The Andhra Agric. J 56(1):1-3, 2009

Grain Yield and Water use Efficiency of Rice as Influenced by Transitions in Rice Cultivation in Krishna Western Delta Command Area of Andhra Pradesh

G Subbarao, D Kalpana, D Srinivas, B Mukunda Rao, P R K Prasad and T V Satyanarayana
A P Water Management Project, Bapatla 522 101, Andhra Pradesh.

ABSTRACT

In the farmers fields of Modukuru No.2 branch canal command of Krishna Western Delta, Guntur District of Andhra Pradesh, different lowland rice production systems have been studied for their grain yield and water use efficiency during *Kharif* 2005 and 2006. Among the rice production systems, System of Rice Intensification (SRI) recorded highest mean grain yield (6900 kg ha^{-1}) followed by Semi-dry Rice (6300 kg ha^{-1}) and rotational system of irrigation (5900 kg ha^{-1}) when compared to farmers practice of growing rice with continuous flooding (5000 kg ha^{-1}). SRI also resulted in higher mean water use efficiency (11.5 kg $ha.mm^{-1}$) when compared to farmers practice of flood irrigation (4.5 kg $ha.mm^{-1}$).

Key words : Efficiency, Grain yield, Rice, Transitions.

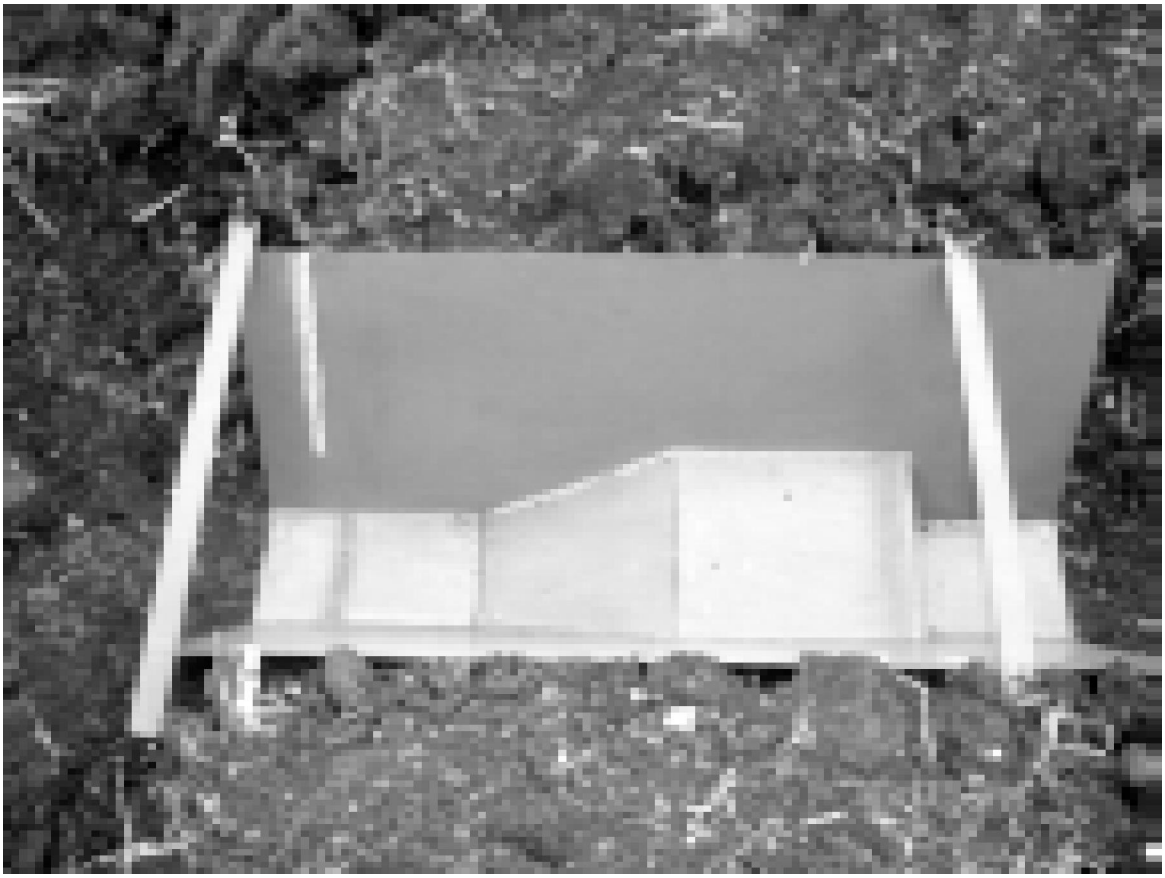
Agriculture is the largest water consumer in most river basins where irrigated rice forms the main activity. Andhra Pradesh state is presently under water scarce situation with per capita availability of water as 14000 cu.m. Rice continues to be the staple food of the region and is identified as one of the growth engines for the development of state (Anonymous 2003). In many irrigation projects the competition for water is increasing day by day and hence the intensive water use in traditional wet rice cultivation comes into question. Under this scarce water situation, different water saving rice production systems such as rotational system of irrigation, semi-dry rice and system of rice intensification (SRI) are receiving greater attention by the individuals and government. These systems reduce water input with similar or slightly higher yields than the rice grown with continuous flooding. Farmers in some parts of Asia who confront scarcity or high cost of water have already started to adopt these water saving technologies. However no systematic research on quantification of water used in these systems appears to have been conducted to understand the performance of water saving rice production systems and to advocate adoption of such systems in Andhra Pradesh. Hence the study was conducted to identify the best viable water saving rice production system with higher grain yield and water use efficiency suitable to Krishna Western Delta command of Andhra Pradesh.

MATERIAL AND METHODS

An experiment was conducted in the farmers field of Modukuru branch No. 2 Canal Command of Krishna Western Delta, Guntur district, Andhra Pradesh during *Kharif* 2005 and 2006 with 4 rice production systems. The soil was clay loam in texture with pH of 7.8 and ECe varying from 0.58-6.5 dS m^{-1}, low to medium in organic matter, medium to high in available P_2O_5 and high in available K_2O. The treatments include T_1: Transplanting with farmers method of irrigation (continuous flooding), T_2: Transplanting with rotational irrigation (irrigation once in 48h after disappearance of 5cm depth of water), T_3: Semi-dry rice (dry seeding, initially grown as rain fed crop & as and when water is available in canals i.e.45- 50 days after sowing the crop converted into wet), T_4: System of rice intensification (planting with younger seedlings of eight days old, field saturation up to panicle initiation stage there after 5cm depth of irrigation water), BPT-5204 was the test variety (long duration) sown during the 2nd week of July, 2005 and 2006. In treatments 1 and 2, 25 days old seedlings were transplanted at a spacing of 20 × 15cm. Dry seed @ 20 kg $acre^{-1}$ was sown with seed drill by adopting a spacing of 22.5cm in between the rows in case of semi-dry paddy (T_3). In SRI weeding was done with rotary weeder while manual weeding was adopted in other treatments. Fertilizer application, plant protection and other operations were common to all the

Table 1. Grain yield (kg ha^{-1}), depth of water applied (mm) and water use efficiency (kg ha^{-1} mm) in different rice production systems during *Kharif* 2005 and 2006.

System of rice cultivation	Grain yield (kg ha^{-1})			Depth of water applied (mm)			Water use efficiency (kg $ha.mm^{-1}$)		
	2005	2006	Mean	2005	2006	Mean	2005	2006	Mean
T_1: Farmers practice	4900	5100	5000	1100	1074	1087	4.4	4.7	4.5
T_2: Rotational irrigation	6000	5900	5900	707	821	764	8.5	7.2	7.8
T_3: Semi-dry	6600	6100	6300	828	714	771	8.0	8.5	8.3
T_4: SRI (System of Rice Intensification)	7000	6800	6900	572	580	576	12.2	11.7	11.5



treatments and adopted as per the recommendations. A Rainguage and RBC (Replogle, T.A, Bos, M.G and Clemmens, A.J.flume) flume (Fig.1) are installed near the experimental plot to measure the amount of rainfall received and also the quantity of irrigation water applied through irrigation channels during the crop growth period to each treatment. Data on yield, rainfall and depth of water given through irrigation channel during the crop growth period were recorded. Finally water use efficiency for all the systems was calculated.

RESULTS AND DISCUSSION

The results presented in Table 1 indicated that, SRI cultivation of rice registered higher grain yield of 7000 kg ha^{-1} and 6800 kg ha^{-1} during *Kharif* 2005 and 2006 respectively compared to other treatments. However the semi-dry cultivation of rice (T_3) also registered equal or slightly higher grain yield over farmers practice (T_1). The higher grain yield with SRI cultivation can be attributed to rotary weeding, keeping moisture condition of the field at saturation level, better aeration and optimum utilization of

nutrients which helped the plant to put forth better root system and plant growth thereby more number of productive tillers, more panicle length and filled grains over other systems. Abu Yamah (2002) and Bruno Andrianaivo (2002) have also reported similar positive results with SRI cultivation over traditional farmers practice.

SRI utilized the (mean) less quantity of 576mm water through irrigation 201mm and effective rainfall 375mm when compared to other treatments during the crop growth period. The mean percent of water saving in T_4, T_3 and T_2 over T_1 was 47, 29 and 30 respectively. A water saving of 40 % with moisture level at field saturation point was reported by Bhagat *et al*. (1999) when compared to continuous shallow ponding with similar yields. Higher mean water use efficiency (11.5 kg ha. mm^{-1}) was recorded with SRI cultivation followed by Semi-dry rice (8.3 kg ha. mm^{-1}) compared to farmers practice (4.5 kg ha.mm^{-1}). Similar results of higher water use efficiency and water saving was reported by Raju *et al*. (1992) with saturation level of moisture and alternate drying and wetting. However transplanting with rotational irrigation and semi-dry rice also resulted in high water use efficiency compared to farmers practice.

The results of the study indicated that the System of Rice intensification registered highest grain yield with higher water use efficiency when compared to traditional system of rice cultivation. However, semi-dry rice and rotational system of irrigation were also found to give similar or slightly higher grain yield with higher water use efficiency when compared to farmers practice of rice cultivation in Krishna Western Delta Command area of Andhra Pradesh.

LITERUATURE CITED

Abu Yamah 2002. The Practice of the System of Rice Intensification in SIERRA LEONE. World Visio Sierra Leone, PMB 59, Freetown, Sierra Leone.

Anonymous 2003. A document on water conservation mission, Government of Andhra Pradesh.

Bhagat R M, Bhuijan S I and Moody K 1999. Water, tillage and weed management options for wet seeded rice in the Philippines. Soil and Tillage Research 52: 51-58.

Bruno Andrianavio 2002. Evaluation of the System of Rice Intensification in Fiana rantsoa Province of MADAGASCAR. FOFIFA, Fianarantsoa.

Raju R A, Reddy M N and Ananda Reddy K 1992. Phasic water management for rice (*Oryza sativa*) in Godavari alluvials. Indian Journal of Agronomy 37 (1): 26-29.

(Received on 28.02.2008 and revised on 12.12.2008)