Response of deepwater rice to nitrogen fertilizer in fluxial ecology in Nigeria

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A 2-year trial (1978-79) at the RRS at Birnin-Kebbi studied the effect of time of nitrogen application on the yield of deepwater rice in the naturally inundated ecology in northern Nigeria where rice is traditionally grown on a vast hectarage.

Nitrogen at 67 kg/ha was applied as a single dose and in various split doses at sowing (worked into soil) 15 days and 30 days after sowing (basal dressing on wet soil) (see table). At the time of sowing 37 kg P_2O_5/ha was incorporated into the soil as, a blanket application. The source of nitrogen and P_2O_5 were calcium ammonium nitrate and single superphosphate. The plots had 30-cm-high bunds.

A long-duration (180 days), tall, photoperiod-sensitive rice variety FARO-14, well adapted to deep flood ecology, was dibbled at 30- × 30-cm spacing in mid-June and harvested in mid-December. During August to October the water depth in the experimental field ranged between 60 and 133 cm.

Effect of time of nitrogen application on grain yield of deepwater rice variety FARO-14. Birnin - Kebbi, Nigeria, 1978-79.

Treatment	Time and split dose of 67 kg N/h[a]			Grain yield[b] (t/ha)		
no.	AS	15 DS	30 DS	1978	1979	Mean
1	67	0	0	4.33	5.34 abcd	4.84 ab
2	0	67	0	3.97	4.96 cd	4.47 bc
3	0	0	67	4.31	5.31 abcd	4.82 ab
4	22.3	22.3	22.4	3.88	4.94 cd	4.41 bc
5	33.5	33.5	0	4.06	5.39 abcd	4.73 ab
6	33.5	0	33.5	4.13	5.59 abed	4.86 ab
7	16.7	33.5	16.8	3.93	5.07 bcd	4.51 bc
8	33.5	16.7	16.8	4.82	5.76 abc	5.29 a
9	15.7	16.8	33.5	4.24	5.33 abcd	4.79 ab
10	0	33.3	33.5	4.43	5.29 abcd	4.87 ab
11	44.6	22.4	0	4.27	5.48 abcd	4.88 ab
12	22.4	44.6	0	3.98	4.83 abcd	4.41 bc
13	0	44.6	22.4	3.74	5.81 ab	4.77 ab
14	0	22.4	44.6	4.38	6.05 a	5.22 a
15		Control[c]		3.72	3.97 e	3.85 d
		Year mean		4.15	5.57*	
		CV (%)		12.11	9.90	10.80

[a]AS = at sowing, DS = days after sowing. [b]Means followed by the same letter are not significantly different at the 5% level. LSD for years 0.75 t/ha at 5% level. Plot size was 13.94 m^2. [c]Control = no nitrogen. applied.

The results of the study indicate that application of 67 kg N/ha increased the paddy yields highly significantly compared with the control. The time of application and split combinations did not show a consistent pattern of response. However, the effect of arrangements of time and splitting as in treatments 8 and 14 appears to be comparatively consistent and useful. ■

Iron coating on rice roots

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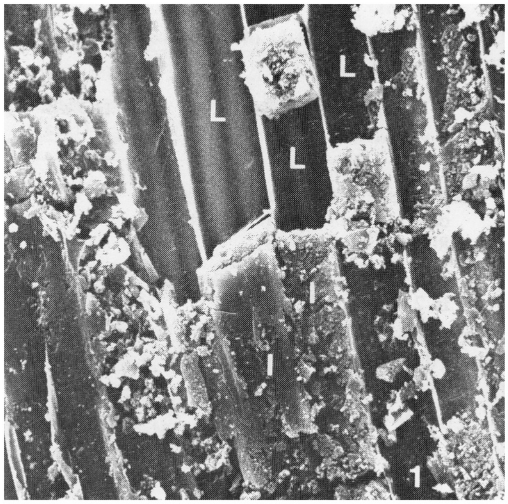
Oxidation and precipitation of ferrous iron in soil result in an iron coating on rice roots. The quantitative determination of the iron coating by dithionite-citrate-bicarbonate extraction revealed that cultivar, plant growth stage, and soil type influenced the quantity of iron compound on the roots. When grown on three east Texas soils (two Alfisols and a Vertisol) the cultivar Brazos had the highest iron coating accumulation (14% of the dry root weight) and highest grain yield compared with cultivars Lebonnet, Labelle, and Bluebelle. When grown on another Vertisol, Brazos ranked second to Labelle in amount of coating and grain yield.

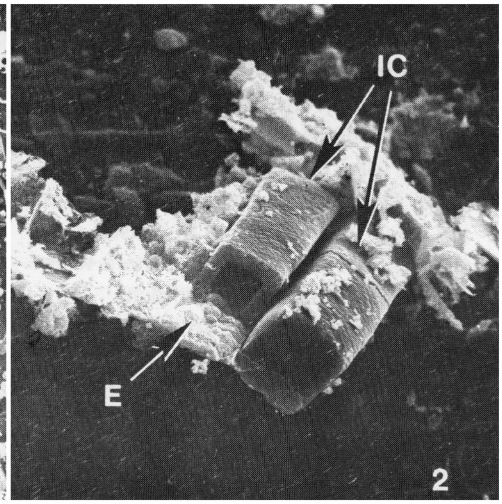
The high levels of iron coating associated with Brazos are believed to be related to the high amount of O_2 that its roots release in vitro.

The accumulation of iron (as FeOOH) was less than 2% of dry root weight for all cultivars within 7 days after soil flooding (plants about 35 days from emergence) and increased to an average cultivar maximum of 10% at plant maturity. Tanaka and others have reported that root-panicle ratio of rice in pots ranged from 20% to 100%. Assuming that rice plants produce 5,000 kg dry roots/ ha, that iron coating is 10% of the dry root weight, and that 1/2 of the oxygen in FeOOH is from the atmosphere, it was estimated that 6,300 liters of O_2 (31,500 liters of air)/ha would diffuse down the rice plant stem to precipitate Fe on the root.

The FeOOH was purified from extraneous materials such as quartz and layer silicate in the root coating by ultrasonication followed by high gradient magnetic separation. X-ray diffraction analysis of the final mixture (50% FeOOH) identified goethite **(α-FeOOH)** and lepidocrocite **(γ-FeOOH)** as the predominant minerals comprising the root-coating material.

Scanning electron microscope examination shows that a mature rice root has an abundance of open lumens resulting from decomposition of epidermal cells and the outermost cell walls. In general, iron coatings appear as porous or dense materials filling the lumens (Photo 1). In a rare case, FeOOH precipitated into lumens with all the cell walls intact and formed an iron cast the shape of the original epidermal cell (Photo 2). The hollow interior on the left cast with a broken end indicates that precipitation begins on the cell walls. No visible coating showed on younger secondary roots and sections of roots near the tips. ■





1. Representative view of iron coating on rice root. L: lumen, I: iron coating.

2. Special case of iron coating formation. IC: iron casts of epidermal cells, E: broken end of a cast.

Performance of new rice entries at different planting dates and nitrogen rates

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The timely planting of rice is important in testing the yield level of any rice variety because it enables the plant to utilize more efficiently the environment in which it is grown. In general early planting (first week of June) of medium-duration varieties results in higher yield. In case of short-duration varieties, planting time does not greatly affect the grain yield of rice. A field experiment at the Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar, during 1977 kharif tested the performance of newly developed rice varieties.

Effect of planting dates on grain yield of rice varieties grown under different levels of nitrogen. Pantnagar, India, 1977 kharif.

Variety	Grain yield (t/ ha) 1 June 60 kg N/ ha	1 June 120 kg N/ ha	16 June 60 kg N/ ha	16 June 120 kg N/ ha	1 July 60 kg N/ ha	1 July 120 kg N/ ha
Jaya	6.1	6.7	6.2	6.9	5.5	6.5
UPR103 D-6-1	5.5	6.5	5.3	5.6	4.4	4.8
UPR171-12	5.3	6.5	5.2	6.4	5.4	5.8
UPR73-23	6.0	6.7	6.0	6.3	5.5	5.9
IET2815	5.9	6.8	6.1	6.7	5.1	6.4
Ratna	5.9	6.7	6.1	6.2	6.5	5.5
Saket 4	6.1	6.7	6.4	6.3	5.3	6.0
UPR4-D-1-1	6.3	6.3	5.4	5.6	5.2	5.6
UPR82-1-7	5.6	6.3	6.1	6.2	5.7	5.9
IR36	6.2	7.0	5.6	6.4	5.3	6.0

	S.Em.±	C.D. at 5%	C.V. (%)
Date × nitrogen × variety	0.23	0.64	7
Nitrogen × variety	0.13	0.37	

Jaya gave maximum yield when planted on 16 June; UPR103-D-61, UPRI 71-12, UPR73-23, UPR4-D-1-1, and IR36 gave higher yields when planted on 1 June, irrespective of nitrogen dose. Ratna, Saket 4, IET2815, UPR82-1-7 yielded more when planted 16 June with 60 kg N/ ha than when planted 1 July with 120 kg N/ha (see table). ■

Neem cake-blended urea for increased nitrogen use efficiency in transplanted rice

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When nitrogen fertilizers are added to soil, their efficiency is reduced considerably — sometimes to the extent of 50% or less — because of leaching, denitrification, volatilization, and surface runoff. There is a need for some simple and cheap device to reduce these losses. One device found effective under the different soil conditions prevailing in Karnataka is blending ordinary urea with nonedible neem cake available locally. Neem (*Azadirachta indica*) trees grow abundantly in India.

The technique consists of mixing well-powdered, country-pressed neem cake with ordinary urea (30% by wt). Adherence of neem cake powder to urea granules is very important in the blending process. To ensure that, the powder and granules are mixed well 1 or 2 days ahead of application. The mixture is incorporated uniformly in equal doses at the time of planting and tilling.

Better adherence of neem cake to urea granules is obtained by using a coal tar (used for road surfacing) and kerosene oil mixture in 1:2 proportions while