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The Effect of Aldicarb On Growth of Sugarbeets

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Introduction

In our field tests with the systemic insecticide aldicarb for control of the sugarbeet root maggot, *Tetanops myopaeformis* (Roder), the plants in treated plots have often produced more dense top growth than those in untreated plots, even in the absence of damaging populations of root maggots or other obvious insect damage. However, aldicarb is registered for the control of a variety of insects, mites, and nematodes. It is possible that control of these pests, each at seemingly non-economic levels, leads to the improved plant performance. But there is speculation that aldicarb directly stimulates plant growth (1, 2, 3, 5).[2] Greenhouse tests were therefore conducted to determine whether aldicarb itself stimulated sugarbeet growth.

Materials and Methods

In the winter of 1973-74, Portneuf silt loam from a single field was prepared 3 ways: untreated, heat-sterilized, and fumigated with ethylene dibromide. The soil was placed in 6 in. pots and each pot was planted with 4 seeds of a sugarbeet single cross hybrid. Then aldicarb 10G was applied at the time of seeding at rates of 1, 2, and 4 lb. AI/acre (as concentrated in a 5½ in. band on 22 in. rows above the seed) and watered in with 8 oz. water/pot. Pots with no aldicarb were included as checks. All treatments were randomized within 4 replicates. Seedlings were thinned to one plant/pot. All plants received the same amount of water when at least half the pots were dry. The data taken 71 days after the seedlings emerged were: leaf length, leaf weight (air dry), number of leaves, root weight, root length, and root diameter.

The second test, conducted during the winter of 1974-75, differed somewhat. In January, approximately 225 single cross beet seeds were planted in a flat. Three weeks after emergence, 75 seedlings in the cotyledon or 2-leaf stage were transplanted into 6 in. clay pots filled with a greenhouse soil mixture of 2 parts dark soil, 2 parts light soil, 3/4 part cow manure, and 1/5 part sand. Aldicarb was applied 10 days after transplanting by sprinkling it on the soil surface at rates of ½, 1, and 2 lb. AI/acre banded on 22 in. rows (this is equivalent to broadcast rates

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[2]Numbers in parentheses refer to literature cited.

of 2, 4, and 8 lb. AI/acre) (4) and then scratching it into the soil to a depth of 0.5 in. Untreated pots were scratched in the same manner. All pots were subsequently given identical care except for watering: watering was varied so we could determine whether the effect of aldicarb was dependent on the amount of moisture in the soil. Thus 8, 6, or 4 oz. of water/pot was applied to a group of pots immediately after the application of aldicarb and thereafter when at least half of the pots in a group were dry. All treatment combinations were randomized in 6 replicates. Six weeks after treatment, the beets were removed from the pots, the soil was removed from the roots by washing with a fine spray nozzle, and the tops were cut off, measured, and left on tables in the greenhouse to air dry. After 10 days, the dried tops were weighed. Roots were weighed after the tops were removed and the root diameter was recorded at the cutting point.

Results and Conclusions

In the 1973-74 test, only 38 of the original plants were harvested because of poor germination and seedling mortality. Also, the initial watering may have washed most of the aldicarb out through the bottom of the pot. In any case the soil in some pots remained wet and mucky throughout the test. The effect of soil sterilization compared with no sterilization is reported in Table 1 as percentage increase or decrease in growth from that of the untreated plants for all rates of aldicarb. Heat sterilization was apparently detrimental to growth, and EDB fumigation was beneficial. The effect of the rates of aldicarb for all soil treatments, also expressed as percentage increase or decrease from that of the untreated plants, is presented in Table 2. Aldicarb had no stimulating effect on plant growth at any of the rates tested.

The results obtained in the 1974-75 test for the rates of aldicarb are shown in Table 3 in terms of percentage increase or decrease from untreated checks. No clear response to dose was demonstrated for root

Table 1. — Effect of soil sterilization on sugarbeet growth, 1973-74.

	Percentage Increase or Decrease Over Unsterilized Soil Of —						
Soil Treatment	Root Weight	Root Diam.	Root Length	Leaf Weight	No. Leaves	Leaf Length	Average
Heat Sterilized	+2.29	−2.68	−7.03	−6.41	−2.72	−4.62	−3.53
Fumigated (EDB)	+13.38	+0.17	−0.26	+5.52	+1.17	+0.71	+3.45

Table 2. — Effect of aldicarb on sugarbeet growth, 1973-74.

	Percentage Increase or Decrease From Untreated Check Of —						
Aldicarb Rate	Root Weight	Root Diam.	Root Length	Leaf Weight	No. Leaves	Leaf Length	Average
4 lb.	−6.81	−0.50	+7.77	−5.84	−7.92	+6.14	−1.03
2 lb.	+9.11	−1.35	−10.11	−3.86	−8.42	−2.77	−2.90
1 lb.	−6.85	−1.06	−2.98	−8.08	−3.96	−1.10	−4.00
$\bar{x}$ of 3 rates	−1.52	−0.97	−1.77	−5.93	−6.77	+0.76	−2.70

weight, root diameter, leaf length, or leaf weight though leaf weight was consistently higher for aldicarb-treated plants and showed an average of 6.44% increase. However, analyses of variance of the same measurements for each rate of water showed signifcant differences only for root weight and root diameter when the water rate was 6 oz. When water rates were combined in an analysis of variance, no significant differences were obtained.

Root and leaf weights, which measure actual vegetative production, are presented in Table 4. Here again, no significant response to aldicarb was demonstrated, but differences due to watering rates are evident. Also, correlations between growth measurements and rates of application of aldicarb (Table 5) show that aldicarb had no significant effect except a negative one on root weight at the 4-oz. water rate. Water rates were positively and significantly correlated with root weight, leaf length, and leaf weight. Leaf length and root weight were also significantly correlated ($r = 0.62^{**}$).

Any increase we obtained in plant growth in our tests can only be attributed to differences in watering rates. Thus increases in field yield at harvest due to aldicarb probably result only from the benefits of insect and/or nematode control. Aldicarb is an effective insecticide with systemic activity that continues for 2-3 months, and many insect pests inhabit fields. Individually the damage due to a particular

Table 3. — Effect of aldicarb on sugarbeet growth, 1974-75.

	Percentage Increase or Decrease From Untreated Checks Of —				
Aldicarb Rate	Root Weight	Root Diam.	Leaf Weight	Leaf Length	Average
2 lb.	−2.67	−1.11	+8.80	+0.24	+1.32
1 lb.	+2.91	+1.86	+3.33	+0.12	+2.06
½ lb.	−1.11	+1.86	+7.18	−0.12	+1.95
$\bar{x}$ of 3 rates	−0.29	+0.87	+6.44	+0.08	+1.78

Table 4. — Root and top weight of sugarbeets associated with 3 rates of aldicarb and 3 rates of water. 1974-75.

	Wet Root Wt. (g/plant) for Aldicarb Rates (lb. AI/acre) of					Dry Leaf Wt. (g/plant) for Aldicarb Rates (lb. AI/acre) of				
Water[1] Rate (oz)	0 (check)	0.5	1.0	2.0	$\bar{x}$ All Aldicarb Rates	0 (check)	0.5	1.0	2.0	$\bar{x}$ All Aldicarb Rates
4 (14)	5.98	5.58	4.93	4.77	5.09	2.85	2.98	2.94	3.10	3.00
6[2] (13)	8.77	10.06	10.75	9.40	10.07	4.14	4.82	4.63	4.63	4.69
8 (11)	10.59	9.42	10.40	10.50	10.10	4.95	5.00	4.77	5.26	5.01
$\bar{x}$	8.44	8.35	8.69	8.22	—	3.98	4.26	4.11	4.33	—

[1]Values in ( ) are the number of waterings.

[2]Differences in root weight among treatments for the 6-oz. water rate were significant at the 5% level.

Table 5. — The effect of aldicarb and water rates on sugarbeet leaf length, leaf weight, and root weight as determined by correlation[1] of data from 1974-75 test.

Water (n = 18)		Aldicarb (n = 24)	
Aldicarb Rate (lb. Al/acre)	r Value	Water Rate (oz)	r Value
	Leaf Length		
0	.84**	4	.13 NS
0.5	.80**	6	−.05 NS
1	.73**	8	−.03 NS
2	.74**		
	Leaf Weight		
0	.85**	4	.26 NS
0.5	.77**	6	.19 NS
1	.82**	8	.22 NS
2	.88**		
	Root Weight		
0	.87**	4	−.46 *
0.5	.76**	6	.12 NS
1	.64**	8	.05 NS
2	.79**		

[1]NS = not significant.
* = significant at 5% level.
** = significant at 1% level.

species may be very minor, but when they are added together, there may be an economic loss. Such minor damage could go unnoticed by growers or fieldmen. If aldicarb sometimes controls these minor infestations, the result would be increased plant growth and yield.

Under the conditions of our tests, aldicarb demonstrated no significant stimulating effect on sugarbeets.

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