WEED CONTROL TECHNOLOGY IN U.S. RICE

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ABSTRACT

The objectives of weed control in a rice production system are: (a) to minimize losses in grain yield due to weed competition and interference; (b) to prevent or minimize quality losses and subsequent lower value of rough and milled rice; (c) to permit highly efficient use of costly production inputs such as high yielding cultivars, fertilizers, insect and disease control and irrigation; (d) to prevent weed buildup in crops rotated with rice; (e) to lower water and energy requirements for production of rice; and (f) to minimize potential damage to the environment and beneficial nontarget organisms. Effective weed control programs for rice integrate preventive, cultural, mechanical, chemical and biological practices. Although nonchemical methods are important in an effective weed control program, chemical methods are essential for weed control in rice. Chemical methods involve the use of herbicide treatments as single, mixture or sequential applications that, correctly applied, selectively control weeds. Biological methods include use of endemic fungi and the use of wild ducks. Various types of weed management methods are combined in the weed control programs, and the weed control inputs are integrated with other pest management and production practices for rice.

WEED ECONOMICS AND INTEGRATED CONTROL

Weeds are the major pests of rice because they reduce yield and quality by an estimated 17% in the U.S. (1), compared with about 8 and 7% for insects and diseases, respectively (2, 3). Losses due to weeds were estimated at 34% in Texas, 12% in California and Missouri, and 17% in Arkansas, Louisiana, and Mississippi; total losses for the U.S. were 1.4 million metric tons of rough rice valued at $269 million (4).
Weeds interfere with rice production and processing in the following ways (5): (a) reduce rice yields and quality, (b) intensify problems with insects, diseases and other pests by serving as hosts, (c) reduce harvesting and processing efficiency, (d) lower efficiency of irrigation systems by restricting the availability and flow of water to reservoirs, canals and ditches, (e) cause consumption of energy for their control, (f) reduce the value and productivity of land, and (g) interfere with normal marketing strategies of the crop from weed seeds being present in the grain.

Weed control technology for rice integrates preventive, cultural, mechanical, chemical and biological practices (6, 7). Although all of these are important in developing successful weed management strategies, the use of herbicides is the backbone of the weed management system for rice. Almost every hectare of rice grown in the U.S. is treated at least once with a herbicide and 80% receives multiple herbicide treatments.

Most farmers integrate cultural and mechanical weed control practices with at least one herbicide treatment that is targeted for control of grass weeds, principally barnyardgrass¹ (watergrass) or sprangletop. However, where grass reinfestations occur or where broadleaf, aquatic, sedge or other hard-to-control weeds occur, farmers may apply as many as four herbicide treatments--two during the early season and two later in midseason. Additionally, each treatment may combine two herbicides in a tank mixture. Herbicide programs for rice may cost as little as $45/ha to as much as $168/ha, depending on weed species or rate and number of herbicide applications required (8). However, the 6-year average cost of weed control was $86/ha in verification trials conducted from 1983 to 1988.

Integrated control systems for hard-to-kill weeds, including red rice and perennial grass and broadleaf weeds, are complex and, in those hectares where rice is rotated with other crops, require attacking the weeds in rotated crops as well as in rice (9). Cropping-herbicide-cultivation systems are essential for the control of red rice where present control technology is very limited (10).

WEED COMPETITION IN RICE

Weed species vary in their competitive ability. Weed competition experiments in Arkansas indicated that season-long competition of red rice or barnyardgrass reduced rice grain yields more than other grass weeds such as bearded sprangletop and broadleaf signalgrass or broadleaf and aquatic weeds such as eclipta, ducksalad, hemp sesbania, spreading dayflower or northern jointvetch (11).

Rice yields decreased with increasing durations of weed-rice interference. Barnyardgrass, red rice, bearded sprangletop, broadleaf signalgrass, hemp sesbania, northern jointvetch, eclipta and spreading dayflower reduced drill-seeded rice yields of standard cultivars with increasing durations of interference (11).

The density of weeds in drill-seeded rice affects rice yields. Research indicates that rice yields decreased with increasing density of

¹For common and scientific names of weeds see Composite List of Weeds, Weed Sci., 1984, 32 (Suppl. 2), 137 pp.