The Effects of Different NPK Fertilization Rates and Water Regimes on Ratooned Black Glutinous Rice

Benyamin Lakitan[1,2*], Karla K. Jaya[1], Rofiqoh P. Ria[1], and Badai Morianto[1]

[1]College of Agriculture, Universitas Sriwijaya, Inderalaya 30662, Indonesia
[2]Research Center for Sub-optimal Lands (PUR-PLSO), Universitas Sriwijaya, Palembang 30139, Indonesia

**Corresponding author. E-mail: blakitan60@unsri.ac.id*
https://doi.org/10.12982/CMUJNS.2020.0023

Received: *April 11, 2019*
Revised: *July 13, 2019*
Accepted: *August 19, 2019*

ABSTRACT

A strategy for increasing rice production in riparian wetlands is to leave roots and growing shoot apices intact after harvest of the main crop so that a second "ratoon" rice crop can follow. A challenge is maximizing production of the ratoon crop with unpredictable rainfall patterns. We measured several yield components and final grain yield in ratooned black glutinous rice under three water regimes that represent a range of possible seasonal growth conditions during a second growing season: continuous flooding with water level maintained at 3 cm above the substrate surface (W1); alternate wetting-drying with water level fluctuating between 3 cm above and 3 cm below the substrate surface (W2); and a shallow water table maintained at 3 cm below the substrate surface throughout the ratoon period (W3). We also measured the effect of enrichment 80, 160, 240, and 320 kg/ha of NPK (15-15-15) fertilizer. Water regime treatment had a significant (P < 0.01) effect on total and productive tillers, leaf and stem dry weight, number of leaves, percentage of filled grain, and grain yield. NPK application significantly affected (P < 0.05) total and productive tillers, number of leaves, and grain yield. Plants grown under continuous flooding (W1) had optimum weed control and significantly higher stem and leaf dry weight than the other two water regimes, but total grain yield was similar to and not significantly different than W3, with the water table consistently maintained at 3 cm below the substrate surface. The alternate wetting-drying treatment (W2) had he poorest growth and a significantly lower yield (P< 0.05) than the other two water regimes. Grain yield increased with NPK application rate except for in the W2 water regime, which

had lowest yields overall and was less responsive to fertilizer. The highest yields for the W1 and W3 regimes was observed at the 320 kg/ha NPK application rate. Averaging across treatments, both total number of tillers and number of productive tillers correlated with grain yield (r = 0.6334 and 0.8499, respectively), suggesting these can be used as an early predictor for grain yield in ratooned rice.

Keywords: Continuous flooding, Alternate wetting-drying, Shallow water table, Glutinous rice, Riparian wetland

INTRODUCTION

The rice growing period in riparian wetlands is often constrained by water extremes ranging from prolonged flooding to severe drought during wet and dry season, respectively (Lakitan et al. 2018a). Local rice farmers prefer early transplanting after the floodwater subsides at < 15 cm (Lakitan et al., 2019a). Since the depths of floodwater vary each season, the start and end of rice cultivation are also affected. In some riparian wetlands both a main rice crop and a second crop can be produced. These are the shallowly and short-period flooded wetlands. Most of these areas are cultivated with rice, followed by short growing season vegetables such snap bean (*Phaseolus vulgaris*), water spinach (*Ipomoea aquatica*), yellow velvet leaf (*Limnocharis flava*), or other leafy vegetables (Meihana et al., 2017; Widuri et al., 2017; 2018; Lakitan et al., 2018b; 2019b; Susilawati and Lakitan, 2019). However, success with the rice-vegetables cropping pattern is often constrained by drought stress if the dry season comes earlier than expected, or by flooding if the wet season comes early. If drought occurs, watering the vegetables will be costlier than cultivating rice continually in a ratoon system, which also can do better under flooding compared to vegetables.

Ratooned rice can also be practiced for intensifying rice production in areas where the growing season is considerably longer than required for a single rice crop but not long enough for double-cropping rice (Chen et al., 2018). Ratooned rice has been found to be an effective and low-cost practice that can add grain yield equivalent to about half of the main rice crop (Sen and Bond, 2017; Ziska et al. 2018; Yuan et al., 2019).

Continuous flooding or waterlogging condition may benefit the ratooned rice since floodwater and anaerobic substrate will suppress weed growth and development. However, alternate wetting and drying condition has also been reported of having advantages, including increasing nitrogen availability, nitrogen uptake, and efficiency of nitrogen recovery (de Borja-Reis et al., 2018; Sun et al., 2019).

Previous studies have found that inorganic fertilizers applied to the main rice crop did not benefit grain yield of the following ratooned crop (Chen et al.,