

Table 2. Effect of seed treatment on crop stand of rice varieties (>14 DAS) sown in standing water.^a Cuttack, India, 1987 dry season.

Treatment	Seedling emergence (no./m ²)	Stand establishment (%)	Plant height (cm)	Dry weight/plant (g)
Variety				
Utkal Prabha	206	52	26	26
Kalinga 3	185	46	26	24
Ratna	171	43	25	25
LSD (0.05)	ns		ns	ns
Seed treatment				
Dry seed	144	36	24	18
Seeds soaked 48 h				
0.3% H ₂ O ₂	200	50	27	30
0.1% KMnO ₄	200	50	27	25
Water	205	51	26	26
LSD (0.05)	22		1.5	3

^a400 seeds sown/1-m² plot in 10 cm standing water; water depth 10 ± 2 cm.

rice seedlings increases greatly 2-3 d after germination.

Among the varieties tested, Sabita

showed comparatively higher emergence, followed by FR13A and

Utkal Prabha. □

Soil fertility and fertilizer management

Response of direct-sown rice to *Azospirillum lipoferum*

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We tested the effect of *A. lipoferum* on direct-sown rice during the Sep-Jan 1989 wet season.

Peat-based *A. lipoferum* inoculum at 2 kg/ha was mixed with 100 kg of IR20 seeds, using rice gruel water as sticker. The mixture was dried in the shade for 20 min, then sown. Peat-based inoculum at 4 kg/ha was mixed with 15 kg well-powdered farmyard

manure, broadcast, and covered with soil.

Four treatments were laid out in a random block design with five replications (see table). Experimental plots of 20 m² received 75 kg N/ha as urea in 3 splits (50% at 30 d after sowing (DAS), 25% at 60 DAS, and 25% at 90 DAS), 37.5 kg P/ha as superphosphate, and 37.5 kg K/ha as muriate of potash, both basal.

A. lipoferum applied through both seed and soil gave the highest grain and straw yields. Root weight, plant height, and productive tillers increased. □

Effect of *A. lipoferum* on direct sown rice. Aduthurai, India, 1989 wet season.

<i>Azospirillum</i> treatment	Plant height (cm)	Productive tillers (no./hill)	Root weight (g/hill)	Grain yield (t/ha)	Straw yield (t/ha)
Seed	69.7	7.7	1.51	2.4	3.2
Soil	67.5	7.6	1.76	2.3	2.8
Seed + soil	73.1	8.8	2.09	3.0	4.0
Control (no treatment)	67.4	7.5	1.45	2.3	2.9
LSD (P = 0.05)	5.5	0.6	0.17	0.53	0.90

Effect of zinc fertilizers on rice grown on Typic Ustochrepts

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We studied the efficiency of ZnSO₄ and Zn-EDTA applied in soil (11.2, 5.6, and 2.8 kg Zn/ha) and as foliar spray (0.02, 0.1, and 0.2% Zn solution) in long-duration PR106 grown on Typic Ustochrepts during 1988 wet season (kharif).

Soil was loamy sand with pH 8.5, electrical conductivity 0.32 dS/m, 0.42% organic C, and 0.50 mg DTPA extractable Zn/kg soil. Urea, diammonium phosphate, and muriate of potash were applied at 120-27-24 kg NPK/ha.

In the soil treatments, Zn was broadcast at transplanting (45-d-old seedlings). In the foliar spray treatments, the first spray was at 4 wk after transplanting and the remaining two at 10-d intervals. The experiment was laid out in a randomized complete block design with three replications. Straw and grain samples were analyzed for Zn content.

Grain yield increased significantly with increasing rates of soil-applied Zn for both sources (see table). Foliar sprays of Zn-EDTA (except at 0.02% solution) and ZnSO₄ significantly

Effect of application methods, rates, and sources of Zn on rice yield and Zn uptake. Ludhiana, India, 1988 wet season.

Zn source	Zn rate	Yield (t/ha)		Zn uptake (g/ha)
		Grain	Straw	
<i>Soil application (kg Zn/ha)</i>				
ZnSO ₄ · 7H ₂ O	11.2	7.1	15.2	351
	5.6	6.6	14.4	283
	2.8	6.1	12.7	225
Zn-EDTA	11.2	7.6	15.9	378
	5.6	6.9	14.8	304
	2.8	6.3	13.5	240
<i>Foliar application (%)</i>				
ZnSO ₄ · 7H ₂ O	0.20	6.2	11.8	206
	0.10	5.9	10.1	164
Zn-EDTA	0.10	6.0	10.7	208
	0.02	5.7	8.2	144
Control		5.3	8.2	123
LSD (P = 0.05)		0.5	1.3	43