Article title	Rice Growth, Grain Yield, and Floodwater Nutrient Dynamics as Affected by Nutrient Placement Method and Rate
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Abstract	The loss of major nutrients can be high in rice (*Oryza sativa* L.) fields, particularly rainfed rice, where water flowing from field to field during periods of high rainfall not only reduces the nutrient use efficiencies but also has the potential for environmental degradation. We examined the influence of deep point placement of N, P, and K briquettes compared to broadcast incorporation of N, P, and K on floodwater nutrient loads after fertilizer application and on the performance of wet season rice in a Vertisol. Broadcast application of N as urea resulted in an average 10 times higher amounts of ammonium N in floodwater compared to deep placement of urea briquette. The broadcast application of single superphosphate resulted in 67 times higher amounts of P in floodwater than plots receiving deep placed P. The floodwater NH4+–N and P content in the deep placement treatments were negligible—similar to floodwater N and P content without fertilizer application. The floodwater K amounts were also significantly lower with deep placed N–P–K briquettes. Significantly higher grain and straw yields, total N, P, and K uptake, and N and P use efficiencies were observed with deep placement of N–P–K compared to broadcast application of N–P–K. Deep placed N–P briquettes gave significantly higher grain yield, straw biomass, total P and K uptake, apparent P recovery, and agronomic N and P use efficiencies when plant spacing was reduced from 20 by 20 cm to 20 by 10 cm. Closer plant spacing led to better utilization of P and K and provided opportunities for deep placement of N–P or N–P–K briquettes in soils with low available P. Combining site specific characteristics (high soil pH, low percolation rate, high rainfall and surface runoffs) with plant spacing and N–P–K briquettes prepared based on site-specific nutrient requirements offers potential for higher yields, improved fertilizer use efficiency, balanced fertilization, and reduced nutrient losses.
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