

Water saving and nitrogen economy of lowland rice

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Introduction

Food security in Asia is challenged by increasing food demand and declining water availability. Irrigated rice is the major consumer of fresh water. Combining the growing demand for food with increasing water scarcity, rice producers in Asia need to produce more rice with less water. Next to water, nitrogen (N) is the most important factor for rice production. It is therefore important to study the combined effects of water regimes and levels of N application on grain yield.

Methodology

Two water-saving regimes were studied in comparison with continuous submergence (CS) at various levels of N application:

- Alternately submerged-non submerged (ASNS);
- Aerobic rice (AR), i.e. growing rice as a dryland crop in aerobic, non-puddled soil without soil submergence.

Experiments were conducted in Muñoz and Los Baños in the Philippines and in Tuanlin, Hubei province in China.

Results and discussion

The effects of water regime and N level on rice yield are presented in Table 1. Rice grain yields with ASNS were at least equivalent compared to CS because soil water potentials in the topsoil stayed close to -10 kPa. Aerobic rice showed a reduction in yield especially under higher levels of N caused by water stress (-30 kPa), despite the choice of a more drought tolerant cultivar.

Table 1. Grain yield (t ha⁻¹) in Tuanlin, Muñoz, and Los Baños under various N levels and water regimes.

Location	Year	N level (kg ha ⁻¹)	Water regime		
			CS	ASNS	AR
Tuanlin ^{a)}	2000+2001	0	4.4	5.0	
		180	8.3	9.1	
Muñoz	2001	0	4.4	4.1	
		90	6.7	6.4	
		180	7.2	7.6	
Los Baños	2002+2003	0	4.0		3.5
		150	7.1		5.3

^{a)} Cultivars were: hybrid 2You725 at Tuanlin, inbred IR72 at Muñoz, and improved upland 'Apo' at Los Baños

Similar trends were observed for biomass and apparent N recovery. Aerobic rice is a promising system for areas with acute water scarcity (water savings up to 60% can be achieved), whereas SNS can maintain yields with a 15–18% reduction in irrigation water use. Rice breeders are currently developing more drought resilient germplasm with a medium-high yield level, thus suitable for the aerobic rice system.



Aerobic rice



Continuously submerged rice

References

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