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Yield Performance of Two HYV Transplant *Aman* Rice under Different Nutrient Management Practices

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ABSTRACT

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, Bangladesh to investigate the influence of plant nutrient management on the yield performance of transplant *Aman* rice. The experiment comprised two *Aman* rice varieties *viz.* Binadhan-15 and Binadhan-16, and ten nutrient management viz. Recommended dose of inorganic fertilizer (RDF) Urea-TSP-MoP-Gypsum-$ZnSO_4$ @ 150-110-70-60-5 kg ha^{-1}, Cowdung @ 10 t ha^{-1}, Poultry manure @ 5 t ha^{-1}, Vermicompost @ 3 t ha^{-1} , 25% less than RDF + cowdung @ 5 t ha^{-1}, 50% less than RDF + cowdung @ 10 t ha^{-1} , 25% less than RDF + poultry manure @ 2.5 t ha^{-1}, 50% less than RDF + poultry manure @ 5 t ha^{-1}, 25% less than RDF + vermicompost @ 1.5 t ha^{-1}, 50% less than RDF + vermicompost @ 3 t ha^{-1}. The experiment was laid out in a randomized complete block design with three replications. Binadhan-15 produced taller plants (97.86 cm), effective tillers $hill^{-1}$ (6.28), grains $panicle^{-1}$ (101.73), higher grain (3.58 t ha^{-1}) and straw (4.99 t ha^{-1}) yields compared to Binadhan-16. In case of nutrient management, 50% less than RDF + poultry manure @ 5 t ha^{-1} produced taller plants (101.1 cm), effective tillers $hill^{-1}$ (7.07), grains $panicle^{-1}$ (105.1) and grain yield (4.08 t ha^{-1}). The highest grain yield (4.25 t ha^{-1}) was recorded in Binadhan-15 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1} and the lowest grain yield (2.28 t ha^{-1}) was obtained in Binadhan-16 fertilized with vermicompost @ 3 t ha^{-1}. So, it can be concluded that transplant *Aman* rice cv. Binadhan-15 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1} appears as the promising practice to obtain the highest grain yield.

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Introduction

Bangladesh is predominantly an agrarian country where the agriculture sector contributes about 14.23 % to the country's gross domestic product (GDP) and employs around 40.60 % of total labour force (BBS, 2019). Agriculture in Bangladesh is mainly rice based as it is consumed as the staple food by 164 million people of our country and production of rice contributes one half of the agricultural GDP and one sixth of the national income in Bangladesh (BBS, 2018). Bangladesh is third among the rice producing countries of the world (Childs, 2020) since the geographic and agro-ecological conditions of Bangladesh are very congenial for rice cultivation. Among different rice group in Bangladesh, transplant *Aman* rice is the most important that contributed a lot to the total yield of rice. The area and production of milled rice are about 11.52 million hectares and 36.39 million tons, respectively (BBS, 2019) in Bangladesh. Among the total rice production, *Aman* rice occupies about 5.62 million hectares of land with an annual production of 14.06 million tons (BBS, 2019) by utilizing varied soil fertility levels and nutrient management. In case of rice production, variety plays an important role. Selection of an improved and certified rice varieties can play an important role in increasing rice productivity (Chandio and Yuansheng, 2018). Among different transplant *Aman* rice, Binadhan-15 and Binadhan-16 are the two promising varieties released by Bangladesh Institute of Nuclear Agriculture (BINA). The average yield of *Aman* rice (2.5 t ha^{-1}) (BBS, 2019) in Bangladesh is very low compared to other rice growing countries of Asia because of an increasing rate of population (1.37%) (BBS, 2019) and decreasing rate of agricultural land (1%) per annum (Hussain et al., 2006) which limits the horizontal expansion of rice area. However, now a days, cropping intensity of Bangladesh is

197% (BBS, 2019) and the organic matter content of most of our soils is below 1.5%, and in many cases, it is less than 1% (BARC, 2005). That's why, to overcome this situation, an increase in rice production per unit area by nutrient management is the only alternative to bring self-sufficiency in food production. In all the agricultural systems, there is an irresistible a loss of plant nutrients. To maintain good soil health and optimum yields, agricultural fields should be treated with combined application of organic manures and inorganic fertilizers which accelerates microbial activity, increases nitrogen use efficiency and enhances the availability of native nutrients to plants, resulting in higher nutrient uptake rates (Narwal and Chaudhary, 2006; Lakshmi et al., 2012). Cowdung and poultry manure can play an important role to improving soil fertility status by supplying nutrients like nitrogen (N), sulfur (S), potassium (K), and zinc (Zn) and also a good source of organic matter in rice crop production (Khanam et al., 2001; Mitchell and Tu, 2006). On the other hand, vermicompost as a soil additive increases both cation-exchange and water-retention capacities and provides nutrients in the required amounts as it reduces the use of mineral fertilizers (Tejada and Gonzalez, 2008). In addition, by maintaining a balanced combination of organic and inorganic fertilizer in one side environment, soil and lives will remain safe. On the other hand, farmers cost of production will be reduced as well as productivity will also be increased. Again, yield performance of two HYV transplant *Aman* rice varieties *viz.* Binadhan-15 and Binadhan-16 under different nutrient management practices are limited in the world's research. Therefore, the present investigation was, therefore, undertaken to observe the effect of nutrient management on the yield performance of transplant *Aman* rice varieties.

Materials and Methods

Experimental Site and Experimentation

The research work was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (24°75' N latitude and 90°50' E longitude at an altitude of 18 m above the sea level), Mymensingh which belongs to the non-calcareous dark grey floodplain soil under the Old Brahmaputra Floodplain Agroecological Zone (AEZ 9) (UNDP and FAO, 1988) during July to December 2017. The field was a medium high flat land with well drained silty-loam texture having pH, organic matter, total nitrogen, available phosphorus (P_2O_5) and potassium of the soil ranged from 5.9-6.5, 0.93%, 0.13%, 16.3 ppm and 0.28%, respectively (Chakraborty et al., 2020). The experiment consisted of two *Aman* rice varieties *viz.* Binadhan-15 and Binadhan-16 and ten nutrient management viz. Recommended dose of inorganic fertilizer (RDF) urea-TSP-MoP-Gypsum-$ZnSO_4$ @ 150-110-70-60-5 kg ha^{-1}, Cowdung @ 10 t ha^{-1}, Poultry manure @ 5 t ha^{-1}, Vermicompost @ 3 t ha^{-1} , 25% less than RDF + cowdung @ 5 t ha^{-1}, 50% less than RDF + cowdung @ 10 t ha^{-1} , 25% less than RDF + poultry manure @ 2.5 t ha^{-1} , 50% less than RDF + poultry manure @ 5 t ha^{-1}, 25% less than RDF + vermicompost @ 1.5 t ha^{-1}, 50% less than RDF + vermicompost @ 3 t ha^{-1}. The experiment was laid out in a randomized complete block design with three replications.

Crop Husbandry

Seeds of tested varieties were sown in the nursery beds on 5 July 2017. The experimental land was first opened with a tractor drawn disc plough followed by puddled thoroughly by repeated ploughing and cross ploughing with a country plough and subsequently levelled by laddering on 10 August 2017. Then, at the time of final land preparation, respective unit plots were fertilized with different levels of cowdung, vermicompost, poultry manure according to treatments. The manures were thoroughly mixed with the soil. The amount of nitrogen, phosphorus, potassium, sulphur and zinc required for each unit plot was calculated on ha^{-1} basis and applied in the form of urea, triple super phosphate muriate of potash, gypsum and zinc sulphate, respectively. Triple super phosphate, muriate of potash, gypsum and zinc sulphate were applied at final land preparation as per treatment requirements. Urea was applied in three equal splits at 15, 30 and 45 days after transplanting (DAT). Thirty-five days old seedlings were transplanted on 11 August 2017 maintaining a spacing of 25 cm × 15 cm using 2-3 seedlings $hill^{-1}$. Intercultural operations were done as and when necessary for ensuring and maintaining the normal growth of the crop.

Sampling, Harvesting and Processing

Five hills (excluding border hills and central 1.0 × 1.0 m) area were selected randomly from each unit plot. The selected plants were uprooted to record data on crop characters and yield contributing characters. After sampling, central 1.0 × 1.0 m was harvested at full maturity. Binadhan-15 was harvested on 15 November whereas Binadhan-16 was harvested on 18 November. The harvested crops of each plot were separately bundled, properly tagged and then brought to the threshing floor. Threshing was done manually. The grains were cleaned and sun dried to the moisture content of 14%. Straws were also dried properly. Finally grain and straw yields per plot were recorded and converted to t ha^{-1}.

Statistical Analysis

The collected data were compiled and tabulated in proper form for statistical analysis. Data were analyzed following the analysis of variance (ANOVA) technique and mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Varietal Performance

Yield and yield contributing characters of *Aman* rice differed significantly due to varietal differences except for plant height, number of non-effective tillers $hill^{-1}$ and harvest index (Table 1). The higher number of total tillers $hill^{-1}$ (7.44) and effective tillers $hill^{-1}$ (6.28) was recorded from Binadhan-15, while the lowest number of total tillers $hill^{-1}$ (7.21) and effective tillers $hill^{-1}$ (6.01) was found in Binadhan-16. The differences in producing tillers $hill^{-1}$ is assessed might be due to the variation in genetic constituents between the variety. Due to varietal characteristics production of total tillers $hill^{-1}$ and effective tillers $hill^{-1}$ varied significantly (Ray et al., 2015; Chowdhury et al., 2016). The longest panicle (21.63 cm) was obtained in Binadhan-15 compared to Binadhan-16 (21.00 cm). This result might be due to the genetic characteristics of the variety which were influenced by heredity. Panicle length was significantly influenced by variety (Shaha et al., 2014; Chakraborty et al., 2020). The highest number of grains panicle^{-1} (101.73) and total spikelets panicle^{-1} (113.86) was achieved from Binadhan-15, while the lowest number of grains panicle^{-1} (94.42) and total spikelets panicle^{-1} (107.00) was received in Binadhan-16. The lowest number of sterile spikelets panicle^{-1} (12.13) was recorded from Binadhan-15 and the highest number of sterile spikelets panicle^{-1} (12.59) was found in Binadhan-16. The highest 1000-grains weight (23.87 g) was obtained from Binadhan-15 and the lower 1000-grain weight (23.14 g) was recorded in Binadhan-16. Different sizes of the spikelets produced by the varieties that were partly controlled by genetic make-up of the varieties were mainly responsible for this variation in 1000-grains weight. Similar results were also reported by Jisan et al. (2014) and Sarkar et al. (2014). The highest grain (3.58 t ha^{-1}) and straw yield (4.99 t ha^{-1}) were recorded in Binadhan-15, while the lowest grain (3.08 t ha^{-1}) and straw yield (4.31 t ha^{-1}) were produced in Binadhan-16. Yield differences might be due to the genetic differences of the varieties and it varies from variety to variety. The highest grain yield might be due to the fact that Binadhan-15 performed best in terms of yield contributing characteristics, which ultimately contributed to the highest grain yield. On the other hand, the highest number of total tillers hill^{-1} and other vegetative characters were responsible for the highest straw yield. Significant variation of grain and straw yield among the rice genotypes were reported elsewhere (Tyeb et al., 2013; Pal et al., 2016; Adhikari et al., 2018).

Effect of Nutrient Management

Nutrient management had a significant effect on all yield contributing characters and yield of *Aman* rice except panicle length (Table 2). The tallest plant (101.10 cm) was recorded from 50% less than RDF + poultry manure @ 5 t ha^{-1} which was at par with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and recommended dose of inorganic fertilizer, while the shortest plant (94.17 cm) was found with vermicompost @ 3 t ha^{-1}. The highest number of total tillers hill^{-1} (8.06) and effective tillers hill^{-1} (7.07) were obtained in 50% less than RDF + poultry manure @ 5 t ha^{-1}, while the lowest number of total tillers hill^{-1} (6.71) and effective tillers hill^{-1} (5.37) were found when fertilized with vermicompost @ 3 t ha^{-1}. It is may be due to the enhanced and continuous supply of nutrients by the combination of poultry manure and inorganic fertilizer which probably favored the cellular activities during formation and development which led to better tiller production. Paul et al. (2019) reported that the combined application of inorganic fertilizers and poultry manure increased total and effective tillers hill^{-1}. The lowest non-effective tillers hill^{-1} (0.99) was achieved from 50% less than RDF + poultry manure @ 5 t ha^{-1} and the highest non-effective tillers hill^{-1} (1.34) was received when fertilized with vermicompost @ 3 t ha^{-1}. The highest number of grains panicle^{-1} (105.10) was recorded from 50% less than RDF + poultry manure @ 5 t ha^{-1} and the lowest number of grains panicle^{-1} (90.63) was found in vermicompost @ 3 t ha^{-1}. Number of grains panicle^{-1} increased with combined application of manures and inorganic fertilizers were reported elsewhere (Sarkar et al., 2016; Jahan et al., 2017; Paul et al., 2020). The lowest number of sterile spikelets panicle^{-1} (10.70) was obtained from 50% less than RDF + poultry manure @ 5 t ha^{-1} and the highest number of sterile spikelets panicle^{-1} (13.64) was observed in vermicompost @ 3 t ha^{-1}. The highest number of total spikelets panicle^{-1} (115.8) was achieved from 50% less than RDF + poultry manure @ 5 t ha^{-1} which was at par with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and the lowest number of total spikelets panicle^{-1} (104.3) was received in vermicompost @ 3 t ha^{-1}. The highest 1000-grain weight (27.28 g) was recorded from 50% less than RDF + poultry manure @ 5 t ha^{-1} which was at par with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and the lowest 1000-grain weight (20.38 g) was found in vermicompost @ 3 t ha^{-1}. Nutrient management increased the availability and uptake of essential plant nutrients of rice fields which ultimately leads to the accumulation of greater source and translocation of photosynthates into the sink resulting in higher 1000-grain weight (Suresh et al., 2013; Islam et al., 2015). The highest grain yield (4.08 t ha^{-1}) was obtained from 50% less than RDF + poultry manure @ 5 t ha^{-1} and the lowest grain yield (2.47 t ha^{-1}) was observed in vermicompost @ 3 t ha^{-1}. The higher grain yield may be due to probably poultry manure with inorganic fertilizers provided adequate nutrients to plants and due to absorption of more nutrients, the crop improved the yield contributing characters *viz.* number of effective tillers hill^{-1}, number of grains panicle^{-1} and 1000-grain weight, which ultimately resulted in the highest grain yield. Application of manure along with inorganic fertilizers greatly influence the grain yield of rice were reported elsewhere (Yasmin et al., 2015; Pal et al., 2016; Roy et al., 2017; Chakraborty et al., 2020). On the other hand, Paul et al. (2020) reported that soil aeration, water holding capacity and microbial activity of soil improved due to the application of poultry manure as an organic matter which ultimately increases nutrient uptake of the crop resulting in higher yield. The highest straw yield (5.33 t ha^{-1}) was achieved from 50% less than RDF + poultry manure @ 5 t ha^{-1} and the lowest straw yield (3.87 t ha^{-1}) was obtained with vermicompost @ 3 t ha^{-1}. Application of poultry manures with inorganic fertilizers influenced the vegetative growth in terms of plant height and number of total tillers hill^{-1}, which resulted in higher straw yield. The combined application of inorganic fertilizers with manures produced the highest straw yield (Jahan et al., 2017; Ali et al., 2018; Paul et al., 2019). The highest harvest index (43.33%) was recorded from 50% less than RDF + poultry manure @ 5 t ha^{-1} which was at par with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and the lowest harvest index (38.96%) was found in vermicompost @ 3 t ha^{-1}. Ali et al. (2018) reported that the harvest index was significantly increased by the application of poultry manure with inorganic fertilizers.

Effect of Interaction Between Variety and Nutrient Management

Number of total tillers hill^{-1}, number of effective tillers hill^{-1}, number of grains panicle^{-1}, number of total spikelets panicle^{-1}, grain yield and straw yield varied significantly due to the interaction effect of variety and nutrient management (Table 3). The highest number of total tillers hill^{-1} (8.13) and effective tillers hill^{-1} (7.15) was recorded from Binadhan-15 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1}, while the lowest number of total tillers hill^{-1} (6.53) and effective tillers hill^{-1} (5.17) were found in Binadhan-16 fertilized with vermicompost @ 3 t ha^{-1}. The highest number of grains panicle^{-1} (107.00) was obtained from Binadhan-15 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1} which was at par with Binadhan-15 fertilized with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and Binadhan-16 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1}, while the lowest number of grains panicle^{-1} (90.09) were observed in Binadhan-16 fertilized with vermicompost @ 3 t ha^{-1}. The highest number of total spikelets panicle^{-1} (117.20) was achieved from Binadhan-15 fertilized with 50% less than RDF + poultry manure @ 5 t ha^{-1} which was statistically identical to Binadhan-15 along with 25% less than RDF + poultry manure @ 2.5 t ha^{-1} and Binadhan-15 fertilized with recommended dose of inorganic fertilizer, while the lowest number of total spikelets panicle^{-1} (104.1) was received in Binadhan-16 fertilized with vermicompost @ 3 t ha^{-1}. The highest grain (4.25 t ha^{-1}) (Figure 1) and straw yield (5.50 t ha^{-1}) were recorded from Binadhan-15 fertilized with 50% less than the recommended dose + poultry manure @ 5 t ha^{-1}, while the lowest grain (2.28 t ha^{-1}) and straw yield (3.58 t ha^{-1}) were obtained in Binadhan-16 fertilized with vermicompost @ 3 t ha^{-1}. This highest result was obtained due to nutrient management which allowed plant roots to uptake adequate nutrients and exhibited the best performance due to absorption of more nutrients and moisture resulted in better growth, yield contributing characteristics and finally yield of rice plant. On the other hand, the combined effect of variety and nutrient management had a positive effect on rice yield due to steady release and higher uptake of nutrients by plants was reported elsewhere (Sarkar et al., 2014; Laila et al., 2020).

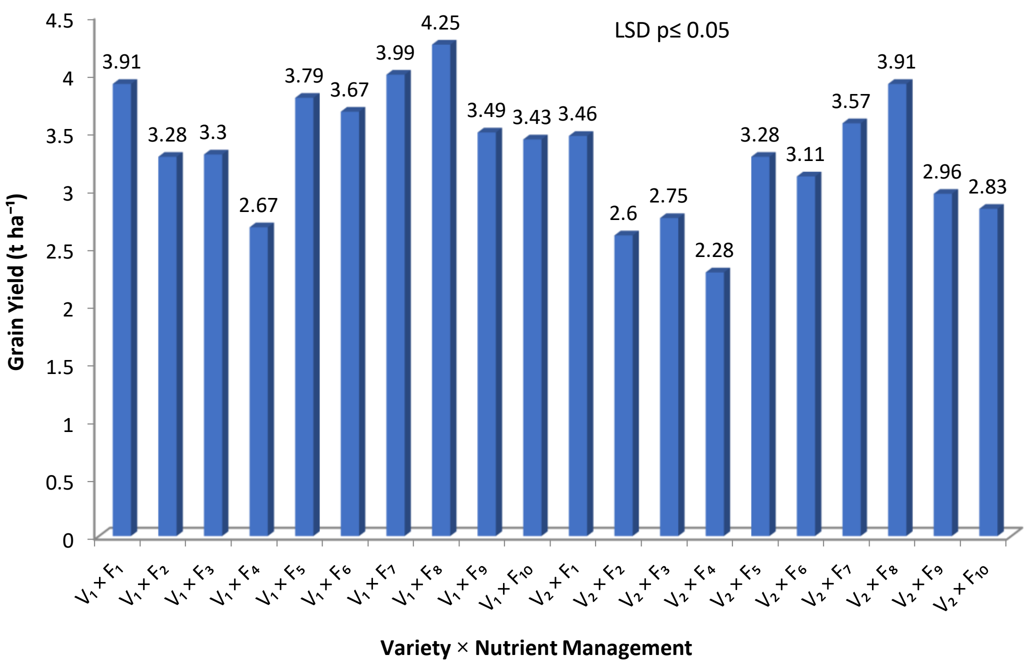

Figure 1. Interaction effects of variety and nutrient management on grain yield of transplant *Aman* rice
V1= Binadhan-15, V2= Binadhan-16
F_1 = Recommended dose (Urea-TSP-MoP-Gypsum-$ZnSO_4$ @ 150-110-70-60-5kg ha^{-1}, F_2 = Cowdung @ 10 t ha^{-1}, F_3= Poultry manure @ 5 t ha^{-1}, F_4 = Vermicompost @ 3 t ha^{-1}, F_5 = 25% less than recommended dose + cowdung @ 5 t ha^{-1}, F_6= 50% less than recommended dose + cowdung @ 10t ha^{-1}, F_7= 25% less than recommended dose + poultry manure @ 2.5t ha^{-1}, F_8= 50% less than recommended dose + poultry manure @ 5 t ha^{-1}, F_9= 25% less than recommended dose + vermicompost @ 1.5 t ha^{-1}, F_{10} = 50% less than recommended dose + vermicompost @ 3 t ha^{-1}

Table 1. Effect of variety on yield and yield contributing characters of transplant *Aman* rice

Variety	PH	TH	ETH	NTH	PL	GP	SSP	SP	GW	GY	SY	HI
Binadhan -15	97.86	7.44^{a}	6.28^{a}	1.16	21.63^{a}	101.73^{a}	12.13b	113.86^{a}	23.87^{a}	3.58^{a}	4.99^{a}	41.64
Binadhan-16	96.78	7.21^{b}	6.01^{b}	1.20	21.00^{b}	94.42^{b}	12.59a	107.00^{b}	23.14^{b}	3.08^{b}	4.31^{b}	41.48
Sx	0.573	0.016	0.014	0.016	0.193	0.416	0.109	0.441	0.192	0.015	0.024	0.170
CV (%)	3.23	1.17	1.25	7.42	4.96	2.33	4.82	2.19	4.48	2.53	2.84	2.24
Level of significance	NS	**	**	NS	*	**	**	**	**	**	**	NS

PH: Plant height (cm), TH: Tillers hill^{-1} (no.), ETH: Effective tillers hill^{-1} (no.), NTH: Non-effective tillers hill^{-1}(no.), PL: Panicle length (cm), GP: Grains panicle^{-1} (no.), SSP: Sterile spikelets panicle^{-1} (no.), SP: Spikelets panicle^{-1} (no.), GW: 1000- grain weight (g), GY: Grain yield (t ha^{-1}), SY: Straw yield (t ha^{-1}), HI: Harvest index (%), 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.

Table 2. Effect of nutrient management on yield and yield contributing characters of transplant *Aman* rice

NM	PH	TH	ETH	NTH	PL	GP	SSP	SP	GW	GY	SY	HI
F_1	98.83^{ab}	7.61^{c}	6.50^{c}	1.112^{de}	21.52	100.60^{bc}	11.79^{d}	112.40^{bc}	25.10^{bc}	3.68^{b}	5.05^{bc}	42.17^{bc}
F_2	95.83^{bc}	6.92^{g}	5.62^{i}	1.300^{a}b	20.96	94.76^{e}	13.42^{ab}	108.20^{d}	21.37^{gh}	2.94^{f}	4.20^{g}	41.17^{c}
F_3	96.57^{bc}	6.99^{g}	5.71^{h}	1.277^{ab}	21.01	96.05^{de}	13.18^{ab}	109.20^{d}	21.81^{fg}	3.02^{f}	4.30^{fg}	41.29^{bc}
F_4	94.17^{c}	6.71^{h}	5.37^{j}	1.340^{a}	20.79	90.63^{f}	13.64^{a}	104.30^{e}	20.38^{h}	2.47^{g}	3.87^{h}	38.96^{d}
F_5	96.83^{bc}	7.51^{d}	6.35^{d}	1.160^{cd}	21.32	98.92^{cd}	12.03^{d}	110.90^{bcd}	24.13^{cd}	3.53^{c}	4.93^{c}	41.75^{bc}
F_6	96.73^{bc}	7.40^{e}	6.21^{e}	1.185^{bcd}	21.22	98.51^{cd}	12.08^{d}	110.60^{bcd}	23.80^{de}	3.39^{d}	4.74^{d}	41.68^{bc}
F_7	99.77^{ab}	7.75^{b}	6.70^{b}	1.050^{ef}	21.56	101.90^{b}	11.60^{d}	113.50^{ab}	26.19^{ab}	3.78^{b}	5.11^{b}	42.50^{ab}
F_8	101.10^{a}	8.06^{a}	7.07^{a}	0.990^{f}	22.48	105.10^{a}	10.70^{e}	115.80^{a}	27.28^{a}	4.08^{a}	5.33^{a}	43.33^{a}
F_9	96.70^{bc}	7.23^{f}	6.02^{f}	1.210^{bcd}	21.20	97.85^{cd}	12.34^{cd}	110.20^{cd}	22.77^{ef}	3.22^{e}	4.55^{e}	41.45^{bc}
F_{10}	96.63^{bc}	7.13^{f}	5.90^{g}	1.235^{abc}	21.08	96.38^{de}	12.83^{bc}	109.20^{d}	22.27^{fg}	3.13^{e}	4.44^{ef}	41.35^{bc}
Sx	1.28	0.034	0.032	0.036	0.432	0.931	0.243	0.985	0.430	0.034	0.055	0.380
CV (%)	3.23	1.17	1.25	7.42	4.96	2.33	4.82	2.19	4.48	2.53	2.84	2.24
LS	*	**	**	**	NS	**	**	**	**	**	**	**

NM: Nutrient management, LS: Level of significance, PH: Plant height (cm), TH: Tillers hill^{-1} (no.), ETH: Effective tillers hill^{-1} (no.), NTH: Non-effective tillers hill^{-1}(no.), PL: Panicle length (cm), GP: Grains panicle^{-1} (no.), SSP: Sterile spikelets panicle^{-1} (no.), SP: Spikelets panicle^{-1} (no.), GW: 1000- grain weight (g), GY: Grain yield (t ha^{-1}), SY: Straw yield (t ha^{-1}), HI: Harvest index (%), 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, F_1 = Recommended dose (urea-TSP-MoP-Gypsum-$ZnSO_4$ @ 150-110-70-60-5kg ha^{-1}, F_2 = Cowdung @ 10 t ha^{-1}, F_3= Poultry manure @ 5 t ha^{-1}, F_4= Vermicompost @ 3 t ha^{-1}, F_5= 25% less than recommended dose + cowdung @ 5 t ha^{-1}, F_6= 50% less than recommended dose + cowdung @ 10t ha^{-1}, F_7= 25% less than recommended dose + poultry manure @ 2.5t ha^{-1}, F_8= 50% less than recommended dose + poultry manure @ 5 t ha^{-1}, F_9= 25% less than recommended dose + vermicompost @ 1.5 t ha^{-1}, F_{10}= 50% less than recommended dose + vermicompost @ 3 t ha^{-1}

Table 3. Interaction effects of variety and nutrient management on yield and yield contributing characters of transplant *Aman* rice

V×N	PH	TH	ETH	NTH	PL	GP	SSP	SP	GW	SY	HI
$V_1 \times F_1$	98.20	7.73^{bc}	6.66^{d}	1.07	21.71	105.40^{ab}	11.53	116.90^{a}	25.60	5.34^{abc}	42.27
$V_1 \times F_2$	96.33	6.97^{ij}	5.69^{klm}	1.28	21.24	97.88^{ef}	13.25	111.10^{bcd}	21.42	4.66^{fg}	41.27
$V_1 \times F_3$	97.40	7.07^{ghi}	5.80^{jk}	1.26	21.31	100.30^{cde}	13.11	113.40^{abc}	22.22	4.68^{fg}	41.33
$V_1 \times F_4$	95.47	6.89^{j}	5.57^{mn}	1.32	21.08	91.17^{h}	13.27	104.40^{f}	20.50	4.17^{ij}	39.03
$V_1 \times F_5$	97.53	7.67^{c}	6.53^{de}	1.14	21.60	103.60^{abc}	11.79	115.40^{ab}	24.60	5.27^{abc}	41.79
$V_1 \times F_6$	97.53	7.60^{cd}	6.43^{ef}	1.17	21.56	103.30^{abc}	11.84	115.10^{ab}	24.00	5.12^{cd}	41.76
$V_1 \times F_7$	99.73	7.83^{b}	6.80^{c}	1.03	21.75	105.50^{ab}	11.49	116.90^{a}	27.02	5.38^{ab}	42.61
$V_1 \times F_8$	101.40	8.13^{a}	7.15^{a}	0.98	23.12	107.00^{a}	10.26	117.20^{a}	27.36	5.50^{a}	43.56
$V_1 \times F_9$	97.53	7.33^{e}	6.14^{g}	1.19	21.55	102.20^{bcd}	12.29	114.50^{ab}	23.14	4.93^{de}	41.47
$V_1 \times F_{10}$	97.47	7.27^{ef}	6.05^{gh}	1.22	21.38	101.00^{cde}	12.52	113.50^{abc}	23.00	4.86^{ef}	41.37
$V_2 \times F_1$	99.47	7.50^{d}	6.34^{f}	1.15	21.32	95.83^{fg}	12.06	107.90^{def}	24.60	4.76^{efg}	42.06
$V_2 \times F_2$	95.33	6.87^{j}	5.55^{n}	1.32	20.68	91.64^{gh}	13.58	105.20^{f}	21.32	3.73^{lm}	41.06
$V_2 \times F_3$	95.73	6.92^{ij}	5.63^{lmn}	1.29	20.72	91.78^{gh}	13.25	105.00^{f}	21.40	3.91^{kl}	41.24
$V_2 \times F_4$	92.87	6.53^{k}	5.17^{o}	1.36	20.51	90.09^{h}	14.01	104.10^{f}	20.26	3.58^{m}	38.89
$V_2 \times F_5$	96.13	7.35^{e}	6.17^{g}	1.18	21.05	94.21^{fgh}	12.26	106.50^{ef}	23.66	4.58^{gh}	41.71
$V_2 \times F_6$	95.93	7.20^{ef}g	6.00^{hi}	1.20	20.89	93.74^{gh}	12.33	106.10^{ef}	23.60	4.36^{hi}	41.60
$V_2 \times F_7$	99.80	7.67^{c}	6.60^{d}	1.07	21.36	98.27^{def}	11.72	110.00^{cde}	25.36	4.85^{ef}	42.39
$V_2 \times F_8$	100.87	8.00^{a}	7.00^{b}	1.00	21.84	103.30^{abc}	11.14	114.50^{ab}	27.20	5.16^{bc}	43.10
$V_2 \times F_9$	95.87	7.13^{fgh}	5.90^{ij}	1.23	20.84	93.48^{gh}	12.39	105.90^{ef}	22.40	4.18^{ij}	41.44
$V_2 \times F_{10}$	95.80	7.00^{hij}	5.75^{kl}	1.25	20.79	91.79^{gh}	13.14	104.90^{f}	21.55	4.01^{jk}	41.34
Sx	1.81	0.048	0.045	0.052	0.611	1.31	0.344	1.39	0.608	0.077	0.537
CV (%)	3.23	1.17	1.25	7.42	4.96	2.33	4.82	2.19	4.48	2.84	2.24
LS	NS	*	**	NS	NS	*	NS	*	NS	*	NS

V×N: Variety × Nutrient management, LS: Level of significance, PH: Plant height (cm), TH: Tillers hill-1 (no.), ETH: Effective tillers hill-1 (no.), NTH: Non-effective tillers hill-1(no.), PL: Panicle length (cm), GP: Grains panicle-1 (no.), SSP: Sterile spikelets panicle-1 (no.), SP: Spikelets panicle-1 (no.), GW: 1000- grain weight (g), SY: Straw yield (t ha-1), HI: Harvest index (%), 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, V1= Binadhan15, V2= Binadhan16, F_1 = Recommended dose (urea-TSP-MoP-Gypsum-$ZnSO_4$ @ 150-110-70-60-5kg ha^{-1}, F_2 = Cowdung @ 10 t ha^{-1}, F_3= Poultry manure @ 5 t ha^{-1}, F_4= Vermicompost @ 3 t ha^{-1}, F_5= 25% less than recommended dose + cowdung @ 5 t ha^{-1}, F_6= 50% less than recommended dose + cowdung @ 10 t ha^{-1}, F_7= 25% less than recommended dose + poultry manure @ 2.5t ha^{-1}, F_8= 50% less than recommended dose + poultry manure @ 5 t ha^{-1}, F_9= 25% less than recommended dose + vermicompost @ 1.5 t ha^{-1}, F_{10}= 50% less than recommended dose + vermicompost @ 3 t ha^{-1}

Conclusion

According to the results of the experiment, Binadhan-15 performed well considering most of yield components and grain yield. Among the different nutrient managements, 50% less than recommended dose of inorganic fertilizer + poultry manure @ 5 t ha^{-1} gave better performance. However, Binadhan-15 fertilized with 50% less than recommended dose of inorganic fertilizer + poultry manure @ 5 t ha^{-1} gave the highest grain yield. So, it can be concluded that Binadhan-15 fertilized with 50% less than recommended dose of inorganic fertilizer + poultry manure @ 5 t ha $^{-1}$ appeared as the promising practice in *Aman* rice cultivation in terms of grain yield.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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