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Effect of plant nutrient and weed management in direct wet seeded *boro* rice

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Abstract

The experiment was conducted at the *Farm* of Farm Management Division, Bangladesh Agricultural University, Mymensingh during December 2012 to June 2013 to find out the effect of plant nutrient and weed management in direct wet seeded *Boro* rice. The experiment consisted of six nutrient management viz. Control (No manure- PM and N-P-K-S-Zn), PM at 5 t ha^{-1}, recommended dose of prilled urea (PU) and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$, respectively), full dose of Urea Super Granules (USG) and other inorganic fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$, respectively) 2.7 g USG + PM at 5 t ha^{-1}, 2.7 g USG + PM at 2.5 t ha^{-1}; and three weeding regimes, *viz.* Unweeded control, hand weeding thrice at 20, 35 and 50 days after sowing (DAS); and Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS. The highest plant height (90.29 cm) was obtained in full dose of USG and other inorganic fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$ respectively) and the lowest one (82.42 cm) was from control (No manure- PM and N-P-K-S-Zn). The highest number of effective tillers $hill^{-1}$ (14.00) was obtained in recommended dose of PU and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N_2, P_2O_5, K_2O, S and $ZnSO_4$ respectively) whereas the lowest effective tillers $hill^{-1}$ 9.15 was obtained from control (No manure- PM and N-P-K-S-Zn). The highest number of grains $panicle^{-1}$ (75.23) was observed in nutrient 2.7 g USG + PM at 5 t ha^{-1} and the lowest one (59.01) was obtained from PM at 5 t ha^{-1}.The highest plant height (90.57 cm) was obtained in Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS and lowest plant height (83.98 cm) was obtained in un weeded control. The maximum grain yield (3.71 t ha^{-1}) was obtained from the application of 2.7 g USG + PM at 2.5 t ha^{-1} and the lowest (1.15 t ha^{-1}) was from control (No manure- PM and N-P-K-S-Zn). The highest grain yield (3.8 t ha^{-1}) was obtained in Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS and the lowest one (1.26 t ha^{-1}) was obtained from unweded control. In case of interaction, the highest number of effective tillers $hill^{-1}$ (17.00) was obtained in recommended dose of PU and other inorganic fertilizers (i.e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$ respectively) with hand weeding thrice at 20, 35 and 50 DAS and the lowest one (7.27) was observed in control (No manure- PM and N-P-K-S-Zn) with no weeding. The highest grain yield (5.29 t ha^{-1}) was obtained in 2.7 g USG + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS which was statistically identical with 2.7 g USG + PM at 5 t ha^{-1} and Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS and the lowest grain yield (0.65 t ha^{-1}) was obtained in the interaction of unweeded and unfertilized control (No manure- PM and N-P-K-S-Zn). *Boro* rice (cv. BRRI dhan28) can be cultivated with 2.7 g USG applied at the centre of the four hills in each alternate row + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS for appreciable grain yield.

Key words: Plant nutrient, weed management, direct wet seeded, *boro* rice, USG

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Introduction

Rice is the staple food crop in Bangladesh and the cropping pattern of the country is predominately rice based and the most dominated cropping pattern is *boro* -T. Aman rice. Out of the total production in this country about 48%, 45% and 7% come from *boro, Aman* and *Aus* crop, respectively (BBS, 2012). In Bangladesh, rice dominates over all other crops and covers 77% of the total cropped area and 93% farmers grow rice (BBS, 2011). The total area and production of rice in Bangladesh are about 11.7 million hectares and 31.88 million tons respectively (BBS, 2011). The increasing rate of population is 1.42% (BBS, 2012) and decreasing rate of agricultural land is 1% per annum (Hussain *et al*., 2006), which limit the horizontal expansion of rice area. To overcome this situations increment in rice production unit-1 area is the only alternative to bring self-sufficiency in food production. Weeds are the major cause of yield loss in upland rice and its control is labour intensive. The climate as well as the edaphic condition of Bangladesh is favourable for the luxuriant growth of weeds. A reduction in grain yield by 40% was recorded for *boro* rice in Bangladesh (Haque *et al*., 2012). The soil fertility status of Bangladesh is gradually declining day by day. Most of the soils of Bangladesh have organic matter less than 1.5% and in many cases it is less than 1% (BARC, 2012). Improper soil management practices and long time intensive use of chemical fertilizers create some fertility problems through soil exhaustion as well as through interactions with other elements causing micronutrients deficiency (Rahman and Main, 1997). In addition, favourable climatic condition for microbial activities throughout the year may be responsible for this. The application of poultry manure to soil is considered as a good management practice in any agricultural production system because of the stimulation of soil microbial growth and activity, subsequent mineralization of plant nutrients, and increased soil fertility and quality (Arancon *et al.,* 2006). Poultry manure may play a vital role in soil fertility management as well as supplying primary, secondary and micronutrients for crop production. So, emphasis should be given to increase the *boro* rice yield through the adoption of proper management especially weed control and nutrient management that might be technically effective and feasible, economically viable, socially acceptable and environmentally sound. Roy *et al.* (2015) reported that inorganic fertilizers along with manure greatly influenced the yield contributing characters and yield of *boro* rice. Application of poultry manure along with inorganic fertilizers increased grain yield, protein content and aroma in aromatic fine rice (Sarkar *et al.,* 2014). Hasan *et al.* (2004) also stated that BRRI dhan34 fertilized with 75% NPKS + poultry manure at 5 t ha^{-1} produced the highest grain yield than Kalizira. The response of *boro* rice to poultry manure and combined with inorganic fertilizer and weed management are scarce under Bangladesh condition. Judicious nutrient management increases crop yield and at the same time reduces fertilization cost. Therefore, the present study was undertaken to observe the effect of plant nutrient and weed management in direct wet seeded *boro* rice.

Materials and Methods

The experiment was conducted at the *Farm of Farm Management Division*, Bangladesh Agricultural University, Mymensingh from December 2012 to June 2013. The experimental site belongs to the Old Brahmaputra floodplain (AEZ-9) with non-calcareous dark-grey floodplain soil. The land was medium high with silty loam texture having pH 6.8, available N 0.13%, P 13.9 ppm, organic carbon 0.93%, K 16.3 ppm and low in organic matter content**.**

The experiment consisted of six nutrient management viz. Control (No manure- PM and N-P-K-S-Zn), PM at 5 t ha^{-1}, recommended dose of prilled urea (PU) and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$, respectively), full dose of Urea Super Granules (USG) and other inorganic

fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$, respectively), 2.7 g USG + PM at 5 t $ha^{-1}$and 2.7 g USG + PM at 2.5 t ha^{-1} and three weeding regimes *viz.*Unweeded control, hand weeding thrice at 20, 35 and 50 days after sowing (DAS) and Panida (Pandimethalin) @ 2.5 l ha^{-1}+ hand weeding once at 20 DAS. The experiment was laid out in a randomized complete block design with three replications. The size of unit plot was 4.0 m × 2.5 m. The distances between blocks and plots were 1 m and 75 cm, respectively. Sprouted seeds of BRRI dhan28 were sown on puddled field having no standing water on 15 February 2013 with four seeds $hill^{-1}$ at 25 cm ×15 cm spacing. The land was fertilized with as per treatment specification. Whole amount of TSP, MoP, gypsum, zinc sulphate and PM were applied at final land preparation. Urea was applied in three equal splits as top dressing at 15, 30 and 50DAS. As per experimental specification USG were placed at 8 cm depth at 15 DAS in the center of four hills in each alternate row with hand using a graduated bamboo stick.

Five hills (excluding border rows) from each plot were randomly selected, uprooted and properly tagged prior to harvest for recording data on crop characters and yield components. The crop of central 5 m^2 area of each plot was harvested on 25 June 2013. The harvested crop was bundled plot-wise separately, tagged properly and brought to the clean threshing floor. The bundles were sun dried, threshed and then grains were cleaned and weighed. The grain yield was adjusted to 14% moisture content. Straws were also sundried properly. Grain and straw yields were then converted to t ha^{-1}.

The collected data were analyzed statistically following the ANOVA technique and the mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984) using a statistical computer package program MSTAT-C.

Results and Discussion

***Effect on crop characters and yield components*:** Yield components such as number of effective tillers $hill^{-1}$, number of grains $panicle^{-1}$ and 1000-grain weight were influenced significantly due to plant nutrient management and weeding regime. The results showed that plant height differed significantly due to integrated fertilizer management. The highest plant height (90.29 cm) was obtained in full dose of USG and other inorganic fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$, respectively) and lowest one (82.42) cm was from control (No manure- PM and N-P-K-S-Zn) (Table 1). The highest number of effective tillers $hill^{-1}$ (14.00) was obtained in recommended dose of prilled urea (PU) and other inorganic fertilizers (i.e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$, respectively) whereas the lowest effective tillers $hill^{-1}$(9.15) was obtained from control (No manure- PM and N-P-K-S-Zn) (Table 1). Number of grains $panicle^{-1}$ was significantly influenced by plant nutrient management. T he highest number of grains $panicle^{-1}$ (75.23) was observed in 2.7 g USG + PM at 5 t ha^{-1} and the lowest (59.01) was obtained from PM at 5 t ha^{-1}(Table 1). In case of weed management, the highest plant height (90.57 cm) was obtained in Panida (Pandimethalin) @ 2.5 l/ha and hand weeding once at 20 DAS and the lowest plant height (83.98 cm) was obtained in unweeded control (Table 2).The highest number of effective tillers $hill^{-1}$ (13.37) was obtained in hand weeding thrice at 20, 35 and 50 DAS and the lowest (9.57) from unweeded control (Table 2). The highest number of effective tillers $hill^{-1}$ (17.00) was obtained in the interaction between recommended dose of PU and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N_2, P_2O_5, K_2O, S and $ZnSO_4$ respectively) with hand weeding thrice at 20, 35 and 50 DAS and the lowest one (7.27) was observed in unfertilized (No manure-PM and N-P-K-S-Zn) with unweeded control (Table 3). Datta and Gagot (1995) reported that hand weeding significantly lowered weed population thereby

increasing number of tillers. Panicle length was significantly influenced by the interaction between plant nutrient management and weed management. The highest panicle length (21.69 cm) was obtained from the interaction between recommended dose of PU and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P^2O_5, K_2O, S and $ZnSO_4$, respectively) with hand weeding thrice at 20, 35 and 50 DAS and the lowest one (16.66 cm) was obtained in PM at 5 t ha^{-1} combined with unweeded control (Table 3). Number of grains $panicle^{-1}$ was significantly influenced by plant nutrient management. The number of grains $panicle^{-1}$ ranged from 56.27 to 85.36. The highest number of grains $panicle^{-1}$ (85.36) was observed in 2.7 g USG + PM at 2.5 t ha^{-1} which was statistically identical with 2.7 g USG + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS the lowest number of grains (56.27) was found in unweeded control with unfertilized (No manure- PM and N-P-K-S-Zn) (Table 3). The findings are in agreement with that of Hasan *et al*., (2004). The highest 1000-grain weight (24.29 g) was recorded in the interaction of full dose of USG and other inorganic fertilizers (i.e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$ respectively) with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS whereas the lowest one (20.48 g) was found in unfertilized control combined with unweeded control.

***Effect on grain yield*:** A remarkable change of grain yield was observed due to the weeding regime and integrated nutrient management and their interaction. The highest grain yield (3.71 t ha^{-1}) was obtained from the application of 2.7 g USG + PM at 2.5 t ha^{-1} and the lowest one (1.15 t ha^{-1}) was in control (No manure- PM and no N-P-K-S-Zn) (Table 1).The highest grain yield (3.8 t ha^{-1}) was obtained Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS and the lowest (1.26 t ha^{-1})was obtained from unweeded control (Table 2).The highest grain yield (5.29 t ha^{-1}) was obtained from the application of 2.7 g USG + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l/ha and hand weeding once at 20 DAS, which was statistically identical with 2.7 g USG + PM at 5 t ha^{-1} and Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS and the lowest grain yield (0.65t ha^{-1}) was obtained in the unweeded control combined with no manuring control (No manure- PM and N-P-K-S-Zn)(Table 3). Islam *et al*. (2015) reported that combined application of poultry manure and nitrogenous fertilizer increased grain yield and harvest index in transplant *aman* rice.

***Effect on straw yield*:** Straw yield was significantly influenced by, plant nutrient management, weeding regime and their interaction. The straw yield (6.06 t ha^{-1}) was recorded in recommended dose of PU and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$, respectively) and the lowest one (3.68 t ha^{-1}) was obtained in no manuring control (Table 1) Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS produced the highest straw yield (6.39 t ha^{-1}) which was statistically identical with hand weeding thrice at 20, 35 and 50 DAS and the lowest one (3.92 t ha^{-1}) was obtained in unweeded control (Table 2). The highest straw yield (7.36 t ha^{-1}) was obtained from the interaction from recommended dose of PU and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$, respectively) with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS, the lowest one (2.62 t ha^{-1}) was obtained from unweeded control combined with no manuring control (No manure- PM and N-P-K-S-Zn) (Table 3). Poultry manure in combination with chemical fertilizers demonstrated superior effect in producing straw yield of *boro* rice as compared to sole application of chemical fertilizers.

***Effect on harvest index*:** Harvest index was significantly influenced by the plant nutrient management, weeding regime and their interaction**.** The highest harvest index (36.94 %) was found in 2.7 g USG + PM at 2.5 t $ha^{-1}$and the lowest one (23.46 %) was obtained from control (No manure- PM and N-P-K-S-Zn) (Table 1).The highest harvest index (36.37 %) was found in Panida (Pandimethalin) @ 2.5 lha^{-1} and

hand weeding once at 20 DAS and the lowest one (23.97 %) was obtained in unweeded control (Table 2). The highest harvest index (44.21 %) was recorded from the interaction of 2.7 g USG + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l/ha and hand weeding once at 20 DAS and the lowest one (20.26 %) from unweeded control with PM at 5 t ha^{-1} interaction (Table 3). The results are in conformity with that of Hossain (2012).

Table 1. Effect of plant nutrient management on crop characters, yield components and yield of direct wet seeded *boro* rice

Plant nutrient	Plant height (cm)	No. of effective tillers $hill^{-1}$	Panicle length (cm)	No. of grains $panicle^{-1}$	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
T_1	82.42^{c}	9.156^{c}	18.52^{bc}	63.26^{ab}	22.48	1.15^{c}	3.68^{c}	23.46^{c}
T_2	88.75^{ab}	11.84^{bc}	18.51^{bc}	59.01^{b}	22.70	1.67^{c}	4.84^{b}	24.44^{bc}
T_3	90.02^{a}	14.00^{a}	20.65^{a}	67.90^{ab}	22.40	3.19^{b}	6.06^{a}	33.56^{b}
T_4	90.29^{a}	12.76^{b}	19.20^{ab}	67.90^{ab}	22.55	3.37^{ab}	5.89^{ab}	35.59^{ab}
T_5	88.34^{ab}	11.76^{bc}	17.84^{c}	75.23^{a}	22.67	3.38^{ab}	5.65^{ab}	34.86^{b}
T_6	87.48^{b}	12.49^{b}	18.92^{b}	72.13^{ab}	22.61	3.71^{a}	5.77^{ab}	36.94^{a}
$S\bar{x}$	4.392	2.149	0.90	4.760	0.28	0.20	0.439	2.504
Level of Significance	*	*	*	*	NS	**	**	**

In a column, figures with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT); ** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not-significant; T_1: Control (No manure- PM and N-P-K-S-Zn); T_2 : PM at 5 t ha^{-1}; T_3: Recommended dose of prilled urea (PU) and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$,respectively); T_4: Full dose of Urea Super Granules (USG) and other inorganic fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$ respectively); T_5: 2.7 g USG + PM at 5 t ha^{-1}; T_5: 2.7 g USG + PM at 2.5 t ha^{-1}

Table 2. Effect of weed management on crop characters, yield components and yield of direct wet seeded *boro* rice

Weed management	Plant height (cm)	No. of effective tillers $hill^{-1}$	Panicle length (cm)	No. of grains $panicle^{-1}$	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
W_0	83.98^{b}	9.57^{c}	18.11^{b}	57.17^{b}	20.58^{b}	1.26^{b}	3.92^{b}	23.97^{b}
W_1	89.10^{ab}	13.37^{a}	19.38^{a}	71.22^{ab}	23.22^{a}	3.13^{ab}	5.63^{ab}	34.04^{a}
W_2	90.57^{a}	13.0^{ab}	19.33^{ab}	76.72^{a}	23.91^{a}	3.84^{a}	6.39^{a}	36.37^{a}
$S\bar{x}$	4.39	2.14	0.90	4.76	0.28	0.20	0.43	2.50
Level of Significance	*	**	*	**	**	**	**	**

In a column, figures with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT); ** = Significant at 1% level of probability, * = Significant at 5% level of probability; NS = Not significant; W_0 : No weeding; W_1: Hand weeding thrice at 20, 35 and 50 days after sowing (DAS); W_2 : Panida (Pandimethalin) @ 2.5 l/ha and hand weeding once at 20 DAS.

Table 3. Effect of interaction between plant nutrient and weed management on crop characters, yield components and yield of direct wet seeded *boro* rice

Interaction (Plant nutrient × Weed management)	Plant height (cm)	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
$T_1 \times W_0$	77.48	7.27^{d}	18.64^{bcd}	56.27^{d}	20.48^{d}	0.6533^{g}	2.620^{j}	20.43^{de}
$T_1 \times W_1$	82.21	10.27^{bcd}	18.69^{bcd}	65.54^{bc}	23.53^{abc}	1.167^{efg}	3.880^{hi}	23.65^{cde}
$T_1 \times W_2$	87.57	9.933^{bcd}	18.23^{bcd}	67.98^{bc}	23.43^{abc}	1.640^{ef}	4.547^{fgh}	26.29^{cde}
$T_2 \times W_0$	84.03	8.133^{cd}	16.66^{d}	56.60^{d}	20.72^{d}	0.8067^{fg}	3.207^{ij}	20.26^{e}
$T_2 \times W_1$	92.07	13.60^{abc}	19.27^{abc}	58.83^{cd}	24.06^{ab}	1.563^{ef}	5.397^{cdef}	22.12^{de}
$T_2 \times W_2$	90.16	13.80^{abc}	19.60^{abc}	61.62^{c}	23.33^{bc}	2.653^{d}	5.930^{bcd}	30.94^{bc}
$T_3 \times W_0$	85.50	10.20^{bcd}	19.55^{abc}	56.67^{c}	20.39^{d}	1.667^{e}	5.170^{defg}	24.59^{cde}
$T_3 \times W_1$	91.65	17.00^{a}	21.69^{a}	66.13^{bc}	22.72^{c}	3.650^{c}	5.663^{bcdef}	39.31^{a}
$T_3 \times W_2$	92.90	14.80^{ab}	20.71^{ab}	80.90^{ab}	24.09^{ab}	4.277^{bc}	7.363^{a}	36.78^{ab}
$T_4 \times W_0$	86.47	10.47^{bcd}	18.52^{bcd}	61.49^{c}	20.61^{d}	1.837^{e}	4.723^{efgh}	28.64^{cd}
$T_4 \times W_1$	94.87	16.80^{ab}	19.39^{abc}	75.87^{b}	22.74^{c}	3.877^{c}	5.840^{bcde}	39.92^{a}
$T_4 \times W_2$	89.54	11.00^{abcd}	19.70^{abc}	80.67^{ab}	24.29^{a}	4.410^{bc}	7.127^{ab}	38.22^{ab}
$T_5 \times W_0$	83.90	9.867^{bcd}	17.28^{cd}	55.00^{d}	20.67^{d}	4.410^{bc}	3.780^{hi}	23.37^{cde}
$T_5 \times W_1$	89.20	11.97^{abcd}	18.01^{cd}	85.36^{a}	23.11^{c}	4.210^{bc}	6.480^{abc}	39.39^{a}
$T_5 \times W_2$	91.92	13.43^{abc}	18.21^{bcd}	85.33^{ab}	24.21^{ab}	4.800^{ab}	6.697^{ab}	41.81^{a}
$T_6 \times W_0$	86.49	11.51^{abcd}	18.01^{cd}	57.00^{cd}	20.59^{d}	1.503^{ef}	4.047^{ghi}	26.53^{cde}
$T_6 \times W_1$	84.59	10.60^{bcd}	19.21^{abc}	75.56^{b}	23.14^{c}	4.343^{bc}	6.563^{abc}	40.08^{a}
$T_6 \times W_2$	91.35	15.37^{ab}	19.53^{abc}	83.84^{ab}	24.10^{ab}	5.293^{a}	6.700^{ab}	44.21^{a}
$S\bar{x}$	4.393	2.149	0.90	4.760	0.2887	0.2000	0.4397	2.504
Level of Significance	NS	*	*	*	*	**	**	*

In a column, figures with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). ** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not-significant; T_1 : Control (No manure- PM and N-P-K-S-Zn); T_2 : PM at 5 t ha^{-1}; T_3: Recommended dose of prilled urea (PU) and other inorganic fertilizers (i. e. 120, 60, 40, 10 and 5 kg of N, P_2O_5, K_2O, S and $ZnSO_4$ respectively); T_4: Full dose of Urea Super Granules (USG) and other inorganic fertilizers (i. e. 60, 40, 10 and 5 kg of P_2O_5, K_2O, S and $ZnSO_4$ respectively); T_5: 2.7 g USG + PM at 5 t ha^{-1}; T_6: 2.7 g USG + PM at 2.5 t ha^{-1}; W_0 : No weeding; W_1: Hand weeding thrice at 20, 35 and 50 days after sowing (DAS); W_2 :Panida (Pandimethalin) @ 2.5 l/ha and hand weeding once at 20 DAS.

Conclusion

From the present study it can be concluded that *Boro* rice can be cultivated with 2.7 g USG at the centre of four hills in each alternate row + PM at 2.5 t ha^{-1} with Panida (Pandimethalin) @ 2.5 l ha^{-1} and hand weeding once at 20 DAS for appreciable grain yield. This practice will in turn be beneficial for soil health and environment.

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