# A COMPREHENSIVE APPROACH TO WEED CONTROL CAN BE COST EFFECTIVE

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Yield, sugar percent and percent sugar loss to molasses data were drawn from American Crystal's grower practice data base for the years 1986, 1987, 1988 and 1989. The information drawn was from the Crookston Factory District and included only representative fields. Over the four years this represented over 195,000 acres of commercial sugarbeet fields. The yields were grouped by preplant herbicides, post-emergence herbicides, labor, and all combinations of the above. Preplant herbicides included: Avadex, Eptam, Ro-Neet, Nortron and Antor. Post emergence herbicides included: Betanex, Betamix, Herbicide 273, Poast and Treflan. Dollar per acre returns were calculated on the yields using the actual numbers from the American Crystal sugarbeet payment for each year's data. American Crystal's data base does not include the rates at which the herbicides were used. To supply comparative costs for different herbicide treatments, data is drawn from Alan Dexter's 1985 Crookston and 1989 Hillsboro Herbicide trials. Yield trends from these studies supports American Crystal grower practice data results. Costs for labor are drawn from Steve Miller's study on weed population per acre versus cost per acre. The effects of weed population on sugarbeet yields are from Phil Brimhall's Michigan study. Results showed that using a combined approach to weed control increased yields sufficiently to cover increased cost and in some years returns exceeded costs by $75.00 per acre.

The following table shows the effects of pigweed density on sugarbeet yields based on a study done by Phil Brimhall from the Michigan Sugar Company.

| Rough Pigweed per | Sugarbeet | = | Tons per Acre Root Yield |
|---|---|---|---|
| 1 | 8 | | 18.8 |
| 1 | 4 | | 17.8 |
| 1 | 2 | | 10.6 |
| 1 | 1 | | 6.8 |
| 2 | 1 | | 4.3 |
| weed free check | | | 22.5 |

Assuming a stand count of 150 sugarbeets per 100 feet of row, 1 pigweed per 8 sugarbeets is equal to 1 pigweed per 5 feet of row. Subtracting the yield of the plot containing 1 pigweed per 5 feet of row from the yield of the weed free check gives a difference of 3.7 tons per acre less yield. A yield loss of 3.7 tons times the 1989 American Crystal sugarbeet payment of $38 per ton equals $140.60 per acre less revenue. This calculation shows how drastically pigweeds effect sugarbeet yields.

The three most common treatments to reduce weed populations are through the use of hand labor, preplant herbicides and post-emergence herbicides. In order to supply comparative costs between these treatments, hand labor will be examined first. The following table shows labor costs with varying weed populations. It is based on a study done by Stephen Miller from the University of Wyoming. It assumes the following: 2.2 hours per acre are required to walk through a sugarbeet field, an additional .5 hours per acre are required for every 1000 weeds per acre,and an average hand labor cost of $5 per hour.

| Weeds per | Feet of Row | = | Hours per Acre | = | Dollars per Acre |
|---|---|---|---|---|---|
| 1 | 100 | | 2.3 | | 11.50 |
| 1 | 20 | | 2.8 | | 14.50 |
| 1 | 5 | | 4.5 | | 22.50 |
| 1 | 1 | | 13.8 | | 69.00 |
| 2 | 1 | | 25.5 | | 127.50 |

The $22.50 cost for labor to remove 1 weed per 5 feet of row compares very favorably with the $140.60 of revenue loss caused by 1 pigweed per 5 feet of row in Phil Brimhall's study. While weed populations and, therefore, cost will vary widely in commercial fields, an assumed cost of $22.00 for hand labor will be used for the basic comparisons to follow.

Calculating cost comparisons between preplant and post-emergence herbicide combinations is more difficult because of the large number of herbicide combinations and rates possible. In order to attempt this, data drawn from Alan Dexter's 1989 herbicide trial in Hillsboro will be used. In this test, different post-emerge herbicide combinations were applied uniformly over strips of no preplant herbicide, a Ro-Neet/Eptam combination and Antor. The rates at which the herbicides were applied is known and the cost of each combination can be calculated. Costs were calculated by using a fall 1989 price list and assuming a 7" band application for all herbicides except the Ro-Neet/Eptam combination which was figured on a broadcast application. The different combinations

were also rated for prostrate pigweed control. Thus, comparisons can be made between the cost and effectiveness of the different herbicide combinations. The following table shows the data from the Hillsboro test grouped into preplant and post-emergence combinations, post-emergence only combinations and preplant only combinations.

| Type | Ave Sugarbeet Injury Rating Prpw Treatments | Number of Treatments | Prpw Control Rating |
|---|---|---|---|
| PRE & POST | 16.4 | 26 | 96 |
| POST | 4.1 | 13 | 82 |
| PRE | 12.0 | 2 | 59 |

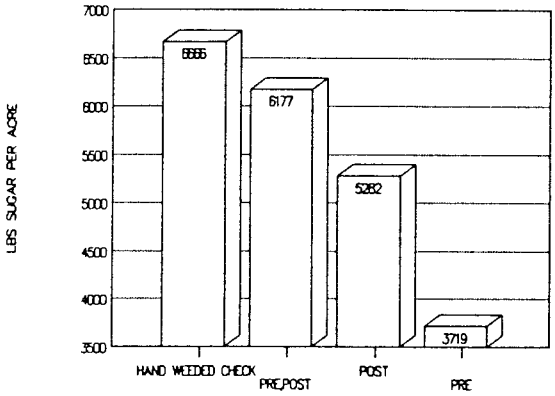
The PRE & POST combinations show superior prostrate pigweed control over the other combinations. The POST combinations show superior control over the PRE combinations. Cost comparisons for PRE & POST combinations versus POST combinations will be developed using individual treatments from the same test. These treatments are shown on the following table.

| Treatment | Rate (lb/A) | Prpw Control Rating | Cost per Acre |
|---|---|---|---|
| None/Betanex/Betanex/Poast & Dash | 0/0.25/0.33/0.2 & 2pt | 87 | $ 22.70 |
| Eptam & Ro-Neet/Betx/Betx/Poast & Dash | 1.5 & 2/0.16/0.25/0.2 & 2pt | 93 | $ 28.53 |
| Antor/Betx/Betx/Poast & Dash | 5/0.16/0.25/0.2 & 2pt | 93 | $ 26.56 |

The above treatments were selected on the following basis. The POST only treatment has the highest pigweed control rating of any POST only treatment in the test. The two PRE & POST treatments are the most economical of the Eptam & Ro-Neet or Antor treatments. Both PRE & POST treatments give superior pigweed control at an increased cost of $5.83 per acre for the Eptam & Ro-Neet treatment and of $3.86 per acre for the Antor treatment. An assumed cost difference between PRE & POST and POST of $6.00 per acre will be used for the basic comparisons to follow.

The Hillsboro test was not carried through to harvest because it was in a commercial field and the weed density was very high. However, Alan Dexter had a similar test at the University of Minnesota at Crookston in 1985 that was carried through to harvest. It contains some experimental combinations that gave high sugarbeet injury ratings. The following table contains the data from the Crookston test minus the experimentals that gave a sugarbeet injury rating of more than 20%. The data is grouped into the same combinations as the Hillsboro test. The yield data is also displayed on a graph.

| Type | Ave Sugb Injury Ratg Treat<20%Inj | Number of Treatments | Rrpw Control Rating | Sugar per Acre <20%Inj |
|---|---|---|---|---|
| CHECK | 2.0 | 1 | 99 | 6666 |
| PRE,POST | 3.8 | 15 | 94 | 6177 |
| POST | 2.6 | 5 | 84 | 5282 |
| PRE | 3.0 | 3 | 66 | 3719 |



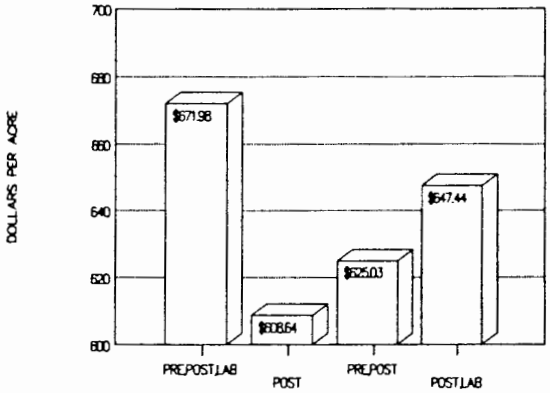

The pigweed control ratings from the two tests are consistent despite the fact that the tests are from different locations in different years. The LSD (0.05) for sugar per acre for the complete Crookston test is 989 pounds. The sugar per acre increase for the <20% Injury PRE & POST combinations over the <20% Injury POST combinations is 895 pounds. While this does not indicate a significant difference between the two, it is a definite trend and it must be noted that by removing the <20% Injury treatments the LSD should change. Without access to the complete data set it is not possible to recalculate it.

The indication that there may be a significant difference is supported by data drawn from American Crystal's grower practice data base for the years 1986, 1987, 1988 and 1989. The data is from the Crookston Factory District and includes only representative fields. The yields were grouped by preplant herbicides, post-emergence herbicides, labor and all combinations of the above. Since some of those combinations are rarely if ever used, the combinations reported in the tables and graphs are limited to the following: PRE,POST & LABOR; POST; PRE & POST; and POST & LABOR. These combinations are existent in all years in enough numbers to be considered reliable data. The dollar per acre returns are calculated on the actual American Crystal sugarbeet payment for each year's data. The following tables and graphs are the actual results obtained in commercial fields in 1986, 1989, and the four year averages for 1986 through 1989.

4 YEAR AVERAGE 1986-1989

| Type | Acres | Percent Sugar | Percent Sug. Loss | Yield |
|---|---|---|---|---|
| PRE,POST,LAB | 51856 | 17.41 | 1.58 | 16.1 |
| POST | 38714 | 17.10 | 1.60 | 15.1 |
| PRE,POST | 49323 | 17.32 | 1.59 | 15.2 |
| POST,LAB | 55741 | 17.32 | 1.61 | 15.7 |

| | Number of Fields | Sugar per Ton | Sugar per Acre | Dollars per Acre |
|---|---|---|---|---|
| PRE,POST,LAB | 659 | 317 | 5135 | $ 671.98 |
| POST | 570 | 310 | 4781 | $ 608.64 |
| PRE,POST | 607 | 315 | 4813 | $ 625.03 |
| POST,LAB | 779 | 314 | 4985 | $ 647.44 |

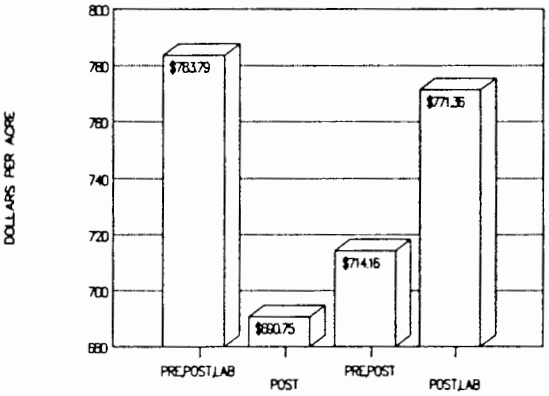



In the four year averages, POST averaged $608.64 per acre. PRE,POST,LABOR averaged $671.98 per acre, $63.34 per acre more than POST. Subtracting $22.00 for the cost of labor and $6 for the additional cost of the preplant herbicides leaves a net return of $35.34 per acre more than POST. POST,LABOR averaged $647.44, $38.80 more than POST. Subtracting $22.00 for the cost of labor leaves a net return of $16.80 per acre more than POST. PRE,POST averaged $625.03, $16.39 per acre more than POST. Subtracting $6.00 for the increased cost of the preplant herbicides leaves a net return of $10.39 per acre more than POST.

1986

| Type | Acres | Percent Sugar | Percent Sug. Loss | Yield |
|---|---|---|---|---|
| PRE,POST,LAB | 10413 | 17.56 | 1.36 | 18.8 |
| POST | 7712 | 17.20 | 1.40 | 17.3 |
| PRE,POST | 17286 | 17.39 | 1.39 | 17.5 |
| POST,LAB | 7231 | 17.46 | 1.41 | 18.8 |

| | Number of Fields | Sugar per Ton | Sugar per Acre | Dollars per Acre |
|---|---|---|---|---|
| PRE,POST,LAB | 132 | 324 | 6088 | $ 783.79 |
| POST | 115 | 316 | 5534 | $ 690.75 |
| PRE,POST | 212 | 320 | 5599 | $ 714.16 |
| POST,LAB | 101 | 321 | 6060 | $ 771.36 |

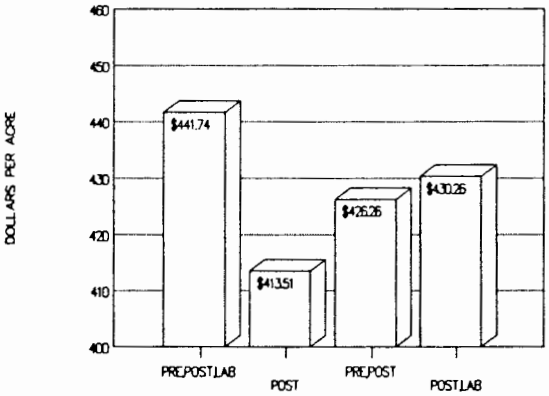



There is some variation between individual years. 1986 is included because it is the last year in which normal rainfall was received in the Crookston District. As would be expected the chemicals worked well and dollar returns per acre were higher. POST averaged $690.75 per acre. PRE,POST,LABOR averaged $783.79 per acre. Subtracting additional costs leaves a net return of $65.04 per acre more than POST. POST,LABOR averaged $771.36 per acre. Subtracting additional costs leaves a net return of $58.61 per acre more than POST. PRE,POST averaged $714.16 per acre. Subtracting additional costs leaves a net return of $17.91 per acre more than POST.

1989

| Type | Acres | Percent Sugar | Percent Sug. Loss | Yield |
|---|---|---|---|---|
| PRE,POST,LAB | 12173 | 16.31 | 1.79 | 11.6 |
| POST | 14105 | 16.02 | 1.79 | 11.3 |
| PRE,POST | 12406 | 16.25 | 1.80 | 11.3 |
| POST,LAB | 18315 | 16.17 | 1.78 | 11.5 |

| | Number of Fields | Sugar per Ton | Sugar per Acre | Dollars per Acre |
|---|---|---|---|---|
| PRE,POST,LAB | 162 | 290 | 3387 | $ 441.74 |
| POST | 211 | 285 | 3261 | $ 413.51 |
| PRE,POST | 147 | 289 | 3280 | $ 426.26 |
| POST,LAB | 257 | 288 | 3309 | $ 430.26 |



In 1989, rainfall was below normal and there was little subsoil moisture to carry the crop through to harvest. As expected, the chemicals are less effective when it is dry, so the differences are smaller. So is the beet payment. The differences are still there. POST averaged $413.26 per acre. PRE,POST,LABOR averaged $441.74 per acre. Subtracting additional costs, leaves a net return exactly the same as POST. POST,LABOR averaged $430.26 per acre. Subtracting additional costs leaves a net return of $5.25 less than POST. This is one of the few times in the study where there was a net loss. PRE,POST averaged $426.26 per acre. Subtracting additional costs leaves a net return of $6.75 per acre more than POST.

In conclusion, by using this approach to weed control, a grower could, on average, expect to increase his dollar return per acre. In years when the chemicals are active and the growing conditions are good, the net increase could be as much as $65 per acre. In years when growing conditions are poor and chemicals are not active, the grower could expect to break even. In either case, he will have lower populations of weeds going to seed in his fields.