

Use of IPC for Weed Control in Sugar Beets¹

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In recent years limited trials of some chemical weed killers have been made in connection with sugar beet experiments at Fort Collins, Colorado.³ In 1947, following suggestions by J. W. Mitchell and P. C. Marth⁴, observations were made on the effect of Isopropyl-N-Phenyl-Carbamate (IPC) applied dry and worked lightly into the surface of the soil at the rate of 40 pounds per acre. Weed control was excellent and adequate stands of sugar beets were obtained from moderately heavy plantings of beet seed. However, observations suggested the possibility of slightly adverse effect of the chemical on early growth of the sugar beet seedlings.⁵

A more comprehensive test was planned for 1948, with IPC applied at rates of 10, 20 and 30 pounds per acre on replicated plots. Rainfall in April and May was below normal, resulting in variable and usually inadequate soil moisture for normal germination of beet seed. The stands of beets were poor and the experiment was not carried to harvest. Observations indicated a marked reduction of weeds on the treated plots. That a slight reduction in emergence of beet seedlings had been caused also appeared probable. No consistent differences attributable to different rates of application of IPC were apparent.

TABLE 1.—Seedling counts; IPC treated and check plots at Fort Collins, Colo., 1949. Data given as 2-plot averages. (20 counts per plot of 4"x12" quadrats, lengthwise of beet row.) Planting date April 25. Surface application of IPC, 10 pounds per acre.

| Treatment | Date of count | Seeding rate 4.3 lb. | | | Seeding rate 2.3 lb. | | |
|-----------|---------------|----------------------|---------|---------|----------------------|---------|---------|
| | | Beets | Grasses | Dicots. | Beets | Grasses | Dicots. |
| Check | May 18 | 6.98 | 9.48 | 1.00 | 3.58 | 13.09 | 0.92 |
| IPC | May 18 | 4.80 | 4.20 | 0.80 | 1.90 | 3.90 | 0.42 |
| IPC | June 1 | 4.45 | 3.05 | 0.55 | 1.62 | 3.20 | 0.10 |

In the spring of 1949, IPC was applied at a rate of 10 pounds per acre on April 25, harrowed lightly into the surface soil and good quality sheared sugar beet seed planted immediately. Planting of the beet seed was at two rates, a medium one of 4.3 pounds per acre and a light one of 2.3 pounds per acre. A few days after planting a heavy rain occurred and storm water from the city streets flowed over one replication of the test. Seedling emergence of both weeds and beets on the IPC treated plot which

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³ Investigations of the Division of Sugar Plants at Fort Collins, Colo., are cooperative with the Agronomy Section of the Colorado A & M Agricultural Experiment Station, and the experiments reported in this paper were conducted on the Agronomy farm of the latter agency.

⁴ Mitchell, John W., and Paul C. Marth. "Sensitivity of grasses and some crop plants to Isopropyl-N-Phenyl-Carbamate." Science 106:15-17, July 4, 1947.

⁵ Deming, G. W.—Progress Report on Weed Control Studies at Fort Collins, Colorado."—Proceedings of the American Society of Sugar Beet Technologists, 1948, pp. 435-444.

was flooded was comparable to the check plot of the same replication. Therefore, data from the flooded replication are excluded from this report.

Counts of weed and beet seedlings were made on May 18 and a second count made on the IPC-treated plots on June 1. There were 20 counts per plot of a 4-inch by 12-inch quadrat centered lengthwise of the beet row. On May 18 the beet seedlings were beginning to show the first pair of true leaves. Those on the check plots were vigorous and making normal growth while the beets on the IPC plots were pale green and generally of smaller

TABLE 2. Stands, acre yields and percentage sucrose; IPC treated and check plots at Fort Collins, Colo., 1949. Data given as 2-plot averages.

| Treatment | Seeding rate 4.3 pounds per acre of sheared sugar beet seed. | | | |
|-----------|--|-------------|--------|-----------------------|
| | Harvested roots per 100' of row | Acre yields | | Percentage sucrose |
| | | Gross sugar | Roots | |
| | (number) | (pounds) | (tons) | (percent) |
| Check | 88.5 | 6045 | 18.09 | 16.72 |
| IPC | 101.3 | 6582 | 19.34 | 17.00 |
| | Seeding rate 2.3 pounds per acre of sheared sugar beet seed. | | | |
| Check | 80.6 | 6848 | 19.88 | 17.20 |
| IPC | 64.6 | 5950 | 17.58 | 16.92 |

size. A few were somewhat distorted. On June 1 the check beets had 4 to 6 true leaves and were growing vigorously and the IPC beets were about half the size of the checks, had a better color than on May 18 and now appeared to be making normal, though delayed growth. Weed and beet seedling counts are summarized as 2-plot averages in Table 1. In this test it is probable that the chemical had ceased to affect the growth of sugar beet seedlings at about four weeks after its application. When seedling counts were made, all living weeds were counted. Some dead weeds were observed on the treated plots and many of the living weeds were pale and making weak growth. When thinned, the treated plots were considered by the laborers to be essentially clean and the check plots moderately weedy.

The treated plots were thinned June 9. Since the initial stands appeared to be slightly thin, particularly on the plots seeded at the 2.3 pound seeding rate, a special effort was made to leave the best obtainable thinned stands. Rains delayed thinning of the check plots until June 16 and probably somewhat less care was used in thinning the checks. Thus it is probable that the treated plots were slightly favored, both in quality and timeliness of thinning.

On June 9, when the treated plots were thinned, most of the beet plants were showing marked recovery from the poor color and slow growth which had been so apparent in mid-May. By July 1, the beets on these plots appeared to be equal in growth and vigor to the checks.

This test was harvested in early October and the harvest results are given as 2-plot averages in Table 2. Considering first the 4.3 pound seeding rate, the difference in stand in favor of the IPC treated plots is probably attributable to the better thinning job done on these plots. However, in general, in this test there were no obvious differences in yield between plots having harvested stands of about 80 beets per 100 feet of row or better.

The differences in yield of roots and gross sugar and sucrose percentages between the treated and check plots seeded at this rate are probably not attributable to the treatment.

When the harvest data from the plots seeded at the 2.3 pound seeding rate are examined it is apparent that the IPC treatment reduced stands and that this resulted in a definite reduction *in* yield.

Treatment with IPC appears to have had no effect upon quality of the crop as measured by sucrose percentage.

Conclusions

IPC applied dry and worked lightly into the surface of the soil at rate of 10 pounds or more per acre just before planting sugar beets has given excellent control of both monocotyledonous and broad-leaved weeds which would normally have germinated at the same time as the sugar beets.

In the trials of previous years, the chemical has reduced emergence of sugar beet seedlings and has appeared to retard the early growth of those which did emerge. However, in 1949, with excellent conditions for emergence and early growth, the 10-pound surface application of IPC just before planting gave adequate thinned stands and a yield at least as good as the untreated check when the seeding rate was 4.3 pounds of sheared sugar beet seed per acre. When the seeding rate with sheared seed was light, 2.3 pounds per acre, the stand on the treated plots was only about two-thirds that of the untreated plots, and the root yields were apparently considerably reduced.

These results warrant further trials of this chemical as a pre-emergence treatment of the soil for control of weeds in the pre-thinning period of the sugar beet crop.