CONTROLLING WATERGRASS IN CORN

with pre-emergence herbicides

CHESTER L. FOY · TORREY LYONS

STEPHEN P. CARLSON

In the Delta where most of California's corn is grown (now that 2,4-D is available for broad-leaved weed control), watergrass is the basic weed problem. Although watergrass can be controlled by timely pre-emergence and post-emergence cultivation, damaging infestations are common. The weeds cause: (1) yield losses by competing for water and nutrients; (2) mechanical interference with harvesting; and (3) weed seed build-up that will increase the weed problem in future crops.

The soils of the Delta range from non-organic, around the fringes and along the faster flowing water courses, to as much as 60 per cent organic matter. Most of the corn is grown on the organic soil types. To aid in watergrass control, it is common practice to work up a loose dry mulch before planting. In some fields this is impossible because an uncontrollable high water table keeps moisture very near the surface.

Subbing from spud ditches is the usual method of irrigation, causing the soil moisture to move up after planting. This means chemicals applied to the surface cannot move downward so there is little possibility of effective surface application.

Weed control evident in photo of test plot above was obtained by use of Eptam at 8 lb per acre (center), as compared with weed-infested check plot (foreground).

Rainfall usually does not occur after planting.

A comparison of surface and soil-incorporated treatments of simazine and Randox, in 1958, at the John Wheeler ranch, Courtland, showed that soil incorporation is necessary for effective pre-emergence watergrass control. Again in 1959 at the same ranch, three rates each of simazine, atrazine, Randox, Vegadex and Eptam were compared by three methods of application—soil-incorporated, non-incorporated and post-emergence spraying. The only successful treatments were with soil-incorporated Randox and Eptam. Subsequent trials have involved only soil-incorporation treatments.

Wilson trial, 1960

Randox-T and Eptam gave best results in the 1960 trial conducted at the Dick Wilson ranch, Courtland. Randox-T was more effective than Randox, and Eptam was slightly more effective than its analog, R-1607. There was considerable phytotoxicity (indicated in table) expressed as leaf rolling and twisting of the seedlings. There was no indication of a reduction in stand or a reduction of vigor of the non-injured plants. All treatments produced higher yields than the check plot, but due to high internal variability, these differences were not statistically significant. Plot conditions for this trial are summarized below:

Soil, Burns silty clay loam; **organic matter,** approximately 15 per cent; **moisture,** at the surface at planting and never more than one inch below without irrigation. The watergrass infestation was severe. **Corn variety** was KY7A; **planting date,** May 17; **seed spacing,** 8 inches; **fertilizer,** 146 lb of NH_3 per acre pre-plant and 160 lb of 6-24-0 banded at planting; **harvest,** October 26. On May 11, four chemicals, each at three rates, were sprayed on the four replicated 400-square-foot plots. **Incorporation** of chemicals 3 inches deep was completed within three hours after application by use of a double disk, combined with a spike-tooth harrow. The process was repeated at right angles. **The treatments** were Randox at 4, 6, and 8 lb per acre; Randox-T at 4, 6, and 8 quarts per acre (see table for Randox-T conversion to pound rates); Eptam at 2, 4, and 8 lb per acre; R-1607 at 2, 4, and 8 lb per acre and the check which received no cultivation.

Four years of testing have shown that chemicals incorporated in the soil as pre-emergence treatments give satisfactory control of watergrass and many broad-leaved weeds in corn growing in the organic soils of the Sacramento–San Joaquin Delta. Eptam, Tillam, atrazine and Randox-T are all potentially useful chemicals. The method of incorporation in the soil and the amount of soil moisture available appear as important as the chemical selected. The least soluble materials are most handicapped by low soil moisture and inadequate mixing in the soil. The remaining task involves application equipment and fitting the use of these chemicals into the farming enterprise.

Two trials were conducted in 1961, each with Tillam, Eptam, Randox-T and atrazine at three different rates, plus a check. Each trial was replicated four times. Rates were increased in the highly organic soil to overcome chemical inactivation. Trial conditions are summarized below:

Dick Wilson ranch

Soil, typically wet Burns silty clay loam, 13 per cent organic matter; **watergrass** infestation, moderate; **corn variety** P.A.G. 347; **planting,** May 7; **seed spacing** 7 inches; seed depth 3 inches; **fertilizer,** 160 lb per acre of 6-24-0 banded at planting; **harvest,** October 18. The test materials were sprayed on the surface between 4 and 5:05 P.M., April 28. **Soil incorporation:** Once over with a power rotary tiller 2 to 3 inches deep between 8:30 and 9:30 A.M., April 29.

John Lewallen ranch

The second trial was on typical well-drained organic soil on the John Lewallen ranch on the lower end of Tyler Island. Conditions: **Soil,** Egbert muck, 35 per cent organic matter; **watergrass** infestation, severe; **corn variety,** Vinton V-95; **planting,** April 28; **seed spacing** 7 inches; seed depth 3 inches; **fertilizer** 100 lb per acre of treble superphosphate with seed; **harvest,** October 18. The test materials were sprayed on the surface and immediately incorporated 3 to 4 inches deep by going once over with a power rotary tiller. The plots were flat rolled on the following day to increase watergrass germination.

Observations made in each plot were standard plant damage counts, watergrass weed ratings, corn vigor ratings, plant height, ear height, ear size and yield. In addition, broadleaf weed control ratings were made on the Wilson plot. Watergrass control percentages shown in the table are averages of objective ratings, offering a reliable comparison between treatments in the same trial, but are not dependable for comparisons between different trials.

The striking difference in results between 1960 and 1961 was that fewer corn plants were injured in 1961 (see table). More uniform mixing by the power rotary tiller compared to the disk and harrow probably accounted for this difference. Uneven distribution of chemicals in former years may have allowed weeds to grow in the thin spots and injured corn in the heavy spots.

There is a striking correlation between watergrass control and yield in the 1961 trials. In the Wilson trial this may have been brought about chiefly by competition for nitrogen. By June 28 each check plot revealed the yellow-green coloration of nitrogen deficiency. By July 18 the checks were one foot shorter than adjacent plots with good weed control. With up to 44 per cent watergrass control, the highest yield was 5,518 lb per acre; at 57 per cent weed control the yield was 5,910 lb per acre and at 82 to 99 per cent weed control the yield range was 6,301 to 6,595 lb per acre. In the Lewallen plot all treatments with 80 per cent watergrass control, or better, yielded 6,170 lb per acre or more. Those with less than 80 per cent watergrass control yielded 5,275 lb per acre or less. Height of plant, height of ear, ear size, and number of ears all were reduced in the more weedy plots. The Lewallen trial also showed an extreme loss in yield due to watergrass competition in the non-cultivated check plot.

Commercial Application

Eighty per cent control of watergrass, lamb's-quarters and pigweed was obtained (except on headlands that were dry) in 1961 tests on 1,700 acres treated at the M and T ranch, Staten Island. Randox-T, at 1.6 quarts per acre, was sprayed in an 8-inch band, which is equivalent to 8 quarts per acre based on total coverage. Fan spray nozzles mounted behind listers preceding the planter sprayed the herbicide on the flat furrow

SUMMARY—1960 AND 1961 DELTA CORN PRE-EMERGENCE WEED TRIALS

CONDITIONS:		WILSON RANCH						LEWALLEN RANCH		
Year		1960			1961			1961		
Per cent soil organic matter		13 per cent			13 per cent			35 per cent		
Soil moisture condition		Very wet			Medium wet			Surface dried rapidly		
Type of incorporation		disc and harrow			power rotary tiller			power rotary tiller		
TREATMENTS:										
Material	Rate per acre	Per cent watergrass control	Per cent damaged corn	Pounds yield at 15% H_2O	Per cent watergrass control	Per cent damaged corn	Pounds yield at 15% H_2O	Per cent watergrass control	Per cent damaged corn	Pounds yield at 15% H_2O
Tillam	2 lbs.	..	..	....	34	0	5355	..	..	....
"	4 "	..	..	....	38	0	5485	<50	0	5257
"	8 "	..	..	....	57	0	5910	50	0	4865
"	16 "	..	..	....	..	.	....	82	0.4	6171
Eptam	2 lbs.	93	1.7	5909	42	0	5518	..	..	
"	4 "	99	3.8	6519	87	0	6367	80	0.3	6301
"	8 "	99	9.1	6181	97	0	6595	85	1.4	6595
"	16 "	..	..	....	..	.	....	97	6.1	6465
Randox-T	2 qts.*	..	..	....	..	.	....	<50	0	3526
"	4 "	80	0	6695	42	0	5518	<50	0	2710
"	6 "	92	0.3	6087	44	0	5453	..	..	....
"	8 "	92	1.1	5567	43	0	5453	60	0	4375
Atrazine	3 lbs.	..	..	....	..	.	....	70	0	3755
"	4 "	..	..	....	82	0	6367	..	..	....
"	6 "	..	..	....	96	0	6628	80	0	6465
"	8 "	..	..	....	99	0	6301	..	..	....
"	12 "	..	..	....	..	.	....	90	0	6236
Checked uncultivated		0	0	4903	0	0	5355	0	0	882
cultivated		..	..	....	..	.	....	0	0	5648
LSD at 5 per cent		..	..	NS	..	.	809	..	..	1894

* Randox-T conversion to pounds: 1 qt = .7 lb Randox (CDAA) plus 1.75 lb "T" (TCBC).

bottoms. The planter placed the seed 1 to 1½ inches below the chemical. A looped chain was dragged behind each planter unit for mixing and mulching. Some of the advantages that appeared to result from this treatment were as follows:

(1) The harvest operation was more rapid due to reduction of weed interference. Harvester plugging and breakdowns were less frequent which resulted in lower cost per ton. In some years, the time saved would also mean less wind-lodged corn because the harvest could be completed earlier.

(2) The usual 2,4-D spray was not needed on some of the acreage because Randox-T also controlled many broad-leaved weeds. This reduced both cost and risk of brittle stalks which may result if 2,4-D is not properly applied.

(3) The first cultivation was delayed until all corn was large enough to escape being covered and this resulted in a more uniform stand.

(4) Weed competition was reduced.

(5) Weed seed production was reduced, which will lessen weed problems in future crops.

The profitable results reported here may have resulted from a fortunate combination of treatment and field conditions; however, the reliability of any one treatment will not be known until there is more commercial experience.

Solubility, adsorption characteristics and volatility of a compound, for example, would be expected to influence its effectiveness. This indicates that type of equipment, moisture conditions, type of soil and manner and depth of soil incorporation should be considered in choosing a chemical.

C. K. Foy is Assistant Botanist, University of California, Davis; T. Lyons is farm Advisor, Sacramento County, and S. P. Carlson is Farm Advisor, Kings County.

WILL THESE CHEMICALS ALWAYS PAY?

Chemical treatment of soil at planting time offers neither a cure-all for weed problems or an obvious saving in weed control costs. It will pay in some situations and not in others, because corn is relatively weed tolerant and many weed problems can be solved with skillful mechanical cultivation.

Growers should consider all of the numerous factors involved before deciding whether to use this type of pre-emergence weed control. It also may reduce the pressure of critical timing in cultivation and harvesting operations—thereby allowing more efficient use of management, labor and equipment for other crops as well as corn.

None of the treatments discussed is recommended by the University of California at this time either (a) because of possible injurious effects on succeeding crops due to chemical residues in the soil or (b) because of lack of clearance from the standpoint of chemical residues in food or feed products when used under these conditions.

New Aqueous Resinous Soil Stabilizers

offer erosion control and water conservation possibilities

ROY J. PENCE · J. LETEY · R. E. PELISHEK · J. OSBORN

Reseeding, or the establishment of any suitable cover crop, will often lessen and even prevent soil erosion. Such measures must be taken well in advance of any subsequent damage brought on by winds or rains, however. Costs and labor of replanting have often been lost due to inadequate root establishment prior to the first eroding effects of adverse weather. This problem has resulted in research aimed at development of an inexpensive, easy-to-apply substance that could be added to the soil surface to stabilize its aggregates against pelting rains, while at the same time allowing the beneficial waters to pass through.

A cooperative research program between the Departments of Entomology and Irrigation and Soil Science was recently set up to formulate and test a simple aqueous resinous system which could be sprayed on or otherwise easily applied to the soil.

System requirements involved the following goals: (1) firm soil stabilization that would remain undisturbed under severe winds, rains or artificial irrigation; (2) stabilized surface aggregates that would allow water to pass through but not tear and separate under strain; (3) a solution capable of maintaining its original polymerization after each wetting so as to form a "seal" against subsequent evaporation—thus serving to trap and retain valuable water beneath to permit moisture for germination of any wild or planted seed; (4) formulation of a free-flowing concentrate having long shelf life, yet capable of offering satisfactory performance under water dilutions; (5) phytotoxicity must not be tolerated, yet the system must be capable of accepting a suitable non-crop herbicide and/or insecticide additive wherever this might be desired.

An aqueous resinous system was developed using a modified copolymer of vinyl acetate integrated with a fixing agent to promote higher flowability and longer shelf life in its concentrate form. Results of preliminary field trials have been encouraging and tests are being continued.

Field tests

The first field test was established prior to the 1960 winter rains. Applications were made to a freshly graded 25 per cent slope on the Los Angeles campus. Plots measured 20 feet wide by 30 feet downslope. The resinous concentrate was diluted to different proportions and sprayed on the soil.

The photographs shown were taken after 2.3 inches of rainfall had fallen in approximately two hours. The untreated area on the left clearly illustrates the degree of rilling and loss of soil following the eroding rain. The darker area on the right of the separating string was treated with the second best of the anti-erosion treatments tested, and exhibits very little rilling. The untreated area directly beneath the sprayed plot is heavily eroded with deeper rills resulting from the sheeting effects of water runoff which suddenly