Water balance analysis of the effect of drought on upland rice

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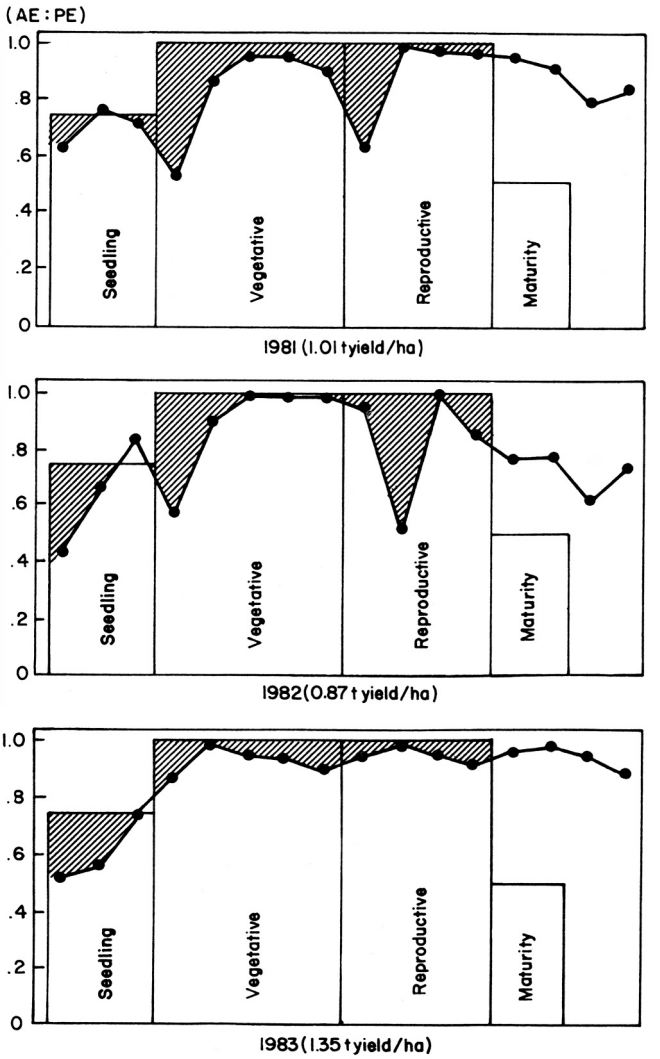
In central India, there are about 0.9 million ha of upland rice. Soils are black with 60% clay. Rice yields are 0.3 to 0.6 t/ha.

For better water management, it is important to know the duration and intensity of water stress during different growth stages. We analyzed the water stress pattern resulting from drought during growth stages from 1981 to 1983 based on the ratio of actual evapotranspiration to the potential evapotranspiration (AE:PE) determined by water balance computations. The Purva grain yield for the analysis was from cropping pattern experiments under upland conditions.

The drought period was initiated when the actual AE:PE values fell below optimum, which are 0.75, 1.00, 1.00, 0.50 during seedling, vegetative, reproductive, and maturity stages (see figure).

Drought intensity varied in the first three growth stages. It was highest (more hatched area) in 1982 followed by 1981; yields were 0.9 and 1.0 t/ha. In 1983, mild drought occurred at vegetative and reproductive stages and rice yielded 1.3 t/ha.



Drought during different physiological stages of upland rice Raipur, India.

This suggests that under upland conditions in central India, rice production without a suitable water harvesting or soil water conservation practice is not practical. □

Rice-Based Cropping Systems

Deep water rice and fish culture

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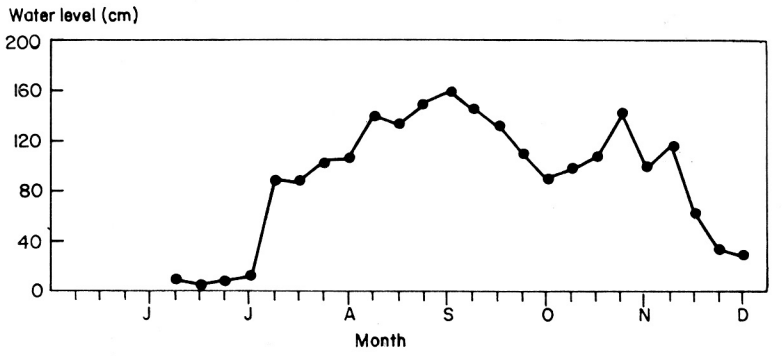
We evaluated an integrated system of deep water rice and fish culture followed by lowland rice culture to increase farm productivity at ORP, West Bengal.

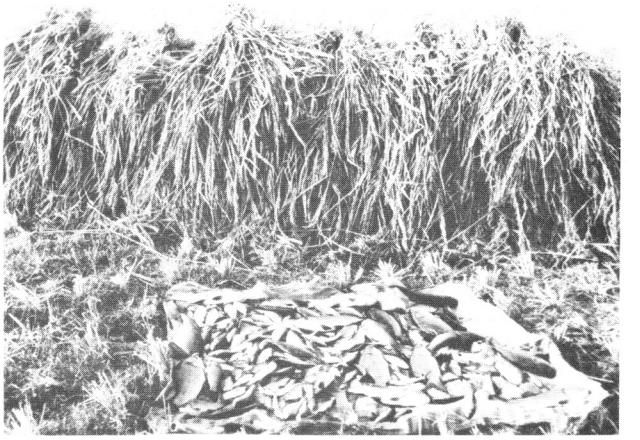
A 0.2-ha renovated, 2.5-m-deep plot for deep water rice cultivation was constructed with a 12 × 8 × 1.5 m central tank. Soil was a clay loam with pH 7.0-7.5. The tank was thoroughly plowed, 10 t farmyard manure/ha was incorporated, and Jaladhi 1, a recommended deep water rice, was direct-seeded in early Jun 1983. Standard cultivation was practiced. Water depth reached a maximum 160 cm and varied as shown in Figure 1.

In late Jul, carp fingerlings - silver carp *Hypophthalmichthys molitrix,* Mrigal *Cirrhinus mrigala,* Catla *Catla catla,* and Rohu *Labeo rohita* — were released in the plot at 9,000/ha in the ratio 6:6:1:1. Each morning, they were fed an inexpensive 1:1 mixture of rice bran and oil cake at 5% total body weight.

In late Dec, mature rice panicles were harvested and fish were harvested periodically by drag net. Only 75% of the fish were table-sized in the first harvest (Fig. 2). The plot was allowed to dry gradually and the remaining small fish were moved to the central tank where they were fed regularly. Final fish harvest was in late Feb.



1. Weekly variations in water levels of deep water rice plots in kharif, West Bengal, India.



2. Harvesting Jaladhi 1 and carp in kharif, West Bengal, India.

IR36 was transplanted in the same plot during boro in mid-Jan 1984, after the plot was thoroughly puddled. Two seedlings at 15- × 15-cm spacing/hill were transplanted and 120 kg N/ha was applied in 3 doses: half at land preparation and half in equal splits, 1 mo after transplanting and 1 wk before flowering. PK at 18-33 kg/ha were added at land preparation. Standard cultivation methods were practiced and the tank water was used for irrigation as needed. IR36 was harvested in mid-May.

Twenty plants of each rice variety were randomly selected for analysis and uprooted at harvest. Growth and yield data for 20 randomly selected fishes from each of the 4 carp species were recorded at harvest, and total yields of fish and rice were determined (see table).

Jaladhi 1 and 1R36 yielded normally (see table). Fish yield was 1.1 t/ha in 7 mo. Catla performed best. □

Growth and yield of fish and 2 rice crops in a low-lying deep water plot at ORP, Pandua, West Bengal, India.

Character	Rice			
	Early Jun-late Dec 1983		Boro (mid-Jan - mid-May 1984)	
	Jaladhi 1		IR36	
Plant height (cm)	295		68	
Stem length (cm)	268		47	
Internodes/stem	16		4	
Effective tillers/plant	3		9	
Panicle length (cm)	24		20	
Grains/panicle	143		79	
Grain yield (t/ha)	2.1		4.2	
	Fish (late Jul 1983 - late Feb 1984)			
	Silver carp	Mrigal	Catla	Rohu
Recovery (%)	45	69	87	40
Increase in length (mm)	95	104	90	115
Increase in weight (g)	34	86	275	96
Fish yield (t/ha)	0.2	0.4	0.4	0.1

Announcements

T. T. Chang named IRRI principal scientist

T. T. Chang, geneticist and head of the International Rice Germplasm Center, has been named IRRI principal scientist.

Chang is an internationally known crop scientist and a fellow of the American Society of Agronomy and the Institute of Biology, London. He is noted for his work with the International Board for Plant Genetic Resources and his research to identify the origins of rice.

Chang holds degrees from the University of Nanking, Cornell University, and the University of Minnesota. He joined IRRI in 1961. □

M. S. Swaminathan receives honorary degree

M. S. Swaminathan, IRRI director general, has been named honorary doctor of technology by the Asian Institute of Technology at Bangkok, Thailand. □

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