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Effect of Depth of Water and Duration of Inundation on Rice-Weed Competition and Grain Yield of Rice in the Central Plains of Thailand

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Abstract

Rice is the main source of energy and income of the Asian people. It is also the dominant crop in smallholder agriculture. Rice yields are often reduced by weed competition. High labour cost of weeding has led to a widespread use of herbicides. Use of herbicides can cause problems, such as the development of herbicide-resistant weed ecotypes and weed resurgence. These are two most crucial situations that lead to the development of more toxic and longer-effective herbicides. Therefore, the use of non-herbicide weed-control measures has been favoured by many agriculturists. This study was conducted to determine the effect of depth of water and duration of inundation on rice-weed competition and grain yield in comparison to the traditional system of manual weeding and herbicide-based weed control.

The treatments were composed of five depths of water (viz. 0, 2, 4, 6 and 8 cm) maintained from seeding and two levels of weeding (viz. weeded at panicle initiation and non-weeded throughout the growing period). In a split-plot design with three replicates, these treatments were compared with the traditional system and also with a plot weeded with commonly used herbicides.

The population and growth of weeds were highest with 0 cm water depth. Increasing water depth from 2 to 8 cm significantly reduced both parameters. There was a significant reduction in the weed population in the plots treated with herbicides during the initial growing period compared to low water depths and the traditional system. Weeds that emerged later in herbicide treated plots caused significant yield reductions.

Rice plants at 0 cm water depth had a lower number of effective tillers and panicles per plant, which significantly increased with water depths up to 6 cm, and decreased at 8 cm water level. Removal of weeds at panicle-initiation (PI) enhanced grain yield compared to the herbicide-treated plots. Grain number per panicle remained almost unchanged at water depths from 2 to 8 cm with weeding at PI stage. However, increasing water depth significantly increased the grain number per plant even without weeding. The final grain yield showed no significant changes over water depths from 0 cm (4.1 t/ha) to 8 cm (4.4 t/ha) when weeding was practiced. Without weeding, the grain yields varied from almost zero to 4.4 t/ha with increasing water depth from 0 cm to 8 cm. This study revealed the possibility for reducing or even replacing herbicides with water management for weed control. This is a promising alternative for areas such as the Central Plains of Thailand.

Keywords: Rice-weed competition, transplanted rice, water depth, water management, weed management