

## Effect of puddling methods, water regimes and NPK levels on yield, income and water use of boro rice (*Oryza sativa* L.)

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### ABSTRACT

The effect of puddling methods, water regimes and NPK levels on boro rice were studied in a field experiment at the ICAR Research Complex for Eastern Region, Patna. Power tiller puddling was better than that by tractor drawn cultivator. Continuous ponding for 10 days twice at tillering and flowering stages combined with intermittent irrigations during rest of the period was given better yield over intermittent irrigation during entire season. The crop has responded upto 150 per cent of recommended NPK schedule (100: 50: 40 kg N,  $P_2O_5$  and  $K_2O$   $ha^{-1}$ ). Maximum grain yield of 5.29 t  $ha^{-1}$  was recorded with power tiller puddling keeping continuous ponding for 10 days twice at tillering and flowering stages with 150 per cent recommended dose of NPK.

**Key words:** Puddling methods, NPK levels, yield, boro rice

Boro rice is popular in northeastern region of Bihar, West Bengal and Assam. In south Bihar, the soils are heavy in texture and puddling variation may cause difference in root environment and crop performance under various nutrient levels. Response of tillage and fertilizer schedules were also associated with water regimes. Application of right quantity of irrigation water and fertilizer in boro rice cultivation may help the farmers to overcome the problems related to irrigation and fertilizer, (Hussain *et al.*, 1998). The evaluation of interactive effect of all these factors is needed for recommendation of package of practices.

A field experiment was conducted at the Research Farm during 2000-01 and 2001-02 to find out the effect of puddling, NPK level and water regimes on the performance of boro rice. The soil was silty clay loam in texture with bulk density of 1.48g  $Cc^{-1}$  and particle density of 2.70g  $Cc^{-1}$ . The available N,  $P_2O_5$  and  $K_2O$  were 153, 14.8 and 190 kg  $ha^{-1}$ , respectively. Rice variety *Gautam* was sown in puddled soil on 20<sup>th</sup> and 19<sup>th</sup> November during 2000 and 2001, respectively using farm yard manure at 15 t  $ha^{-1}$ . Transplanting was done on Feb 14<sup>th</sup> and 12<sup>th</sup> during 2001 and 2002 respectively with seedlings of 85 days old under two tillage ( $T_1$ -Tractor drawn cultivator puddling and  $T_2$ -

Power tiller), two water regimes,  $WM_1$ - Irrigation at 3 days after disappearance (DAD) during whole crop period, and  $WM_2$ - Continuous submergence for 10 days at tillering and flowering stages and irrigation at 3 DAD during rest crop period and three NPK levels *viz.*, 100, 125 and 150 per cent of recommended dose (100: 50: 40 kg N,  $P_2O_5$  and  $K_2O$   $ha^{-1}$ ).

The experiment results revealed that continuous ponding for 10 days at tillering and flowering stages and rest irrigation at 3 DAD of ponded water produced significantly higher grain yield (5.03 t  $ha^{-1}$ ) over intermittent irrigation at 3 DAD during entire season (4.70 t  $ha^{-1}$ ). Tarafder and Saha, 2004 also recorded similar findings. So far, puddling method was concerned; the yield of tractor drawn cultivator puddling (4.64 t  $ha^{-1}$ ) was at par with power tiller (4.76 t  $ha^{-1}$ ) puddling. Application of 125 and 150 per cent of recommended dose (100: 50: 40) of NPK showed 14 and 27 per cent higher grain yield over recommended dose of NPK. Amin and Amin (1990) also opined alike. Combination of power tiller puddling with 10 days ponding twice and 150 per cent NPK recorded the highest yield of 5.29 t  $ha^{-1}$ . The lowest yield of 4.64 t  $ha^{-1}$  was under tractor puddling keeping water ponding at 3 DAD at recommended NPK dose.

Irrigation was differed based on the treatments. Total 17 irrigations with 860 mm depth of water was required under continuous ponding as against 12 irrigations with 620 mm depth of water, which was applied under 3 DAD during entire season. The water saving was 38%. Tractor puddling required less irrigation (720 mm) than power tiller puddling (760 mm) and the water saving was 6%. It was observed that application of higher dose of fertilizer required more irrigation than that in normal recommendation. Total 17 irrigations under 150 per cent and 15 irrigation under 125 per cent NPK were required as against 12 irrigation under 100 per cent NPK (Table 1). It indicated that the role of high nutrition on the removal of the moisture. It can also be inferred

The study on effect of puddling methods, water regimes and NPK levels in boro rice revealed that maximum grain yield and net return was recorded under power tiller puddling with continuous ponding for 10 days at tillering and flowering stages and intermittent irrigations for remaining growth period along with 150 per cent of recommended dose of fertilizer (150: 75: 60 kg NPK ha<sup>-1</sup>).

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**Table 1. Yield attribute grain, yield and economics of boro rice under various tillage, NPK and water management level**

Treatment	Plant height (cm)	Panicles nos.m <sup>-2</sup>	Panicle length (cm)	1000 grain weight (g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Cost of cultivation (Rs. ha <sup>-1</sup> )*	Net income (Rs. ha <sup>-1</sup> )
Water Management level								
WM <sub>1</sub> -Intermittent Irrigation ± 5cm at 3 DAD of ponded water during entire season	77.5	365	19.63	25.92	4.70	7.58	15,805	11,486
WM <sub>2</sub> -Continuous ponding for 10 days at tillering and flowering stage rest as WM <sub>1</sub>	81.3	379	20.18	26.80	5.03	7.64	15,805	13,165
CD (P= 0.05)	NS	NS	NS	NS	0.31	NS	NS	NS
Tillage								
T <sub>1</sub> - Tractor puddling	78.0	372	20.05	27.00	4.64	7.73	16,105	10,960
T <sub>2</sub> - Power tiller puddling	80.5	381	20.06	26.23	4.76	7.78	15,805	11,885
CD (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS
NPK Level								
F <sub>1</sub> - 100per cent NPK (100 : 60 : 40)	77.5	356	19.60	25.65	4.18	7.08	15,805	8,635
F <sub>2</sub> - 125per cent NPK (125 : 75 : 50)	80.1	373	20.21	26.70	4.78	7.45	16,441	11,186
F <sub>3</sub> - 150per cent NPK (150 : 90 : 60)	81.4	384	20.07	26.63	5.29	8.50	17,078	13,622
CD (P= 0.05)	1.1	NS	NS	0.96	0.20	0.65	845	3325

\* Price grain - Rs. 5000 q<sup>-1</sup> and straw - RS. 500 t<sup>-1</sup>

that utilization of nutrient is improved in presence of normal water regime. Maximum net income of Rs. 13,622 ha<sup>-1</sup> was recorded at 150 per cent NPK with power tiller puddling and continuous ponding for 10 days twice at tillering and flowering and rest irrigations at 3 DAD treatment. Net income was influenced by level of NPK followed by water regimes and puddling methods. The lowest net income of Rs.8635 was recorded in with 100 per cent NPK fertilizer dose.

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