

Weeds in Drained Rice Fields

early application of herbicides by air and by ground rig controlled weeds in drained rice fields in tests in 1956

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Spraying drained rice fields for weed control is a recent development although the spraying of flooded rice by airplane is an established and steadily increasing practice.

When the rice leaf miner—*Hydrellia griseola* var. *scapularis* Loew—heavily infested California rice fields in 1953, little was known about the control of the pest and some growers drained their fields in an effort to avoid damage. Draining the water encouraged the rapid growth of many weeds, including water plantain—*Alisma plantago*—burhead—*Echinodorus cordifolius*—and arrowhead—*Sagittaria* sp.

In one Colusa County field, badly infested with seedling sedge—*Cyperus* sp.—draining speeded the development of the sedge to the point where the young rice crop was threatened. Based on limited experience from the previous year, spray tests were made in areas of the drained field, 38 days after seeding instead of the customary 55–65 days.

Two materials, MCPA and 2,4-D—both as amine salts—were applied by air in replicated strips at the rate of 18 ounces of acid equivalent in 10 gallons of water per acre. Water was turned on the field immediately after spraying. Flooding of the rice field to a 6" depth was completed within five days. Weed

Weed Counts* on Erdman, Colusa County Rice Plots, 1953

Weeds	Treatment		
	2,4-D	MCPA	Unsprayed
Sedge	0	0	266
Cattail	0	0	25
Lily	0	0	16

* Counts are the average of 16 square foot quadrats from the three replicates.

control was excellent in the sprayed blocks as shown by weed counts taken just prior to harvest.

Symptoms of spray damage in the 2,4-D treated strips were first noticed shortly after spraying. Injury consisted of severe root pruning with the elimination of much of the root system existing at the time of spraying. There was a later development of somewhat bristly, thickened adventitious roots higher on the stem than normal. Some distortion of the heads was also evident after they had emerged from the boot. These symptoms were less common and less severe in the plots treated with MCPA.

Rice yield from the 2,4-D treated strips was less than from the MCPA sprayed areas, but all treated strips gave strikingly higher yields than the untreated areas.

The MCPA gave just as effective control of the weeds as 2,4-D, with less in-

Rice Yield from Erdman, Colusa County Spray Plots, 1953

Treatment	Yield* in pounds per acre
Untreated control	3,667
2,4-D	5,575
MCPA	6,430

* Yield is average of three plots.

jury to the rice as evidenced by the higher yield. The weed competition in the untreated controls drastically reduced yield. In the 2,4-D treated areas there was considerable evidence of excessive late tillering which resulted in some small immature rice heads at harvest. This spray-induced tillering was not evident in the MCPA blocks where the rice heads appeared larger and more uniform.

In the rice-growing counties of the lower Sacramento Valley and the upper San Joaquin Valley the use of airplane applied hormone-type herbicides is legally restricted because of the hazard of damage to susceptible crops such as grapes, melons and cotton. Rice growers in those areas are faced with developing means other than aerial application of herbicides to control rice field weeds.

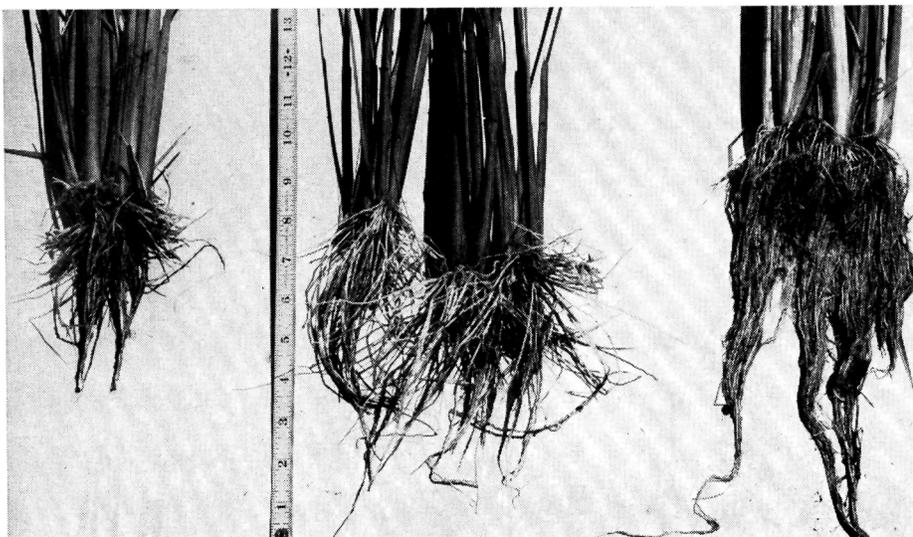
In 1956, that situation faced rice farmers in San Joaquin County where no 2,4-D or similar hazardous growth regulating material can be applied by airplane—in certain areas—after March 15. Other types of chemicals—such as the selective dinitros—had been tried on one ranch for two years previous but weed control was not satisfactory and the yield of rice was decreasing each year because of weed competition.

Based on the early spray trials in Colusa County in 1953 the San Joaquin County grower tried spraying by ground rig after the rice fields were drained. In that particular area 2,4-D and related compounds can be used with ground equipment after March 15 if certain officially approved procedures are followed, including an application permit from the local agricultural commissioner, use of correct nozzle size, volume, and pressure and careful attention to wind conditions to avoid drift.

Several fields of rice—totalling 320 acres—were planted on Stockton adobe clay soil between April 30 and May 2. In preparation for spraying, the fields

Concluded on page 15

Rice plants from: left—2,4-D treatment, center—MCPA treatment, and right—untreated. Note reduction in root system, particularly from the 2,4-D treatment, and the development of the bristly secondary roots on the sprayed plants.



the product is cased after freezing, costs are slightly higher with all methods. With the manual and the semi-mechanical methods the higher cost is caused by a reduction in the production standard for the casing workers to approximately 155 cases per hour. This increases estimated variable costs about 2% with the manual method and 8% with the semi-mechanical method. With the mechanized method an additional worker is required to guide the cartons from the freezing trays into the casing machine. This would increase estimated labor costs by \$1.70 per hour per machine. Changes in the analysis—necessitated by these cost differences—

could be approximated by corrections in the larger table on the preceding page. Such correction would show a moderately decreased cost advantage of the semi-mechanical method over the manual and of the mechanized method over both, with the amount of change depending on rate of output and number of hours operated.

To estimate potential savings to be effected by the mechanization of the casing operation in some plants—or producing areas—adjustments in production standards, wage rates, equipment replacement and depreciation, and other charges might be appropriate. Questions of plant

flexibility and availability of qualified equipment maintenance personnel in small plants, as well as variation in charges for labor and equipment, might well enter the calculations but with suitable adjustment of the basic data, computations could be made for such cases.

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This is the second in a series of progress reports on efficiency in the processing and marketing of frozen fruits and vegetables. The studies are being conducted cooperatively with the State Experiment Stations in Washington, Oregon, and Hawaii and the Agricultural Marketing Service, U.S.D.A.

WEEDS

Continued from page 5

were drained beginning June 15 when the rice was 7"-8" high. The fields drained rapidly and it was possible to get into the fields with ground equipment by June 23.

The spray equipment was mounted on a track-type tractor with special extensions attached to the tracks. The extensions were needed only in a few exceptionally wet spots in the field. A volume of 28 gallons per acre was applied at 20 pounds pressure through a broadjet nozzle covering a 40' swath.

All spraying was done at night—to take advantage of still air conditions and minimize the possibility of drift from air movement—with 220 acres sprayed in three nights. Because of concern over mounting daytime air temperatures, 100 acres were left unsprayed. Previous experimental work and field experience had shown increased susceptibility of the rice plant to injury when daytime temperatures reached 95°F and higher. During the period of spraying—June 23, 24 and 25—maximum day temperatures ranged from 95°F-100°F. On June 26 the maximum reached 101°F. It rose to 105°F on June 27 and 108°F on June 28, falling thereafter.

The MCPA was applied to part of the field at 10 ounces of actual MCPA per acre. Due to error in mixing, another part of the field received only 4¾ ounces of actual MCPA. Weed control was good even at the lower rate but was better at the 10-ounce rate. Skips and unsprayed areas were a mass of weeds with rice plants barely discernible. The most abundant weed was umbrella sedge with water plantain and burhead present in quantity.

Flooding was begun soon after the spraying and it took an average of six days to reflood the various fields. The entire operation from draining to flooding covered 19 days.

The average yield on the 220 acres

sprayed was 4,450 pounds of dried paddy rice per acre. The unsprayed field yielded 2,200 pounds per acre. The rice lodged in the unsprayed field when the water was taken off before harvest because the heavy growth of umbrella sedge pulled the rice down as it settled. The sprayed rice did not lodge.

All investigative work to date indicates that 55-65 days after planting is the safest period to spray. However, the two instances of plane and ground rig application indicate the possibility of early spraying on drained rice with MCPA at low rates. MCPA is more selective than 2,4-D and that increased selectivity is especially important if spraying is done early or when temperatures are high.

Early spraying should be considered as a last resort where weed competition is extremely severe.

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RICE YIELDS

Continued from page 6

rice to eliminate the milled rice variable which would exist if pounds head were used. An approximate pounds head value can be obtained by multiplying the per cent by an appropriate total rice value—for example—80% times 70 pounds total milled rice gives 56 pounds head rice.

The yield of total milled rice in the humidified drying-air study was reduced significantly by an increase in drying temperature or a lowering in drying humidity. The reduction rate was nearly constant as drying progressed.

Humidification of the drying-air improves the quality of the dried rice remarkably. One-pass drying at 110°F and about 33% relative humidity produced

the same head yield as three-pass drying at 110°F with unhumidified air. Higher humidities produced even higher head yields.

Humidification caused an extension of the drying time. The three-pass drying required 2.2 hours. One-pass humidified drying required 4.5 hours to yield the same quality product.

Checking of the rice increases at a faster rate as drying progresses at any given humidity. During the removal of the first 4% of moisture—at 130°F—12% checked while 45% checked during the last 4% of moisture removed.

The results of these studies indicate the possibility of increasing both yield and quality of column-dried rice by using elevated humidity drying air. However, because this process extends the drying time considerably, a procedure would be required that would yield satisfactory capacity such as stage single-pass drying—using high-temperature low-relative-humidity air to remove the first few per cent of moisture, finishing with lower-temperature higher-relative-humidity air—reducing the number of passes by humidifying during one or more passes or additional drying capacity to use complete low-temperature high-relative-humidity drying.

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FERTILIZER

Continued from page 7

ing an ammonium source of nitrogen and providing for its maintenance in flooded soils for rice was shown to be an important factor in achieving the best utilization of nitrogen for the best growth and yields of rice.

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