

Influence of plant type on grain yield in rice

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New South Wales produces 96% of the Australian rice crop and has among the highest average rice yields in the world. Fluctuations in annual yields occur, however, because of lodging in the cultivar Calrose and because of an unfavourable nitrogen response in the cultivar Inga. Calrose, a medium-grain, is the most widely grown cultivar, while Inga is the only long-grain presently grown, having completely replaced Kulu in the 1980/81 season. The use of semi-dwarf cultivars is seen as a way of solving these problems and increasing grain yield (1).

Methods

Two tall cultivars, Calrose and Kulu, and their respective semi-dwarf breeding lines YR71003 and YR71011 were grown for two seasons with varying nitrogen rates (0, 75, 150, 225 kg N ha⁻¹ and 0, 50, 100, 150, 200 kg N ha⁻¹). The pedigree of YR71003 is Tarra 140/(Calrose*4/I-geo-tze) and of YR71011 is (Kulu*4/I-geo-tze)/Selle Patna. I-geo-tze is a tropical semi-dwarf cultivar with backcrosses designated by an asterisk followed by a number, indicating the dosage of the recurrent parent.

Results and Discussion

There was a significant interaction between cultivar and nitrogen rate on yield in both years. Two distinct types of yield response were evident. Tall cultivars had greatest yield at intermediate nitrogen rates with large reductions in yield at the highest rate. Both semi-dwarfs yielded on average 1 t ha⁻¹ more than their respective local parents.

Table 1. Mean grain yield of four rice cultivars

Cultivar	Yield t ha ⁻¹	
	Experiment 1 (1978/79)	Experiment 2 (1979/80)
Calrose	8.9	10.0
YR71003	9.5	10.3
Kulu	8.2	8.5
YR71011	9.2	9.6
LSD (P = 0.05):	0.58	0.43

Yield of YR71011 reached a plateau between the intermediate and high nitrogen rates, whereas that of YR71003 increased almost linearly with increasing nitrogen.

The major cause of depressed yield in the tall cultivars at the highest nitrogen rate was difficulty with harvesting because of lodging. Not all panicle-bearing tillers could be lifted and consequently up to 1.4 t ha⁻¹ remained on the ground after harvesting. The semi-dwarfs in contrast were generally lodging-resistant and therefore fully harvestable.

These observations indicate that both semi-dwarf cultivars show some advantage over their respective major parents. On these results, an additional 1 t ha⁻¹ might be expected from the semi-dwarfs compared to the taller cultivars, but this would require an additional 50 kg N ha⁻¹. In relation to the rice breeding programme at the Agricultural Research Centre, Yanco, the concept of an improved plant type of short stature and with erect leaves is a valid approach to overcoming current cultivar deficiencies.

1. Yoshida, S. 1972. Ann. Rev. Plant Physiol. 23: 437-464.

