responsible for the yield increase. At this stage, the response to different levels of pyrite appears to be due to widespread deficiencies of many elements in Uttar Pradesh soil.

Effect of nitrogen source, rate, and placement method on growth and yield

G.R. Singh and T.A. Singh, Soil Science Department, G.B. Pant University of Agriculture and Technology, Pantnagar 263145, U.P. India

The efficiency of urea, urea supergranules (USG), and NPK (12-32-16) rates and placement methods in flooded lowland transplanted rice was studied in 1984 kharif. The design used three N rates and placement methods in a randomized block design with three replications.

Twenty-three-day-old Jaya rice seedlings were transplanted at 20- × 10-cm spacing. The soil (Beni silty clay loam) had pH 7.2, 1.51% organic C, CEC 23.91 meq/ 100 g of soil, and percolation rate of 15.3 mm/d. Treatments are described in the table.

All plots except NPK treatments received 28 kg P/ ha as single superphosphate and 26 kg K/ ha as muriate of potash.

Effect of source, rate, and placement of N on yield attributes of rice.

Treatment [a]		Plant ht	Tillers/m²	Gram yield
Rate (kg N/ha)	Source and application	(cm)		(t/ha)
0	(control)	75.3	157	2.9
60	Urea, 3 splits	78.0	199	4.1
90	Urea, 3 splits	81.9	218	5.1
120	Urea, 3 splits	84.2	239	5.4
60	USG B&I at transplanting	76.8	207	4.0
90	USG B&I at transplanting	79.6	220	4.8
120	USG B&I at transplanting	84.0	290	5.2
60	USG deep placed 11 DT	84.4	243	4.8
90	USG deep placed 11 DT	88.2	253	5.3
120	USG deep placed 11 DT	89.2	303	5.4
60	2/3 N as USG B&I at transplanting + 1/3 N as urea at panicle initiation	77.9	191	4.0
90	2/3 N as USG B&I at transplanting + 1/3 N as urea at panicle initiation	81.5	209	4.9
120	2/3 N as USG B&I at transplanting + 1/3 N as urea at panicle initiation	84.4	214	5.3
120	24 kg N/ha at transplanting + 96 kg N/ha as urea in 2 equal splits at tillering & panicle initiation	90.8	296	5.8
120	24 kg N/ha at transplanting + 96 kg N/ha as USG deep placed 11 DT	89.3	308	5.1
	CD (0.05)	2.6	14	0.2

[a] B&I = broadcast and incorporated. Deep placed USG is put in the center of 4 hills in alternate rows at 8-10 cm depth. DT = days after transplanting.

At 60 kg N/ ha, yields from deep placed USG were significantly superior to those from 3 splits of urea, USG broadcast and incorporated (B&I) at transplanting, and 2/3 N as USG B&I at transplanting, and 1/3 N as urea at panicle initiation. Above 60 kg N/ ha, response to deep placed USG was less than the response to N applied by other methods.

Rice-Based Cropping Systems

Energy use in rice-based farming system in India

A. S. Saini, Regional Research Station, Dhaulakuan 173 001 District Sirmour (H.P.); R.K. Pateland R.V. Singh, National Dairy Research Institute (NDRI), Karnal 132 001 (Haryana), India

We estimated and compared the energy requirements of rice and wheat crops at farmers' and improved levels of technology. Data on direct energy inputs in rice and wheat were obtained from a randomly selected sample of 191 farmers for one agricultural year. Indirect energy inputs (which represent about 20% of the total direct energy inputs) are not accounted for in this study.

The data on per hectare energy input and output for rice and wheat at farmer's field (farmers' technology) and NDRI demonstration unit (improved technology) are presented in the table. The data suggest that farmyard manure and chemical fertilizerd were the major energy inputs for rice and wheat crops under both technology levels. The use of energy from these sources was comparatively higher under the improved technology level than under the farmers' technology level for both crops. Bullock and human labor were the next important energy inputs under farmers' technology and machinery under improved technology.

Under farmers' technology, energy use was higher for wheat; under improved technology, energy use was higher for rice. Total energy inputs, in general, were higher under farmers' technology. Nevertheless, energy output was higher with the improved than with the farmers' technology, resulting in a relatively higher energy output-input

Per hectare energy input and output in rice and wheat production (MJ).[a]

Energy source	Farmers' technology		Improved technology	
	Rice	Wheat	Rice	Wheat
Seed	318.19 (2.54)	1,366.23 (9.40)	446.77 (1.35)	1,836.72 (8.43)
Farmyard manure	3,549.17 (28.30)	5,202.06 (35.79)	10,972.36 (33.25)	–
Chemical fertilizer	3,828.94 (30.53)	3,584.35 (24.66)	13,324.03 (40.38)	14,933.23 (68.62)
Machinery				
Diesel engine or electric motor	1,574.25 (12.55)	1,041.53 (7.17)	4,321.09 (13.09)	2,632.93 (12.10)
Tractor	182.41 (1.46)	289.41 (1.99)	1,552.28 (4.70)	1,725.23 (7.93)
Human labor	1,126.57 (8.98)	590.22 (4.06)	1,818.85 (5.51)	634.89 (2.92)
Bullock labor	1,961.45 (15.64)	2,460.38 (16.93)	568.89 (1.72)	–
Total energy input	12,540.99 (100.00)	14,534.18 (100.00)	33,004.27 (100.00)	21,763.00 (100.00)
Total energy output	50,436.77	64,739.39	144,077.18	105,203.40
Energy output-input ratio	4.02	4.45	4.37	4.83
Energy input/t	4,118.54	6,884.98	4,929.56	5,230.23

[a] Figures in parentheses indicate percent of total energy input.

ratio for the improved technology. In terms of energy output-input ratio, wheat performed better than rice under both situations. It may be inferred that farmers in the study area were better equipped with wheat technology than with rice technology. It is interesting to observe that I calorie of energy input could produce 4-5 calories of food from rice or wheat.

The International Rice Research Newsletter and the IRRI Reporter are mailed free to qualified individuals and institutions engaged in rice production and training. For further information write: IRRI, Communication and Publications Dept., Division R, P. O. Box 933, Manila, Philippines.

Announcements

D. L. Umali honored

Dioscoro L. Umali has been conferred the rank and title of National Scientist of the Philippines by President Corazon C. Aquino. The citation issued 11 Jul 1986 lauds Umali as an academician, scientist, educator, research organizer, development administrator, and science statesman. Currently, Umali is affiliated with IRRI as parttime liaison scientist for China.

ISS award for S. K. De Datta

S.K. De Datta has been selected for the 1986 International Soil Science Award. He is being recognized for his outstanding contributions to the growth and development of international soil science, his creativity in the establishment of scientific research, and his influence in bringing about long-lasting change in practices related to soil science in the developing nations. De Datta is principal scientist and head of IRRI's Agronomy Department. The award will be presented 2 Dec at the Soil Science Society of America annual meeting in New Orleans, LA, USA.

ASA award for B. S. Vergara

Benito S. Vergara has been selected to receive the 1986 Fellow award by the American Society of Agronomy. He is the author of *A farmer's primer on ,growing rice,* probably the most widely published agricultural book in existence, with 35 translated editions published in 30 languages of Asia, Africa, and Latin America and about 20 additional translations in progress. For the last 15 yr, he has conducted basic studies on the physiology of deep water rice. Vergara is head of IRRI's Plant Physiology Department. The award will be presented 3 Dec at the annual ASA meeting in New Orleans, LA, USA.

New IRRI publications

Development and spread of high-yielding rice varieties in developing countries

Farmer's primer on growing rice (Waray and Maguindanao eds.)

Global aspects of food production

Rice genetics proceedings of the international rice genetics symposium

The International Rice Research Newsletter (IRRN) invites all scientists to contribute concise summaries of significant rice research for publication. Contributions should be limited to one or two pages and no more than two short tables, figures, or photographs. Contributions are subject to editing and abridgment to meet space limitations. Authors will be identified by name, title, and research organization.