds. The dalapon will also provide effective control of annual

grasses where they are a problem. The addition of one gallon of nonphytotoxic crop oil to the combination of pyrazon and dalapon has provided increased effectiveness in control. In certain cases where the polygonum species such as smartweed or wild buckwheat are present the addition of Herbicide 273 at 1 lb. per acre increases the control. The 65-223A shown in Table 6 is a combination of pyrazon plus dalapon plus a wetting agent, and it can be seen that this is also an effective control measure for post-emergence treatment. The control from 65-223A is essentially comparable with the pyrazon-dalapon-oil combination. Generally, there will be some stunting of the beets and some curling of the leaves and browning of the leaf margins of the sugarbeets from the post-emergence treatment with dalapon. However, this is generally outgrown within a week to 10 days and has not been reflected in yield reduction.

In more recent research in 1968, the herbicide phenmedipham (Betanal) provided effective control of broadleaved and grassy weeds when applied post-emergence at the rate of 1 to 1½ lb. per acre. The addition of a nonphytotoxic crop oil also increased the effectiveness in control from Betanal. This material will be evaluated to a greater extent in the 1969 season to determine its place in a post-emergence control program.

In summary the pre-emergence applications of herbicides in sugarbeets are affected by various soil types particularly the silt and clay content and organic matter of the soil. It would appear on many of the heavier soils, those of which the clay content is over 20 per cent and organic matter is in the 4 or 5 or 6 per cent level, that a combination of pre- and post-emergence treatments are going to be necessary to provide the 100 per cent weed control that is necessary for effective production of sugarbeets.

Table 1. Weed Control in Sugarbeets from Varying Rates of Pyrazon on a Number of Soil Types

Treatments	Rate Lb/A	SCL*/ 23% 4.8%**	SL*/ 11% 2.7%	SCL/ 26% 13%	L/23% 3.6%
Pyrazon + TCA	2 + 8	97	96	69	41
Pyrazon + TCA	3 + 8	98	99	76	71
Pyrazon + TCA	4 + 8	99	98	87	83
Pyrazon + TCA	6 + 8	100	100	85	94
Pyrazon	4	97	98	35	58
Pyrazon	6	99	100	66	78

*SCL - Sandy clay loam SL - Sandy loam

**Organic matter

Table 2. Influence of Soil Properties on Effectiveness of Pyrazon

Soil Properties			Broadleaf Weed Control, %		
Texture	Clay,%	O.M.,%	2 Lb/A	3 Lb/A	4 Lb/A
Sandy loam	18	3.7	100	100	100
Sandy clay loam	26	4.7	85	93	100
Sandy loam	10	2.9	97	84	98
Loam	23	3.6	41	71	83
Sandy loam	17	3.0	46	58	64
Sandy clay loam	21	4.1	0	0	0

In each pair of soils, plots were established within a two day period within a two mile radius. First pair treated April 13; second May 1; third May 12
Pyrazon applied in combination with TCA at 6 Lb/A

Table 3. Application Date Related to Weed Control with Pyrazon

Application Date	Broadleaf Weed Control, %	
	3 Lb/A	4 Lb/A
1966 April 8	99	98
April 15	93	100
1967 April 25	96	97
May 1	61	90
1966 May 5	71	83
May 7	67	89
1967 May 5	45	65
May 13	62	58

Pyrazon applied in combination with TCA

Table 4. Rates of Pyrazon for Pre-emergence Control in Sugarbeets on Michigan Soils, Organic Matter 2.5 to 5%

Application Date	Percentage Clay					
	10	20	30	*	40	*
April 1	2.4	3.0	3.6	*	4.2	*
April 15	3.6	4.2	4.7	*	5.3	*
May 1	4.6	5.2	5.8	*	6.4	*
May 15	5.9	6.5	7.1	*	7.7	*
May 31	7.4	8.0	8.5		9.2	*

In combination with 6 Lb/A TCA

Table 5. Herbicide Combinations Affect Pre-emergence Effectiveness of Pyrazon

SOIL TYPE	Broadleaf Weed Control, % Pyrazon + TCA 3 + 6 Lb/A	Pyrazon + Propachlor 3 + 2 Lb/A
Sandy loam	56	86
Sandy loam	62	83
Sandy loam	58	73
Sandy clay loam	0	28

Treatments applied between May 4 and 13, 1967

Table 6. Post-emergence Sugar Beet Herbicide Evaluation

Treatment	Lb/A	Injury	Broadleaf Weed Control
Pyrazon	4	0.7	6.0
Pyrazon + Dalapon	3 + 2	2.0	7.3
Pyrazon + Dalapon	3 + 3	3.3	9.0
Pyrazon + Oil	3 + 1 Gal/A	0.7	8.3
Pyrazon + Dal. + Oil	3+2+1 Gal/A	3.3	10.0
Pyrazon + Dal. + Oil	3+3+1 Gal/A	5.7	10.0
Pyrazon + Dal. + 273	3 + 2 + 1	1.7	9.0
Pyrazon + Dal. + 237	3 + 3 + 1	3.7	9.7
Pyrazon + H-634	3 + 1	0.3	4.7
Pyrazon + H-634	3 + 2	0.3	5.7
65-223A	12	2.3	9.3
65-223A	15	2.0	9.7

0 = no control or injury - 10 = complete kill

Table 7. Post-emergence Sugarbeet Herbicide Evaluation

Treatment	Lb/A	Beet Stand	RATINGS Injury	Bd.Lv. Control
Pyrazon	3	92	0.0	2.7
Pyrazon + Oil	3 + 1	94	0.0	7.7
Pyrazon + Dalapon	3 + 2	97	0.0	6.7
Pyrazon + Dal. + Oil	3+1+1	92	0.7	8.7
" " "	3+2+1	91	0.3	9.0
" " "	3+3+1	94	1.3	9.0
Pyrazon+Dal.+W.A.	3+2+2	87	0.0	5.7
65-223A	9	86	0.0	9.3
65-223A	12	96	0.7	10.0

0 = no control or injury - 10 = complete kill