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

K. WAHAB, V. VEERABADRAN and K. SRINIVASAN
Agricultural College and Research Institute
Tamil Nadu Agricultural University
Kilkuttam 627252

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-à-vis continuous submersion, field experiments were conducted at the Agricultural College, Kilkuttam 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 submersion. The practice of irrigation immediately after disappearance 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 submersion. 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 submersion. Past research elsewhere suggests that continuous submersion may not be always essential for higher grain yield and the practice of intermittent flooding gives yield comparable to continuous submersion (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, Kilkuttam. 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 (I1), irrigation immediately after disappearance of ponded water (I2), irrigation 2 days after disappearance of ponded water (I3), irrigation 4 days after disappearance of ponded water (I4) and irrigation 6 days after disappearance of ponded water (I5) were tried in the main plots. The sub plots treatments comprised the different nitrogen management practices, viz., 100 kg N ha⁻¹ as inorganic fertilizer (N1), 75 kg N + azolla (N2), 75 kg N + blue green algae (BGA) (N3) and 75 kg N + azolla + BGA (N4). Half of N was applied at planting and the remaining half in two equal splits at active tilling and panicle initiation stages. A common dose of 50 kg ha⁻¹ each of P₂O₅ and K₂O 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 tilling and grain development. Irrigation immediately after disappearance 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 (Ponnampetuma, 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 tilling. Here again, the reduction in straw yield due to intermittent irrigation was given immediately, 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 disappearance of ponded water instead of continuous submergence.

<table>
<thead>
<tr>
<th>Water Management</th>
<th>Grain yield (kg ha⁻¹)</th>
<th>Water used (mm)</th>
<th>Water use Efficiency (kg ha⁻¹ mm⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1 - Continuous Submergence</td>
<td>5625</td>
<td>5883</td>
<td>5754</td>
</tr>
<tr>
<td>I2 - Irrigation Immediately after DPW</td>
<td>3455</td>
<td>5483</td>
<td>5469</td>
</tr>
<tr>
<td>I3 - Irrigation 2 days after DPW</td>
<td>5290</td>
<td>5292</td>
<td>5291</td>
</tr>
<tr>
<td>I4 - Irrigation 4 days after DPW</td>
<td>3150</td>
<td>4958</td>
<td>5034</td>
</tr>
<tr>
<td>I5 - Irrigation 6 days after DPW</td>
<td>5127</td>
<td>4783</td>
<td>4955</td>
</tr>
</tbody>
</table>

(DPW : Disappearance of ponded water)
From the results of the study, it can be recommended that for *rabi* rice in Tambraraparani command area, irrigation can be given immediately after disappearance of ponded water instead of continuous submersion. 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.

**REFERENCES**


(Received: January 1995 Revised: August 1996)

---

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

PUSHA RANI

University of Connecticut, USA

**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 1.115 to 1.810 per cent in the different genotypes studied in 1980 and in 1981, they ranged from 0.037 to 0.400 and from 0.035 to 1.295 respectively. No correlation between these two quality traits was noticed. The reduction in capsanthin and capsaicin contents was lowest in "Duede" and 'IHR 393-4' genotypes respectively. It is inferred 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 qualities during storage. Colour in mature fruits is due 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 branched-chain allyl 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.