Controlling Submersed Weeds in Rice

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Field tests in 1966 and 1967 have confirmed initial reports from the Rice Experiment Station, Biggs, that chemical control of submersed aquatic weeds frequently results in substantial increases in rice yield. Promising materials for this purpose are TD294, Hydrothal 191, and chloroxuron. Injury to the seedling rice was the least when these chemicals were applied about 35 days after flooding and seeding. More work is needed to determine precisely how long riceland-treated water must be held to control the submersed weeds most effectively while also eliminating any possible hazard to wildlife, including fish. It should also be determined whether the yield increases result from decreased weed competition or from fertilization provided by the killed submersed weeds (which soon decay, releasing the organically bound plant nutrients).

DENSE INFESTATIONS of submersed aquatic weeds such as southern naiad (*Najas guadalupensis*), horned pondweed (*Zannichellia palustris*), and chara (*Chara* spp.) frequently impede water management in California rice fields possibly because they compete with rice for space and nutrients, as do the more obvious emersed weed species. American pondweed (*Potamogeton nodosus*), a perennial submersed weed, interferes with rice stand establishment by its early growth from winter buds and its rapid formation of floating leaves, which frequently blanket the water surface and impede the emergence of water-seeded rice.

A basic copper salt of 7-oxabicyclo-(2.2.1) heptane-2,3,dicarboxylic acid (endothall-Pennsalt TD-294), 2-amino-3 chloro-1,4- naphthoquinone (Uniroyal 06K), and N'-4-(p-chlorophenoxy)-phenyl-N', N'-dimethylurea (chloroxuron-CIBA Tenoran) had previously been reported (in 1966) to control both submersed vascular weeds and stonewort algae without seriously injuring rice. The best of the treatments resulted in increased rice yields worth about 10 times the costs of application. Since this early report was the first indication that submersed weeds might depress rice yields, further field tests were conducted in 1966 and 1967.

Aerial applications of granular 06K and TD 294 were made to portions of eight different Fresno County rice seed fields 35 to 40 days after the rice emerged from the water. Rates varied from 2 to 4 lbs of technical herbicide per acre. Within 21 days of treatment in static water, 06K killed up to 100 per cent of the southern naiad, horned pondweed, and chara, whereas TD294 had no effect on submersed weeds. No damage to rice or fish was observed.

An 80 per cent wettable powder formulation of chloroxuron was applied by Danzig ground spray rig to the lower 4-acre portions of two 35-day-old seed fields of Caloro rice in Glenn County. Control of American pondweed was excellent, without injury to rice or fish in the field that received chloroxuron at 4 lbs per acre, whereas chloroxurun at 2 lbs per acre gave rather poor control of southern naiad (the predominant submersed weed in the other field) probably because levee leaks allowed water flow, and consequent dilution of the herbicide.

Unfortunately, most of these fields treated in 1966 were harvested by the growers before samples could be taken to determine the effects of the treatments on rice yields. Such data would have been desirable even though the treatments were replicated between fields rather than within fields.

Since previous field trials indicated good submersed aquatic weed control with chloroxuron and Pennsalt TD294, replicated field trials were conducted in Glenn and Butte counties in 1967 to determine the effect of control upon rice yield. A different granular formulation of TD294, chloroxuron wettable powder, and 11.2 per cent granules of the mono-(N-N-dimethylalkylamine) salt of endothall (Hydrothal 191) were included. 06K was not tested in 1967. All treatments were applied about 32 days after planting to replicated areas of 144 sq ft. A single application of 2 lbs per acre of active ingredient was made to areas enclosed by aluminum strips. These strips were left in place for 14 days to contain the chemicals within each treated area. Control was good in southern naiad; acceptably effective in emersed broad-leaved Eisen waterhyssop (*Bacopa eisenii*), redstem (*Ammania cocinea*), and California arrowhead (*Sagittaria calycina*); and poor in chara. American pondweed was not present in any of the plots. Results are listed in the table.

Material—rate		Rice yield		
		Sutter Co.	Glenn Co.	
		Test 1	Test 1	Test 2
	lb/A	lb/A	lb/A	lb/A
Chloroxuron	2	5868	5783	....
TD294	2	6232	....	6534
Hydrothal 191	2	4901	....	....
Check		4171	5348	5778

Detailed rate and date-of-application studies were conducted at the Rice Experiment Station, Biggs, using aluminum rings to contain the plots. These tests showed that Pennsalt TD294 and Hydrothal 191 could be applied 25 days after seeding at rates up to 4 lbs of active ingredient per acre without injury to rice. Chloroxuron caused severe rice plant injury at rates of 1, 2, and 3 lbs per acre when applied 15 and 25 days after planting. The same concentrations were not injurious, however, when applied at 35 days.

In replicated 2500-sq-ft plots, Pennsalt TD294 granules applied at 2 lbs acid equivalent (endothall) per acre at 15 and 25 days after planting gave 90 per cent control of horned pondweed and had no effect on yield. Hydrothal 191 granules at 1 and 2 lbs of acid equivalent (endothall) per acre at 28 days gave 90 to 100 per cent control of these weeds with no effect on yield. Chloroxuron wettable powder applied at 1 and 2 lbs active per acre did not control horned pondweed, nor was yield significantly affected.

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