Influence of Krilium Soil Conditioner on Sugar Content of Beets

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Introduction

Investigations reported in this paper with Krilium soil conditioner were initiated in connection with sugar beet varietal studies. Two different types of injury to the beet root had been observed in the vicinity of Salt Lake City. These injuries were thought to be associated with inadequate soil aeration. Certain inbred lines of beets were much more susceptible to the injury than others. It was assumed that a soil conditioner might provide better aeration.

Therefore, in 1952 five inbred lines of beets were included in a field test which consisted of three Krilium-treated blocks and three controls. Varieties appeared in two-row plots 39 feet long. Each treatment block contained five of these variety plots. It turned out that no significant differences were observed for the amount of root injury on the treated and control blocks. However, there was a remarkable difference in soil structure and when the beets were analyzed those from the Krilium-treated blocks showed a higher sugar percentage, also a better purity and a lower sodium content. In 1953 the test was repeated with one additional replication, but highly vigorous varieties and F_1 hybrid beets were grown on the treated and control plots instead of inbred lines.

The soil type on the experimental field for both years was Welby fine sandy loam with 18 to 20 percent clay, having a lime zone in the subsoil and of about medium alkalinity. A crop rotation of grain and onions, along with a good fertilizer program, maintained the soil at a high fertility level. A heavy application of chicken litter (15 spreader loads per acre) and commercial fertilizer (100 pounds treble superphosphate and 100 pounds of ammonium sulphate per acre) was worked into the soil during seed bed preparation.

Experimental Results, 1952 Test

Krilium No. 6, produced by the Monsanto Chemical Company, was applied April 23, 13 days after planting, just as seedlings were beginning to appear. The application rate was 2,000 pounds per acre applied with a hand-drawn grass seeder. A tractor-drawn harrow moving crosswise of the rows worked the Krilium into the top one inch of soil. Shortly after application treated plots became crusted. In the early morning hours the soil in treated plots was gummy and sticky but hardened during the day. Crusting continued to be a problem until several cultivations and irrigations aided in more thoroughly mixing the Krilium with a larger quantity of soil. By midsummer, soil on treated plots did not become crusted or packed between irrigations and was much more friable than soil in control plots. Krilium brought about beneficial changes in the physical structure of the soil. Treated soil did not dry out as rapidly and maintained better porosity and more rapid water penetration than did soil on control plots.

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Although emergence stands were not as uniform and heavy as desired, the stands on treated plots were as uniform as those on control plots. The late application of the Krilium caused soil crusting and required special treatment until the beet seedlings emerged. Subsequent rate of growth, color of foliage, vigor of plants, or rate of crop maturity were not noticeably different on treated and control plots.

In the final analysis of results, yield was not affected within varieties. The main differences were in sucrose percentage, purity and sodium content. A small but consistent increase was noted in sucrose percentage. An average overall difference of 0.65 percent sucrose was obtained in favor of the Krilium treatment (see Table 1). Likewise the overall difference of 1.57 percent purity was in favor of Krilium treatment. A corresponding decrease in sodium content was observed in favor of Krilium treatment. The small overall difference in amino nitrogen percentage was not significant.

Table 1.—Results from Field Test, 1952

Replication	Treatment	Sucrose	Sodium	Amino Nitrogen	Purity	Beets Per Acre
		Percent	p.p.m.	Percent	Percent	Tons
1	Krilium	13.98	597.0	0.470	80.92	26.68
	Control	13.37	700.0	0.628	78.94	27.28
	Difference	+0.61	—103.0	—0.158	+1.98	—0.60
2	Krilium	14.73	421.8	0.540	81.04	27.00
	Control	14.14	612.8	0.618	80.86	29.94
	Difference	+0.59	—191.0	+0.022	+0.18	—2.94
3	Krilium	14.05	559.2	0.584	80.48	28.10
	Control	13.29	659.2	0.658	77.92	27.12
	Difference	+0.76	—100.0	—0.074	+2.56	+0.98
Average	Krilium	14.25	526.0	0.565	80.81	27.26
	Control	13.60	657.3	0.635	79.24	28.11
	Difference	+0.65	—131.0	—0.07	+1.57	—0.85
Standard Error		0.05	29.88	0.04	0.72	0.86
t Value (S.E. ÷ Diff.)		12.08[2]	4.38[1]	1.71	2.19	0.99

[1] t = 4.30 for 5 percent level of significance.
[2] t = 9.92 for 1 percent level of significance.

Krilium treatment did not affect the amount of root rot or internal breakdown, which was the primary purpose of the test.

1953 Test

In 1953 a replicated test of five varieties of sugar beets, chosen because of their high or low sodium or sugar relationships under normal conditions, were superimposed upon four Krilium-treated and four control blocks.

Krilium No. 6 was applied at the rate .f 700 pounds per acre by a hand-drawn grass seeder and raked into the surface inch and one-half of soil with hand rakes just prior to drilling the seed March 24, a rather early planting date for this area.

After light spring rains the Krilium treatment sealed the soil surface. The crust which formed became hard when dry and had to be broken prior

to seedling emergence. Temperatures were cool and frequent storms, both rain and snow, maintained good soil moisture. Seedling emergence in general was slowed up considerably due to prolonged low temperatures. However, seedlings appeared first on Krilium-treated plots. This was believed due to the darkened color of the soil and better soil aeration caused by better aggregation of soil particles on treated plots. Seedling growth was faster on Krilium-treated plots before thinning, but after thinning growth became more uniform.

Excellent stands of beets were obtained on both treated and control plots. No differences were observed in growth, color of plants or rate of maturity. The physical structure of the soil in treated plots was definitely improved over control plots. Although the soil was rather wet at harvest due to a late irrigation and rains just prior to harvest, soil on treated plots was friable compared to the compact balling effect of soil on control plots.

Harvest data indicated very small differences between treated and control plots for tons of beets, sodium, nitrogen and potassium control (Table 2) . No difference was observed in average sucrose content from treated and control plots.

Table 2—Results from Field Test, 1953.

Replication	Treatment	Sucrose	Sodium	Amino Nitrogen	Purity	Potassium	Beets Per Acre
		Percent	p.p.m.	Percent	Percent	p.p.m.	Tons
1	Krilium	15.10	559.0	0.346	87.46	3,528.4	44.30
	Control	14.38	615.4	0.374	85.82	3,741.2	43.38
	Difference	+0.72	—56.4	—0.028	+1.64	—212.8	+0.92
2	Krilium	16.72	235.9	0.306	89.16	3,353.6	42.00
	Control	16.94	277.8	0.308	89.26	3,355.8	42.02
	Difference	—0.22	—41.9	—0.002	—0.10	—2.2	—0.02
3	Krilium	16.56	285.4	0.375	88.44	3,589.2	40.82
	Control	16.96	267.2	0.292	89.38	3,417.8	41.28
	Difference	—0.40	+18.2	+0.084	—0.94	+171.4	—0.46
4	Krilium	16.58	315.2	0.248	90.08	3,130.8	40.94
	Control	16.68	257.4	0.326	89.44	3,414.4	40.84
	Difference	—0.10	+57.8	—0.078	+0.64	—283.6	+0.10
Average	Krilium	16.24	348.85	0.319	88.78	3,400.50	42.01
	Control	16.24	354.45	0.325	88.47	3,482.35	41.88
	Difference	0.0	—5.6	—0.006	+0.31	—81.85	+0.13
Standard Error		0.35	33.66	0.0443	0.62	109.84	0.85
t value (S.E. ÷ Diff.)		0.35	1.66[1]	0.0014	0.50	0.75	0.38

[1] t = 3.18 for 5 percent level of significance.

Summary and Conclusions

In 1952 a heavy application (2,000 pounds per acre) of Krilium soil conditioner improved soil structure but failed to alleviate two special types of injury prevalent to beet roots on Welby fine sandy loam soil near Salt Lake City. However, the sucrose percentage was increased and sodium content in the beets was reduced by the treatment. This test was conducted

with inbred lines of sugar beets. The experiment was repeated in 1953 with a reduced quantity of Krilium (700 pounds per acre) and with vigorous hybrid sugar beets instead of inbreds. Seedling emergence and early seedling growth were improved by the Krilium treatment. Soil structure was greatly improved. There was a slight but statistically insignificant reduction in sodium and potassium content. There was no increase in sucrose in beets from Krilium-treated plots. The final results, therefore, are not fully conclusive. The increase in sucrose percentage by the Krilium treatment in the 1952 test looked very encouragaing.

The reasons for the different results obtained in 1953 are not evident unless explained by the smaller quantity of Krilium used or by the change from the use of inbred lines to vigorous hybrid sugar beets.