(intercrop) proved better for higher economic returns with advance sowing.

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WATER AND NITROGEN MANAGEMENT FOR LOWLAND TRANSPLANTED RICE UNDER LIMITED WATER SUPPLY

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ABSTRACT

Under conditions of limited water supply, intermittent irrigation instead of continuous flooding is necessitated in rice cultivation. To assess the response of lowland transplanted rice to intermittent irrigation *vis-a-vis* continuous submergence, field experiments were conducted at the Agricultural College, Killikulam during *rabi* seasons (Oct-Feb) of 1990 and 1991. The effect of partial substitution of inorganic nitrogen through bio fertilizers-azolla and blue green algae (BGA) - was also evaluated. The results indicated that rice yield was reduced by 3 to 19 per cent by intermittent irrigation compared to continuous submergence. The practice of irrigation immediately after disapperance of ponded water was most suitable under limited water supply. With this practice, the yield reduction was only marginal (3-5%) but it helped to save about 28.7 per cent of irrigation water compared to continuous submergence. Substitution of 25 per cent of inorganic nitrogen through inoculation of azolla or BGA maintained the grain yield of rice on par with the application of 100 per cent of N through inorganic fertilizers.

KEY WORDS : Lowland Rice, Limited Water, Nitrogen, Water, Management

Sixty per cent of total available irrigation water in India and about 80 per cent in Tamil Nadu is utilised for rice cultivation (Sheik Dawood *et al.*, 1990). with water becoming a scarce input, its economic use is of utmost importance today. In the Tambiraparani command area of Tamil Nadu, the *rabi* rice (Pishanam Oct-Feb) frequently suffers due to inadequate water availability caused by early closure of canal water due to insufficient storage in the reservoir. Very often, irrigation water is made available under a turn system of supply in the canals, making it difficult to practise the usual system of continuous submergence. Past research elsewhere suggests that continuous submergence may not be always essential for higher grain yield and the practice of intermittent flooding gives yield comparable to continuous submergence (Wann, 1978). The response of rice to such intermittent flooding at varying intervals and the potential yield of rice under such limited water supply need to be assessed for making meaningful recommendations on water management under limited water supply.

Another aspect of concern for the rice farmers is the long term effect of continuous and exclusive use of inorganic fertilizers on crop productivity. Partial substitution of inorganic fertilizers through biofertilizers is a strategy recommended under such conditions. This study was therefore programmed to evaluate different water management regimes and integrated use of biofertilizers with inorganic nitrogen in *rabi* rice of Tambiraparani command area of Tamil Nadu.

MATERIALS AND METHODS

The experiment was conducted during *rabi* (*Pishanam*) season (Oct-Feb) of 1990 and 1991, at the College Farm, Agricultural College and Research Institute, Killikulam. The soil of the experimental field was red sandy loam, neutral in reaction, low in available N and medium in available P and K. The bulk density of the soil was 1.45 g cm^{-3}. Rice variety IR 20 was used for the study. The crop was planted at a spacing of 20 x 10 replicated thrice. Different irrigation regimes, *viz.*, continuous submergence to 5 cm (I_1), irrigation immediately after disappearance of ponded water (I_2), irrigation 2 days after disappearance of ponded water (I_3), irrigation 4 days after disappearance of ponded water (I_4) and irrigation 6 days after disappearance of ponded water (I_5) were tried in the main plots. The sub plot treatments comprised the different nitrogen management practices, *viz.*, 100 kg N ha^{-1} as inorganic fertilizer (N_1), 75 kg N + azolla (N_2), 75 kg N + blue green algae (BGA) (N_3) and 75 kg N + azolla + BGA (N_4). Half of N was applied at planting and the remaining half in two equal splits at active tillering and panicle initiation stages. A common dose of 50 kg ha^{-1} each of P_2O_5 and K_2O was adopted for all the plots. Azolla inoculation at 1000 kg ha^{-1} was done at 7 days after planting (DAP) and incorporated at 30 DAP. Blue green algae was inoculated at 10 DAP.

RESULTS AND DISCUSSION

Effect of irrigation regimes

When irrigation was withheld under limited water supply, rice grain yield declined (Table 1). During the first year (1990), the grain yield reduction with irrigation given at varying intervals after disappearance of ponded water as compared to continuous submergence was 3.0 to 8.8 per cent. But during the second year (1991), the grain yield was reduced by 6.8 to 18.7 per cent. Under intermittent irrigation, the grain yield reduction was much pronounced (15.7 - 18.7%) when irrigation was given at 4-6 days after disappearance of ponded water. The prolonged intervals between irrigations under the above regimes probably affected nutrient availability and reduced the tillering and grain development. Irrigation immediately after disapperance or two days after disappearance of ponded water also resulted in yield reduction compared to continuous submergence. Such reduction with irrigation at two days after disappearance was 6-10 per cent. The yield reduction with irrigation immediately after disappearance of ponded water was relatively lesser at 3-6.8 per cent during the two years.

The change in the physico-chemical properties of the soil due to continuous ponding has been known to favourably influence the chemical environment of rice roots (Ponnamperuma, 1972). However, such a practice of continuous ponding of water consumed the largest quantity of irrigation water of 1748-1792 mm (Table 1). Irrigating the rice crop at varying intervals after disappearance of ponded water required 990 to 1261 mm of water resulting in a saving of 509 to 780 mm of water.

Irrigation at 2,4 or 6 days after disappearance of ponded water, though economical in water requirement, caused greater yield loss. However, when irrigation was given immediately after disappearance of ponded water, the yield loss was only marginal (around 5%) but the water saved was 509 mm (28.7% less than continuous submergence). The water use efficiency also was higher (4.33 kg ha^{-1} mm^{-1}) than under continuous submergence (3.25 kg ha^{-1} mm^{-1}). Straw yield of rice also was higher only under continuous submergence possibly due to more tillering. Here again, the reduction in straw yield due to intermittent irrigation was given immeditely, after disappearance of ponded water.

Hence, under conditions of limited water supply as experienced often during the *rabi* season in Tambiraparani command area, irrigation to rice can be given immediately after disapperance of ponded water instead of continuous submergence.

Table 1. Effect of water management practices on yield, water requirement and water use efficiency of rabi rice

Water Management	Grain yield (kg ha^{-1})			Water used (mm)			Water use Efficiency (kg ha^{-1} mm^{-1})		
	1990	1991	Mean	1990	1991	Mean	1990	1991	Mean
I_1 - Continuous Submergence	5625	5883	5754	1748	1792	1770	3.22	3.28	3.25
I_2 - Irrigation Immediately after DPW	5455	5483	5469	1268	1254	1261	4.30	4.37	4.34
I_3 - Irrigation 2 days after DPW	5290	5292	5291	1177	1172	1175	4.49	4.51	4.50
I_4 - Irrigation 4 days after DPW	5150	4958	5054	1127	1133	1130	4.57	4.37	4.47
I_5 - Irrigation 6 days after DPW	5127	4783	4955	988	991	990	5.19	4.82	5.01
CD (P=0.05)	131	185	-	72	63	-	0.17	0.13	-

(DPW : Disappearance of ponded water)

Table 2. Nitrogen management and yield of *rabi* rice

Nitrogen Management	Grain yield (kg ha^{-1})		
	1990	1991	Mean
N_1 - 100 kg N ha^{-1} as inorganic	5319	5367	5343
N_2 - 75 kg N as inorganic + Azolla	5402	5360	5381
N_3 - 75 kg N as inorganic + BGA	5337	5167	5252
N_4 - 75 kg N as inorganic + Azolla + BGA	5253	5227	5240
CD (P=0.05)	NS	NS	

Similar results have been reported by Nageswara Reddy and Raju (1987).

Nitrogen management

The results from the study clearly established that the use of azolla or BGA alone or together could help to save 25 per cent of inorganic N without any yield loss (Table 2), in transplanted rice. The yield difference between 100 per cent N through inorganic fertilizer and 75 per cent N + biofertilizer was not significant. The results imply that it is possible to substitiute 25 per cent of inorganic N through the inoculation of azolla or BGA without any loss of yield in transplanted rice.

From the results of the study, it can be recommended that for *rabi* rice in Tambiraparani command area, irrigation can be given immediately after disapperance of ponded water instead of continuous submergence. This practice would save about 29 per cent of irrigation water with only marginal yield reduction. For nitrogen management to *rabi* rice, 75 kg N ha^{-1} through inorganic fertilizer + azolla or BGA inoculation can be recommended for high yield and reduction of inorganic fertilizers by 25 per cent.

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EVALUATION OF CHILLI GERMPLASM FOR CAPSANTHIN AND CAPSAICIN CONTENTS AND EFFECT OF STORAGE ON GROUND CHILLI

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ABSTRACT

The two quality traits *viz* capsanthin and capsaicin contents were determined in 21 and 29 genotypes of chilli (*Capsicum annuum L*) in 1980 and 1981 respectively. Wide variation was observed in both the qualities in 1980 as well as in 1981 after storage of the materials for one year. Capsanthin content ranged from 0.144 to 0.407 per cent and capsaicin from 0.105 to 1.810 per cent in the different genotypes studied in 1980 and in 1981, they ranged from 0.057 to 0.400 and from 0.035 to 1.295 respectively. No correlation between these two quality traits was recorded. The reduction in capsanthin and capsaicin contents was lowest in "Ducale" and "IHR 309-4" genotypes respectively. It is infered that the higher the capsanthin and capsaicin contents in the genotypes, the higher the amount of loss in the storage.

KEY WORDS : Capsanthin, Capsaicin, Chilli, Genotypes, Storage

Chilli (*Capsicum annuum L*) is extensively cultivated in India and is marketed as whole fruit, powder, paste and oleoresin. It is used in cuisines all over the world. Several uses of capsicum have been reported (Bosland, 1992, Smith *et al.*, 1987). Red chilli is dehydrated and from dried pods, red chilli powder is made. The quality of red chilli is based on colour, pungency and retention of these ualities durin storaee. Colour in mature fruits c2. cl) (Hurtado-Hernandez and Smith, 1985). Further, red colour is attributed to the presence of about 20 carotenoids of which capsanthin is the major one. Pungency is another important quality. It is due to the mixture of 7 homologous branded-chain alkyl vanillyl amides namely capsaicinoids (Hoffman *et al.*, 1983) which are produced in glands on the placenta of the fruit. Dried capsicum powder is classified into 5 groups