Grass Control in Sugar Beet with the Herbicides IPC, TCA and DCU

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IPC

Preliminary work showed IPC to be safe on sugar beets only at rather low rates. Early investigations of Deming (2)[2] showed a crop of sugar beets survived a rate of 10 pounds per acre isopropyl-N-phcnylcarbamate (IPC) with only a partial loss in stand. Final yield was not affected when an average seeding rate was used. Deming (2) received control of both mono- and dicotyledonous weeds. The writer (3) (4) (5) found IPC to be particularly effective in controlling wild oats and volunteer grain which included barley, oats and wheat. Good control of these weeds was obtained at a rate of 3 to 6 pounds per acre technical IPC. The IPC gave better control, and was less injurious to sugar beets than isopropyl-N- (3 chlorophenyl) carbamate.

The Great Western Sugar Company used IPC commercially on 4,800 acres of sugar beets during the spring of 1953. Recommendations by the company to growers were to spray IPC at the rate of 3 pounds per acre, and double disc material into soil immediately for the control of wild oats and volunteer grain, only. Final seedbed preparation and planting of sugar beets was to follow as soon as practical. Results were good. In fact, results were spectacular enough to reveal any inefficiency in application or incorporation of chemical into soil. See Figure 1.

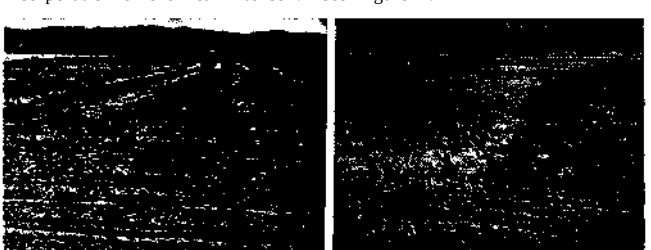

Figure 1.—Wild oats appearing as strips in sugar beet field treated at an average rate of three pounds IPC per acre. Right: The farmer claims inadequate mixing in sprayer before starting to spray was responsible for wide grassy strip. Left: Lower side of same field where farmer had corrected his faults in spraying; however, strips indicate skips in incorporation of IPC with soil since strips follow direction of discing and not direction of travel in spraying.

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[2] Numbers in parentheses refer to literature cited.

One test was made at Longmont, Colo., to find what influence date of application of IPC might have on results. Applications were made at about 2-week intervals starting February 3, and ending May 14. Using barley as the test plant, and a standard rate of 3 pounds per acre IPC, good practical control was obtained from all dates of application. Soil moisture content and soil temperature were obtained at each time of application. Moisture content varied from 5 to 13 percent, and temperature from 41° to 59° F. With the exception of the February 14 date of application, soil temperature at the 1- to 2-inch depth was within the range of 55° to 59° F. In this test the later applications gave slightly better control and were accompanied by more moisture.

In commercial use it was observed that IPC was more phytotoxic under conditions of warm temperature and good growing conditions. During cool temperatures the apparent action of IPC on plants was slow; however, under these conditions the persistence of IPC in the soil was much prolonged. The final control obtained with IPC was satisfactory even under cool temperatures, although there was a period in which it was questionable whether control would be satisfactory. In many instances during the spring of 1953 the wild oats and grain emerged and later died. This was a new experience since, in experimental trials conducted during 1951 and 1952, these weeds usually died before reaching the surface of the soil. The eventual kill of emerged weeds was accompanied by warm temperatures and drying winds. Apparently, under these conditions, the restricted root system of the weeds did not provide adequate absorption of water to keep them alive. The emergence of the weed is proof that the level of IPC in the soil is inadequate under the existing conditions. Thus, in view of the lower activity of IPC under cool temperatures, rates of 3 to 5 pounds per acre might be considered by some growers making early application, especially if the price of IPC is reduced so that chemical control at the higher rates would compete with other means of control. At the present prices of IPC, the rate of 3 pounds per acre does give fairly economical control, and the percentage control has usually been more than 85 percent.

Injury to sugar beets by IPC applications at the 3-pound per acre rate was negligible. In one case where IPC application was late (April 30), and the farmer had an unusually hard seedbed so that discing was only 21/2 inches, there was noticeable retardation in growth of sugar beets in the early seedling stage. By thinning time, there was no apparent difference.

During sunny weather it is especially important to incorporate IPC into the soil immediately after spraying, plus immediate refirming of soil to prevent loss by volatilization. Loss of IPC at temperatures of 85° to 88° F. was found to be about 80 percent within a 24-hour period by Anderson, et al, (1) when spread as a thin layer.

TCA and DCU

Eight field tests were initiated *in* the spring of 1953 to compare the effectiveness of TCA and DCU for control of foxtail *(Setaria)* and barnyard grass *(Echinochloa)*. These followed tests in the greenhouse which

showed DCU to be effective when mixed with the surface soil for control of grass. Grass control with DCU was independent of direction of moisture movement in the soil. See Figure 2.

Figure 2.—Test showing control of green foxtail grass *(setaria)* with DCU without stunting broadleaf weeds or sugar beets. Treatments: left to right—0, 10, 20 and 40 pounds of 73 percent active formulation of DCU applied as a spray and incorporated in surface soil to a depth of 1 inch. Foreground flats, sprinkle irrigated. Background flats, subirrigated.

Tests were made in Colorado, Wyoming and Montana. Rates of 7.3 pounds per acre technical dichloral urea (DCU) and 7.2 pounds per acre acid equivalent of sodium trichloroacetate (TCA) were used. In some tests a rate of 14.6 pounds per acre DCU was used, also. The DCU used was a wettable powder, and was applied in water suspension at a volume equivalent to 20 gallons per acre. Plots were 28x400 feet in size. All treated plots were bordered on both sides by a check plot. The herbicides were applied as a spray prior to planting, and worked into the soil by shallow discing or harrowing. The control of grass was good on all treated plots except in the case of one test. In this test the control with DCU was excellent, while TCA gave no visible control. The test just referred to was started March 26, while other tests in the same district were applied approximately one month later. The DCU, being water insoluble, apparently stayed in the effective soil layer during April and May when most of the grass seeds germinated. Grasses surviving on DCU plots were malformed, and lacked vigor through June. Grass seedlings starting in July appeared normal; however, they succumbed to shading by the dense beet foliage at that time.

At rates used, TCA was more injurious to sugar beets than DCU. This is indicated in pre-thinning stand counts on one field. There was no indication in any of the tests that the chemicals might adversely affect yield. It was expected that in one field which was especially foul with foxtail grass a yield increase would be obtained on the treated plots. This was substantiated in harvest results obtained for Location 15, and reported in Table 1.

Table 1.—Stand, Yield and Percentage Sugar of Sugar Beets Grown on DCU and TCA Treated Plots.

Treatment	Beets Per 100 Inches Pre-thinning Count	Beets Per 100 Feet Harvest Count	Tons Per Acre Beets	Percent Sugar
	Location 15, Loveland, Colo.			
DCU 7.3 lbs./A.	22.0	68	13.8[1]	15.3
DCU 14.6 lbs./A.	27.1	71	14.9	15.7
TCA 7.2 lbs./A.	17.6	66	13.4	15.5
Check	23.3	57	11.4	15.5
LSD 5% pt.	6.4	—	1.7	NS
LSD 1% pt.	NS	—	2.3	—
	Location 16, Longmont, Colo.			
DCU 7.3 lbs./A.	—	91	16.5	13.4
DCU 14.6 lbs./A.	—	101	16.8	12.8
TCA 7.2 lbs./A.		102	17.9	13.2
Check	—	91	16.3	13.3
LSD 5% pt.		—	NS	NS

[1] Weights of paired samples of beets grown on treated and untreated soil were adjusted proportionately for local area affected by an obvious variation in field. Most of area within test was uniform, and thus only a single check value is carried.
NS = no significant differences at indicated level.

Location 16, sampled for yield and sugar, showed no significant difference in yield, Table 1. The latter field was practically free of weeds all season, and use of herbicides under such conditions would not have been expected to be beneficial.

The commercial use of TCA on a limited scale during 1950 through 1953 in territories served by the Great Western Sugar Company has indicated that 5 pounds per acre TCA, acid equivalent, is about the highest rate one might advocate for use on sugar beets of this area. Even then injury has occurred on occasions, and in other cases no effect on beets or weeds has been noticeable.

Summary

In tests and in commercial use IPC has been found to give effective control on wild oats and volunteer grain in at least 85 percent of all cases, as observed in areas within Colorado, Wyoming and Montana served by the Great Western Sugar Company. General usage to date, which included 4,800 acres treated in the spring of 1953, has been to apply as a spray 3 pounds per acre technical IPC during seedbed preparation, and double discing to a depth of 3 to 4 inches immediately after application. Final seedbed preparation and planting of sugar beets followed as soon as practical.

Tests using TCA and DCU were made to compare effectiveness of treatments in controlling foxtail and barnyard grass. Applications of TCA at 7.2 pound per acre, and DCU at 7.3 and 14.6 pounds per acre, were made prior to planting, and chemicals incorporated with soil surface by harrowing or shallow discing. In most tests TCA and DCU controlled foxtail grass equally well. Under conditions where TCA failed to controll grass DCU gave good control. DCU was less injurious to sugar beets than TCA. In

the limited commercial use of TCA a rate of 5 pounds per acre, acid equivalent, is about the upper rate one might advocate for use within areas observed, including parts of western Nebraska, Colorado and Montana.

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