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Integrated Effect of Organic manures and Nitrogen on Yield Contributing Characters and Yield of Rice (BRRI dhan29)

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Abstract- An experiment was conducted to asses the integrated effect of organic manures and nitrogen on yield contributing characters and yield of rice (BRRI dhan29). The experiment consisted of 12 treatments, T_1: Control condition (No chemical fertilizer, no organic manure); T_2: 100% recommended N (120 kg N ha^{-1}) + recommended P, K, S and Zn); T_3: 100 kg N from urea + 20 kg N substituted by vermicompost (VC) + P, K, S and Zn; T_4: 100 kg N from urea + 20 kg N substituted by cowdung (CD) + P, K, S and Zn; T_5: 80 kg N from urea + 40 kg N substituted by VC + P, K, S and Zn; T_6: 80 kg N from urea + 40 kg N substituted by CD + P, K, S and Zn; T_7: 60 kg N from urea + 60 kg N substituted by VC + P, K, S and Zn; T_8: 60 kg N from urea + 60 kg N substituted by CD + P, K, S and Zn; T_9: 100 kg N from urea + 20 kg N substituted equally by VC and CD + P, K, S and Zn; T_{10}: 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn; T_{11}: 60 kg N from urea + 60 kg N substituted equally by VC and CD + P, K, S and Zn and T_{12}: 120 kg N substituted equally by VC and CD. Highest plant (88.87 cm) was recorded from T_{10} and lowest plant (61.95 cm) was observed from T_1 as control condition. The highest grain (6.73 t ha^{-1}) and straw (7.10 t ha^{-1}) yield were recorded from T_{10}, while the lowest grain (2.16 t ha^{-1}) and straw (4.33t ha^{-1}) yield from T_1. The highest N (43.99 kg ha^{-1}), P (14.63 kg ha^{-1}) and K (19.66 kg ha^{-1}) uptake by grain were recorded from $T_{11,}$ while the lowest N (16.38 kg ha^{-1}), P (6.32 kg ha^{-1}) and K (7.72 kg ha^{-1}) from T_1. The highest N (30.87 kg ha^{-1}), P (4.72 kg ha^{-1}) and K (73.98 kg ha^{-1}) uptake by straw were recorded from T_6, while the lowest N (21.85 kg ha^{-1}), P (3.77 kg ha^{-1}) and K (50.76 kg ha^{-1}) from T_1. Applications of 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn was the superior among the other treatments in consideration of yield contributing characters and yield of BRRI dhan29.

Index Terms- Cowdung, vermicompost, NPKS, Rice, Yield.

I. INTRODUCTION

Rice (*Oryza sativa* L.) is the most important food for the people of Bangladesh and it is the staple food for more than two billion people in Asia (Hien *et al.*, 2006). The national average rice yield in Bangladesh (4.2 t ha^{-1}) is very low compared to those of other rice growing countries, like China (6.30 t ha^{-1}), Japan (6.60 t ha^{-1}) and Korea (6.30 t ha^{-1}) (FAO, 2009). The efficient N management can increase crop yield and reduce production cost. An increase in the yield of rice by 70 to 80% may be obtained from proper application of N-fertilizer (IFC, 1982. The optimum dose of N fertilizer plays vital role for the growth and development of rice plant and its growth is seriously hampered when lower dose of N is applied, which drastically reduced yield; further, excessive N fertilization encourages excessive vegetative growth which make the plant susceptible to insect pests and diseases which ultimately reduces yield. Depleted soil fertility is a major constrain to higher crop production in Bangladesh. The increasing land use intensity has resulted in a great exhaustion of nutrient in soils. The farmers of this country use on an average 102 kg nutrients ha^{-1} annually (70 kg N + 24 kg P + 6 kg K + 2 kg S and Zn) while the crop removal is about 200 kg ha^{-1} (Islam *et al*., 1994). In Bangladesh, most of the cultivated soils have less than 1.5% organic matter while a good agricultural soil should contain at least 2% organic matter (Ali, 1994). Moreover, this important component of soil is declining with time due to intensive cropping and use of higher dose of chemical fertilizers with little or no addition of organic manure in the farmer's field. The long-term research of BARI revealed that the application of cowdung @ 5 t ha^{-1} $year^{-1}$ improved rice productivity as well as prevented the soil resources from degradation (Bhuiyan, 1994). Soil organic matter improves the physicochemical properties of the soil and ultimately promotes crop production. More recently, attention is focused on the global environmental problems; utilization of organic wastes, vermicompost and poultry manures as the most effective measure for the purpose. Organic fertilizer enhances soil porosity by increasing regular and irregular pores and causes a priming effect of native soil organic matter. Application of both chemical and organic fertilizers needs to be applied for the improvement of soil physical properties and supply of essential plant nutrients for higher yield. The main target of the study was to select a suitable combination of organic manures and nitrogenous fertilizer as a source of nitrogen for successful growth and yield and evaluate the integrated effect of organic manure with the combination of chemical fertilizer on the growth and yield of BRRI dhan29 and uptake pattern of NPKS by BRRI dhan29 rice from organic and inorganic combine treated plot.

II. MATERIALS AND METHODS

The research work was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka from January to April 2010. The soil of the experimental field belongs to the Tejgaon series of AEZ No. 28, Madhupur Tract, classified as Deep Red Brown Terrace Soils in Bangladesh soil classification system. The soil texture was silt loam having pH 5.8 and contains organic matter 1.19%, total N 0.06%, available P 19.85 ppm**,** available K 0.12 ppm and available S 14.40 ppm. BRRI dhan 29 was used as the test crop in this experiment. The experiment consisted of 12 treatments. The treatments were as follows:T_1: Control condition (No chemical fertilizer, no organic manure), T_2: 100% recommended N (120 kg N ha^{-1}) + recommended P, K, S and Zn), T_3: 100 kg N from urea + 20 kg N substituted by vermicompost (VC) + P, K, S and Zn, T_4: 100 kg N from urea + 20 kg N substituted by cowdung (CD) + P, K, S and Zn, T_5: 80 kg N from urea + 40 kg N substituted by VC + P, K, S and Zn, T_6: 80 kg N from urea + 40 kg N substituted by CD + P, K, S and Zn, T_7: 60 kg N from urea + 60 kg N substituted by VC + P, K, S and Zn, T_8: 60 kg N from urea + 60 kg N substituted by CD + P, K, S and Zn, T_9: 100 kg N from urea + 20 kg N substituted equally by VC and CD + P, K, S and Zn, T_{10}: 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn, T_{11}: 60 kg N from urea + 60 kg N substituted equally by VC and CD + P, K, S and Zn and T_{12}: 120 kg N substituted equally by VC and CD.

The experiment was laid out in randomized complete block design (RCBD) with three replications. Thus the total numbers of plots were 36. The unit plot size was 5 m × 2.5 m and was separated from each other by 0.5 m ails. The distance maintained between two blocks and two plots were 1.0 m and 0.5 m respectively. The experimental plot was opened by a tractor, and then the land was ploughed and cross-ploughed several times with the help of a power tiller followed by laddering to obtain a good tilth and puddled condition Weeds and stubbles were removed, and the large clods were broken into smaller pieces to obtain a desirable tilth. Finally, the land was leveled and the experimental plot was partitioned into the unit plots. Full amounts of TSP, MP, gypsum, zinc, cowdung and vermicompost were applied as basal dose before transplanting of rice seedlings. Urea were applied in 3 equal splits: one third was applied at basal before transplanting, one third at active tillering stage (30 DAT) and the remaining one third was applied at 5 days before panicle initiation stage (55 DAT). Thirty days old seedlings of BRRI dhan 29 were transplanted on 30 January, 2010 at two seedlings per hill in a spacing of 20 cm × 20 cm. Intercultural operations were done whenever required. The crop was harvested at full maturity when 80-90% of the grains were turned into straw color on 24 April, 2010. Ten hills of rice plant were selected randomly from the plants for measuring yield contributing characters. After drying, the grain and straw yields were determined. Biological yield and harvest index were also determined. The plants, soil and manure samples were collected, processed and analyzed for N, P, K and S. The N concentration of cowdung and vermicompost were 1.48 and 1.9% respectively. The available (soil) and total P (plant) were determined by ascorbic acid blue color method (Olsen *et al*, 1954). Exchangeable (soil) and total K (plant) were determined by using flame photometer. The available (soil) and total S (plant) were analysed by turbidimetric method as described by Hunter (1984). N was determined by Micro-Kjeldahl method. The statistical analysis was done using the Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

III. RESULTS AND DISCUSSION

III.1. Integrated effect of organic manures and nitrogen on yield contributing characters of BRRI dhan29

Different treatments of organic manure and N showed significant variations in respect of all yield contributing characters of rice (Table 1). Among the different treatments, T_{10} (80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn) showed highest number of effective tillers/hill (13.43), plant height (88.87 cm), panicle length (24.50 cm), number of filled grain/panicle (91.40), highest 1000 grain weight (21.8 g) and lowest values were found from control treatment. Nayak *et al.* (2007) reported a significant increase in effective tillers/hill due to application of chemical fertilizer with organic manure. Yang *et al.* (2004) recorded that 1000-grain weight was increased by the application of chemical fertilizer along with organic manure.

III.2. Integrated effect of organic manures and nitrogen on yield of BRRI dhan29

Yield of rice was significantly influenced by integrated use of organic manures and nitrogen (Table 2). The highest grain yield (6. 73 t/ha), straw yield (7.10 t/ha), biological yield (13.83 t/ha) and harvest index (48.67 %) were obtained from T_{10} (80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn) and the lowest values were found with T_1 treatment where no fertilizer was applied. Rahman *et al.* (2009) reported that the application of organic manure and chemical fertilizers increased the grain and straw yields of rice. It is clear that organic manure in combination with inorganic fertilizers increased the vegetative growth of plants and thereby increased straw yield of rice.

Table 1. Integrated effect of organic manures and nitrogen on yield contributing characters of BRRI dhan29

Treatments	No. of effective tillers/hill	Plant height (cm)	Panicle length (cm)	No. of filled grain/panicle	1000 grain weight (g)
T_1	5.90 f	61.95 f	15.28 e	52.63 g	15.5 bc
T_2	11.03 cd	82.17 cd	22.20 bcd	82.70 cde	20.33 ab
T_3	11.77 bcd	84.23 bc	23.05 abcd	84.80 bcd	21.02 a
T_4	10.37 de	81.70 cd	22.87 abcd	81.40 de	20.53 a
T_5	11.53 bcd	83.97 bc	22.67 abcd	84.77 bcd	20.53 a
T_6	11.67 bcd	85.94 ab	22.75 abcd	87.90 abc	21.07 a
T_7	12.47 abc	85.33 abc	22.52 abcd	88.33 abc	21.3 a
T_8	9.27 e	79.50 d	21.14 cd	78.93 ef	20.17 ab
T_9	12.37 abc	86.80 ab	23.16 abc	88.57 abc	21.5 a
T_{10}	13.43 a	88.87 a	24.50 a	91.40 a	21.8 a
T_{11}	12.90 ab	86.01 ab	23.66 ab	90.17 ab	21.5 a
T_{12}	9.23 e	75.81 e	21.06 d	73.70 f	19.83 ab
$LSD_{(0.05)}$	1.504	3.340	1.806	5.248	1.45
CV(%)	8.08	8.41	4.83	7.77	6.33

In a column figures having same letter do not differ significantly whereas figures with different letter differ significantly by DMRT at 5% level.

T_1: Control condition, T_2: 100% recommended N (120 kg N ha^{-1}) + recommended P, K, S and Zn),T_3: 100 kg N from urea + 20 kg N substituted by vermicompost (VC) + P, K, S and Zn,T_4: 100 kg N from urea + 20 kg N substituted by cowdung (CD) + P, K, S and Zn, T_5: 80 kg N from urea + 40 kg N substituted by VC + P, K, S and Zn, T_6: 80 kg N from urea + 40 kg N substituted by CD + P, K, S and Zn, T_7: 60 kg N from urea + 60 kg N substituted by VC + P, K, S and Zn, T_8: 60 kg N from urea + 60 kg N substituted by CD + P, K, S and Zn, T_9: 100 kg N from urea + 20 kg N substituted equally by VC and CD + P, K, S and Zn, T_{10}: 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn, T_{11}: 60 kg N from urea + 60 kg N substituted equally by VC and CD + P, K, S and Zn and T_{12}: 120 kg N substituted equally by VC and CD.

Table 2. Integrated effect of organic manures and nitrogen on yield of BRRI dhan29

Treatment	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
T_1	2.16 g	4.33 e	6.49 e	33.26 d
T_2	5.00 def	6.04 bcd	11.04 bcd	45.29 bc
T_3	5.67 bcd	6.46 abc	12.13 ab	46.54 ab
T_4	4.26 ef	5.56 cd	9.81 cd	43.29 c
T_5	5.10 cde	6.11 abcd	11.21 bc	45.45 bc
T_6	5.79 abcd	6.93 ab	12.72 ab	45.72 abc
T_7	6.03 abcd	6.69 ab	12.72 ab	47.33 ab
T_8	4.45 ef	5.16 de	9.61 cd	46.22 abc
T_9	6.06 abc	6.78 ab	12.84 ab	47.17 ab
T_{10}	6.73 a	7.10 a	13.83 a	48.67 a
T_{11}	6.46 ab	7.05 a	13.52 a	47.78 ab
T_{12}	4.03 f	5.24 de	9.28 d	43.51 c
$LSD_{(0.05)}$	0.934	0.882	1.714	2.670
CV(%)	10.72	8.50	8.99	5.50

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 5% level of probability

III.3. Integrated effect of organic manures and nitrogen on NPKS concentration in grain and straw of Boro rice

The nitrogen, phosphorus, potassium and sulphur content in grain and straw were significantly influenced with the different levels of fertilizer and manure application (Table 3). The higher levels of N, P, K and S concentrations in grain and straw were recorded in control treatment and similar results were also obtained from T_{12} (120 kg N substituted equally by VC and CD).

Table 3. Integrated effect of organic manures and nitrogen on NPKS concentration in grain and straw of Boro rice

Treatment	Concentration (%) in grain				Concentration (%) in straw			
	N	P	K	S	N	P	K	S
T_1	0.759 a	0.293 a	0.358 a	0.126 ab	0.506 a	0.087 a	1.175 a	0.098 a
T_2	0.682 bc	0.255 b	0.315 cde	0.109 bcd	0.442 c	0.073 abc	1.084 abc	0.083 ab
T_3	0.639 c	0.235 cd	0.296 f	0.098 d	0.404 d	0.064 cd	0.969 c	0.074 bc
T_4	0.700 b	0.265 b	0.326 bc	0.111 abcd	0.470 b	0.078 abc	1.140 ab	0.087 ab
T_5	0.688 bc	0.262 b	0.315 cde	0.109 bcd	0.444 c	0.074 abc	1.137 ab	0.088 ab
T_6	0.668 bc	0.250 bc	0.322 cd	0.108 bcd	0.446 c	0.068bcd	1.070 abc	0.079 ab
T_7	0.637 c	0.237 cd	0.304 def	0.106 cd	0.409 d	0.067bcd	1.030 bc	0.076 bc
T_8	0.700 b	0.285 a	0.331 bc	0.118 abc	0.489 a	0.078 abc	1.154 ab	0.089 ab
T_9	0.657 bc	0.215 ef	0.301 ef	0.104 cd	0.401 d	0.064 cd	0.991 c	0.073 bc
T_{10}	0.566 d	0.201 f	0.265 g	0.075 e	0.332 e	0.051 d	0.778 d	0.058 c
T_{11}	0.681 bc	0.227 de	0.304 def	0.108 bcd	0.413 d	0.065 bcd	1.043 abc	0.076 bc
T_{12}	0.717 ab	0.284 a	0.344 ab	0.129 a	0.501 a	0.084 ab	1.149 ab	0.091 ab
$LSD_{(0.05)}$	0.054	0.017	0.017	0.017	0.017	0.017	0.120	0.017
CV(%)	7.08	6.29	8.47	6.93	5.93	8.24	6.52	5.58

In a column figures having same letter do not differ significantly whereas figures with different letter differ significantly by DMRT at 5% level.

III.4. Integrated effect of organic manures and nitrogen on NPKS uptake by grain and straw of Boro rice

Statistically significant variation was recorded for NPKS uptake by rice grain and straw due to the integrated effect of organic manure and nitrogen (Table 4). Highest N (43.99 kg/ha), P (14.63 kg/ha), K(19.66 kg/ha) and S (6.96 kg/ha) uptake by grain was recorded from T_{11} (60 kg N from urea + 60 kg N substituted equally by VC and CD + P, K, S and Zn) and Highest N (30.87 kg/ha), P (4.72 kg/ha), K(73.98 kg/ha) and S (5.48 kg/ha) uptake by straw was recorded from T_6 (80 kg N from urea + 40 kg N substituted by CD + P, K, S and Zn). On the other hand, the lowest nutrient uptake by grain and straw was found from control treatment. Duhan *et al.* (2002) also reported similar result.

Table 4. Integrated effect of organic manures and nitrogen on NPKS uptake by grain and straw of Boro rice

Treatment	Uptake by grain (kg ha^{-1})				Uptake by straw (kg ha^{-1})			
	N	P	K	S	N	P	K	S
T_1	16.38 e	6.32 c	7.72 g	2.72 e	21.85 d	3.77 bc	50.76 d	4.24 cd
T_2	34.10 bcd	12.76 ab	15.77 def	5.44 bcd	26.69 bc	4.39 abc	65.48 abc	5.04 ab
T_3	35.75 bc	13.11 ab	16.48 bcde	5.39 bcd	25.82 bc	4.07 abc	61.80 bc	4.69 abcd
T_4	29.78 cd	11.25 b	13.86 f	4.73 d	26.10 bc	4.31 abc	63.38 abc	4.82 abcd
T_5	35.10 bcd	13.36 ab	16.02 cdef	5.58 bcd	27.19 abc	4.53 ab	69.54 ab	5.37 ab
T_6	38.70 ab	14.45 a	18.68 ab	6.30 abc	30.87 a	4.72 a	73.98 a	5.48 a
T_7	38.44 ab	14.38 a	18.35 abc	6.42 ab	27.38 abc	4.51 ab	68.92 ab	5.06 ab
T_8	31.14 cd	12.67 ab	14.70 ef	5.23 cd	25.22 bcd	4.00 abc	59.55 bcd	4.59 bcd
T_9	39.88 ab	13.00 ab	18.23 abcd	6.31 abc	27.19 abc	4.34 abc	67.24 ab	4.95 abc
T_{10}	38.13 ab	13.51 ab	17.87 abcd	5.05 d	23.72 cd	3.65 c	55.21 cd	4.12 d
T_{11}	43.99 a	14.63 a	19.66 a	6.96 a	29.07 ab	4.55 ab	73.51 a	5.38 ab
T_{12}	28.91 d	11.46 b	13.87 f	5.19 d	26.28 bc	4.40 abc	60.38 bcd	4.77 abcd
$LSD_{(0.05)}$	5.899	2.197	2.272	0.977	3.541	0.694	9.893	0.694
CV(%)	10.19	10.32	8.42	10.59	7.90	9.60	9.11	8.41

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 5% level of probability.

III.5. Integrated effect of organic manures and nitrogen on the pH, Organic matter, N, P, K and S of post harvest soil

Organic matter, pH and nutrient content in post harvest soil were statistically significant due to the combined application of organic manure and nitrogen (Table 5). Highest pH (6.47), total nitrogen (0.053) and available phosphorous (25.58 ppm) was found from T_{12} as 120 kg N substituted equally by VC and CD. The lowest total nitrogen (0.024) and available phosphorous (19.42 ppm) was found

from T_{10} as 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn. Highest exchangeable k (0.166 me %) and available sulphur (20.69) were recorded from T_1 control condition which was statistically identical (19.86 ppm) with T_{12} as 120 kg N substituted equally by VC and CD, while the lowest available sulphur in post harvest soil (12.45 ppm) was observed from T_{10} as 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn. The highest organic matter in post harvest soil (1.533%) was recorded from T_9 (100 kg N from urea + 20 kg N substituted equally by VC and CD + P, K, S and Zn) and the lowest organic matter in post harvest soil (1.110%) was observed from T_7 as 60 kg N from urea + 60 kg N substituted by VC + P, K, S and Zn. Similar results were also found by Mathew and Nair (1997); Azim (1999) and Hoque (1999).

Table 5. Integrated effect of organic manures and nitrogen on the nutrient content of post harvest soil

Treatment	pH	Organic matter (%)	Total N (%)	Available P (ppm)	Exchangeable K (me %)	Available S (ppm)
T_1	6.05	1.34	0.052 a	25.53 ab	0.166 a	20.69 a
T_2	5.93	1.26	0.044 ab	23.57 abcd	0.146 bcd	17.79 bcd
T_3	5.92	1.21	0.036 abc	22.03 cde	0.129 d	15.84 d
T_4	6.13	1.29	0.050 ab	24.98 abc	0.156 ab	18.93 ab
T_5	5.9	1.22	0.046 ab	24.05 abcd	0.154 ab	18.00 bcd
T_6	5.95	1.21	0.040 abc	23.66 abcd	0.141 bcd	17.44 bcd
T_7	5.67	1.11	0.038 abc	22.48 bcd	0.132 cd	16.30 cd
T_8	5.83	1.28	0.048 ab	23.89 abcd	0.151 abc	18.89 abc
T_9	5.8	1.53	0.032 bc	21.09 de	0.128 d	16.05 d
T_{10}	5.85	1.16	0.024 c	19.42 e	0.103 e	12.45 e
T_{11}	5.85	1.22	0.041 abc	23.26 abcd	0.135 cd	17.43 bcd
T_{12}	6.47	1.29	0.053 a	25.58 a	0.158 ab	19.86 ab
$LSD_{(0.05)}$	0.53	0.019	0.017	2.674	0.017	2.316
CV(%)	3.59	2.03	9.95	6.78	5.74	7.83

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 5% level of probability.

IV. CONCLUSION

The integrated effect of organic manures and nitrogen significantly influenced the yield contributing characters and yield of rice (BRRI dhan29). Sole and integrated use of different types of organic manure (vermicompost and cowdung) and nitrogen fertilizer were used in the study. The highest plant height (88.87 cm), maximum number of effective tillers per hill (13.43), length of panicle (24.50 cm), maximum number of filled grain plant^{-1} (91.40), weight of 1000 seeds (21.80 g), grain yield (6.73 t ha^{-1}), straw yield (7.10 t ha^{-1}) and highest biological yield (13.83 t ha^{-1}) was recorded from T_{10} (80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn)and all the cases lowest values were observed from T_1 as control condition.

The highest N (43.99 kg ha^{-1}), P (14.63 kg ha^{-1}), K (19.66 kg ha^{-1}) and S (6.96 kg ha^{-1}) uptake by grain were recorded from T_{11} and the lowest values were recorded from T_1. The highest N (30.87 kg ha^{-1}), P (4.72kg ha^{-1}), K (73.98 kg ha^{-1}) and S (5.48 kg ha^{-1}) uptake by straw were recorded from T_6 and the lowest values were recorded from T_1. The highest pH of post harvest soil (6.47) was found from T_{12} and the lowest (5.67) was recorded from T_7. The highest organic matter in post harvest soil (1.533%) was recorded from T_9 and the lowest (1.110%) was observed from T_7. The highest total nitrogen in post harvest soil (0.054%) was recorded from T_1 and the lowest (0.024%) was obtained from T_{10}. The highest available phosphorus in post harvest soil (25.58 ppm) was recorded from T_{12}, again the lowest (19.42 ppm) was found from T_{10}. The highest exchangeable potassium in post harvest soil (0.166 me%) was recorded from T_1 and the lowest (0.103 me%) was observed from T_{10}. The highest available sulphur in post harvest soil (20.69 ppm) was obtained from T_1 while the lowest (12.45 ppm) was observed from T_{10}.

From the above discussion it can be concluded that applications of 80 kg N from urea + 40 kg N substituted equally by VC and CD + P, K, S and Zn was the superior among the other treatments in consideration of yield contributing characters and yield of BRRI dhan29.

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