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NUTRIENT CONTENT IN T. AMAN RICE AS INFLUENCED BY PHOSPHORUS FROM INORGANIC AND ORGANIC FERTILIZERS APPLIED WITH IPNS BASIS

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ABSTRACT

A field study was conducted at the Bangabandhu Sheikh Mujibur Rahman Agricultural University Research Farm, Gazipur, during the aman season July 2008 to February 2009 to evaluate the effect of combined use of organic and inorganic phosphorus (P) sources on nutrient content in rice grain and straw of T. Aman rice. Eight treatments including a control, a recommended doses of inorganic fertilizers and six other treatments which were combinations of inorganic and organic fertilizers where 50 % and 75 % of recommended doses of P were provided by using triple super phosphate (TSP) and the remaining 50 % and 25 % of P were amended by using either cowdung (CD), poultry manure (PM) or household waste (HW). The nutrient P as per treatments and nitrogen (N), potassium (K) and zinc (Zn) as per recommended dose were applied. Combined application of inorganic and organic sources of P significantly increased the nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and calcium (Ca) content in both rice grain and straw of T. Aman rice. The treatment T_4 receiving 50 % P through TSP and 50 % P through PM increased the concentration of N, P, K, S and Ca in rice grain. On the other hand, the rice straw contained maximum N from treatment of T_6 receiving 50 % P through TSP and 50 % P through HW whereas P, K and S content was maximum from the treatment of T_4. The Ca content found maximum in rice straw from T_5 treatment receiving 75 % P through TSP and 25% P through PM. Magnesium (Mg) and sodium (Na) concentration of both rice grain and straw did not show any significant differences in all the treatments. Therefore, the above results suggest that the together application of both inorganic and organic fertilizers as IPNS basis increase the different nutrients concentration in rice grain and straw of T. Aman rice.

Keywords: inorganic, IPNS, nutrient, organic, rice

INTRODUCTION

Rice (*Oryza sativa* L.) is an important staple food for billions of world people including Bangladesh. To assure food security in the rice-consuming countries of the world, farmers are practicing rice-rice cropping system to produce more rice of better quality to meet the demands of consumers in coming years (Peng and Yang, 2003).This cropping system has been gradually declining the nutrient supplying power of most of the soils. Continuous use of chemical fertilizers has significant deleterious effects on soil fertility and crop productivity (Moe *et al.,* 2019). Chemical fertilizers pollute soil and water making environment even more harmful for both terrestrial as well as aquatic life.

Nutrients supplied exclusively inorganic fertilizers enhance the yield of rice initially, but the yields are not sustainable over time. Imbalanced use of inorganic fertilizers decreases soil fertility and reduces 38% of grain yield in rice (Singh *et al.,* 2001). Thus, in order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields (Babhulkar *et al.,* 2000). It was also reported that integrated nutrients management increases the rice yield, quality and nutrient uptake (Masarirambi *et al.,* 2012). The efficiency of nutrient use may be raised by the combined use of organic and inorganic fertilizers. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil-physical behaviour as well as increased the

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efficiency of applied nutrients but it was reported that excessive application of organic manure should be avoided, particularly in soil, to reduce the risk of toxic effects from reduced metabolic intermediates (Liang *et al.*, 2003). In fact, organic manure alone might not meet the plant's requirements due to the relatively low nutrient contents and the slow release of plant nutrients (Miah, 1994).

Many soils of the Indo-Gangetic plain, including Bangladesh have become phosphorus (P) deficient (BRRI, 1992; Ali *et al*., 1997). Thus, the rice yield in the P deficient soil was less than 50% of that obtained from soils containing even moderate levels of P (Saleque *et al*., 1998). Much of the P applied to soils as fertilizer can become fixed into forms unavailable to the plant leading to agronomic and economic inefficiency. Similar to inorganic fertilizers, organic fertilizers such as poultry manure mainly contain nitrogenous compounds, which are readily mineralized to ammonia and nitrate (Choudhury *et al.,* 2007). Cow manure, an important nutrient source for crop production is rich in N content and recognized as a substitute for inorganic fertilizer (Sharma and Mitra, 1991). As a result, in recent years there has been considerable scholarly interest in managing soil fertility and crop productivity through an integrated approach. For sustaining soil fertility of rice-rice cropping system, it is important to apply chemical fertilizers in conjunction with organic sources of nutrients viz. cowdung, household wastes, poultry manures in such a way that crop yield and nutrient use efficiency could be maximized without deteriorating soil, air and water quality (Islam *et al.,* 2012). However, to our knowledge no study has evaluated to find the influence of phosphorus supplied from TSP, cowdung, poultry manure and household wastes on the nutrient content in T. Aman rice under the climatic and edaphic conditions of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh.

MATERIALS AND METHODS

The study was conducted at Bangabandhu Sheikh Mujibur Rahman Agricultural University Research Farm, Gazipur during the aman season July 2008 to February 2009. The physical and chemical properties of the field soils show in Table 1. Chemical analyses of grain, straw, poultry manure, cowdung and household wastes were shown in Table 2.

Table 1. Physical and chemical properties of the initial soils sample

Physical properties	**Value**
Sand (%)	15.90
Silt (%)	47.10
Clay (%)	37.00
Texture	Silty clay loam
Porosity (%)	48.5
Bulk density (g/cc)	1.37
Particle density (g/cc)	2.68
Chemical properties	**Value**
Soil pH	5.95
Organic Carbon (%)	0.93
Total N (%)	0.079
Available P (ppm)	5.8
Exchangeable K (meq/100 g soil)	0.14
Available S (ppm)	7.12
Exchangeable Ca (meq/100 g soil)	6.55
Exchangeable Mg (meq/100 g soil)	1.88
Exchangeable Na (meq/100 g soil)	0.32
Cation exchange capacity (CEC meq/100 g soil)	10.65

Treatments consisted of different levels of phosphorus (P) derived from both inorganic and organic sources are shown in Table 3. As an organic sources of P well decomposed poultry manure (PM), cowdung (CD) and household wastes (HW) were applied as per treatments one week before final land preparation and inorganic P as triple superphosphate (TSP), potassium as muriate of potash (MoP), sulphur from gypsum and zinc as zinc oxide were applied two days before final land preparation and T. Aman BRRI dhan33 was used as test crop in this experiment.

Table 2. Nutrient content of cowdung, poultry manure and household wastes (oven-dried at 65^{O}C)

Sample	Nutrient content (%)						
	N	P	K	S	Ca	Mg	Na
Cowdung	1.23	0.30	1.2	0.12	3.40	0.20	0.21
Poultry manure	1.3	0.62	0.9	0.20	6.27	0.30	0.36
Household wastes	1.2	0.35	1.25	0.11	3.50	0.52	0.26

Table 3. Treatments of phosphorus on the nutrient content in grain and straw of T. Aman rice

Treatments	Description
T_0 = Control	No fertilizers
T_1 = RD	Recommended fertilizer dose
T_2 = TSP_{50}+CD_{50}	50% P through TSP and 50% P through cowdung
T_3 = TSP_{75}+CD_{25}	75% P through TSP and 25% P through cowdung
T_4 = TSP_{50}+ PM_{50}	50% P through TSP and 50% P through poultry manure
T_5 = TSP_{75}+ PM_{25}	75% P through TSP and 25% P through poultry manure
T_6 = TSP_{50}+ HW_{50}	50% P through TSP and 50% P through household wastes
T_7 = TSP_{75}+ HW_{25}	75% P through TSP and 25% P through household wastes

Figures shown as subscript represent percent phosphorus either from TSP, CD, PM or HW

Nitrogen as urea was top dressed in three equal instalments (splits) at the time of final land preparation, maximum tillering stage and at booting i.e. panicle initiation stage of crop growth. A common procedure was followed in raising of seedling in seed bed. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The treatments were randomly assigned to the plots. Twenty five days old seedlings were transplanted in experimental plots with distances of 20 cm from row to row and 15 cm from plant to plant. Irrigation was done as required and other intercultural operations were performed regularly. The crop was harvested separately on different dates at full maturity when 90 % of the grains become golden yellow color. The rice grain and straw were kept in separately according to treatment for measuring the different nutrients content as sample collection. We measured N, P, K, S, Ca, Mg and Na from the collected samples.

Preparation of samples: Grain and straw samples were dried in an oven at 65^{0}C for 48 hours and then ground by a grinding machine to pass through a 20 mesh sieve and stored in small paper bags into a desiccators. The samples were analyzed for N, P, K, S, Ca, Mg and Na contents.

Digestion of samples with nitric-perchloric acid: Sample amounting 0.5 g was transferred into a dry clean 100 ml kjeldahl flask. A 10 ml of diacid (HNO_3: $HClO_4$ in the ratio 2:1) was added. After leaving for a while, the flask was heated at a temperature slowly to raise up to 200^{0}C. Heating was momentarily stopped when the dense white fumes of $HClO_4$ occurred and after cooling, 6 ml of 6N HCl was added to it. The contents of the flask were boiled until they became sufficiently clean and colourless. P, K and S contents were determined from this digest.

Distillation of samples with sulphuric acid: An amount of 100 mg oven dry ground sample was taken in a 100 ml kjeldahl flask and 1.1 g catalyst mixture (K_2SO4:$CuSO_4$ $5H_2O$: selenium in the ratio 10:1:0.1), 2 ml 30% H_2O_2 and 3 ml conc. H_2SO_4 were added into the flask. The flask was swirled and allowed to stand for about 10 minutes. After that, the flask was heated and continued until the digest became clear and colorless. After cooling, the digest was transferred into 100 ml volumetric flaks and the volume was made up to the mark with distilled water. A reagent blank was prepared in a similar way. This digest was used for the estimation of total N.

Determination of N, P, K, Ca, Mg and Na: Nitrogen, phosphorus, potassium, calcium, magnesium and sodium contents in the digest were determined following the methods.

Nitrogen (N): Nitrogen of grain and straw was estimated following the micro-kjeldahl method. The soil was digested with H_2O_2 and conc. H_2SO_4 in presence of the catalyst mixture (K_2SO_4:$CuSO_4$ 5 H_2O: Se in the ratio 10:1:0.1) and nitrogen in the digest was determined by distillation with 40% NaOH followed by titration of distillate trapped in H_2B0_3 with 0.1 N H_2SO_4 (Page, *et al.,* 1982).

Phosphorus (P): Phosphorus was extracted from the grain and straw with 0.5 M $NaHC0_3$ at pH 8.5. The phosphorus in the extract was then determined by developing the blue colour by $SnCl_2$ reduction of phosho-molybdate complex and measuring the colour calorimetrically at 660 nm (Olsen *et al.,* 1954) using Spactrophotometer.

Potassium (K): Potassium of grain and straw was determined from 1 N ammonium acetate (pH 7.0) extract of the soil by using flame-photometer.

Sulphur (S): Sulphur content was extracted by $CaCL_2$ extraction method and determined by adding acid seed solution and then precipitation with $BaCl_2$ and measuring the turbidity calorimetrically at 420 nm wave length (Black, 1965) using Spactrophotometer.

Calcium (Ca): Exchangeable Calcium of soil was determined from 1 N ammonium acetate (pH 7.0) extract of the soil by using flame-photometer.

Magnesium (Mg): Exchangeable Magnesium of soil was determined from 1 N ammonium acetate (pH 7.0) extract of the soil by using flame-photometer.

Sodium (Na): Exchangeable Sodium of soil was determined from 1 N ammonium acetate (pH 7.0) extract of the soil by using flame-photometer.

Statistical analysis

All data were subjected to analysis of variance (ANOVA) and tested for significance by by Duncan's Multiple Range Test (DMRT) using PC-SAS software (SAS Institute).

RESULTS AND DISCUSSION

Nitrogen content in grain

The effects of P applied through TSP along with cowdung, poultry manure and household wastes on nitrogen content in grain of T. Aman rice was significant (Table 4). Significantly maximum nitrogen content in grain (1.193%) was recorded in T_4 treatment receiving 50% P through TSP and 50% P through poultry manure. The effect of this treatment was, however statistically identical to T_2, T_3 and T_6 treatments. Triple superphosphate along with organic manures exerted positive effect on nitrogen content in grain of T. Aman rice compared to inorganic fertilizer only. The minimum nitrogen content in grain (1.06%) was found in T_0 (control) treatment. Timsina *et al*. (2006) observed 1.12 to 1.24% N in rice grain in a rice-wheat system experiment. Roul and Sarawgi (2005) found significant effects of manures and fertilizers on the grain N content of rice.

Phosphorus content in grain

Mean phosphorus content of T. Aman rice grain is presented in (Table 4). Data in the table showed that P content of rice grain was significantly influenced by the P treatments, sources and levels. The table indicated that minimum P content (0.121%) was registered by the phosphorus control (T_0) treatment. Treatment T_4 receiving 50% P through TSP and 50% P through poultry manure produced the maximum phosphorous content in grain (0.155%) whose effect was statistically identical to all the treatments except T_7 and control. Triple superphosphate in association with poultry manure was found to be more effective in producing phosphorus content in grain compared to other treatments. Gupta (1995) reported that the highest P concentration in rice tissue was obtained with the combined application of poultry manure and phosphorus.

Potassium content in grain

The effects of different doses of P applied through TSP in association with cowdung, poultry manure and household wastes were significant in recording potassium content in grain of T. Aman rice (Table 4). The highest potassium content (0.247%) was recorded in T_4 treatment receiving 50% P through TSP and 50% P through poultry manure. The effect of this treatment was statistically identical to T_2 and T_6 but superior to the rest of the treatments. The minimum potassium content in grain (0.124%) was recorded in T_0 (control) treatment. Bhoite (2005) found that treatment receiving 50% recommended inorganic fertilizer with 50% organic fertilizer increased concentration of nutrients in rice grain over organic or inorganic treatment alone. Astrael *et al.* (2006) found that increasing municipal waste compost (MWC) increased plant content of N, P and K.

Sulphur content in grain

Sulphur content in grain was significantly influenced by P applied through TSP along with cowdung, poultry manure and household wastes (Table 4). With respect to sulphur content in grain, the maximum sulphur content of grain (0.063%) was recorded in treatment T_4 receiving 50% P through TSP and 50% P through poultry manure which was statistically similar to T_2, and T_6 treatments and identical with T_3 and T_5 treatments. The lowest sulphur content in grain (0.053%) was produced by T_0 (control) treatment. This might be due to the balanced supply of nutrients from triple superphosphate in association with organic manures which recorded higher amount of sulphur content in grains. Similar findings were reported by Hossain (1996) who found that sulphur concentration in grain was increased due to application of organic manure in association with NPKS fertilizers in rice field.

Table 4. Effects of phosphorus applied through triple superphosphate (TSP), cowdung (CD), poultry manure (PM) and household wastes (HW) on nitrogen, phosphorus, potassium and sulphur contents in grain of T. Aman rice

Treatment	N content (%)	P content (%)	K content (%)	S content (%)
T_0 = Control	1.060 c	0.121 c	0.124 d	0.053 c
T_1 = Recommended dose	1.111 bc	0.142 ab	0.221c	0.055 c
$T_2 = TSP_{50}+CD_{50}$	1.152 ab	0.150 ab	0.238 ab	0.062 a
$T_3 = TSP_{75}+CD_{25}$	1.134 ab	0.144 ab	0.222 c	0.059 ab
$T_4 = TSP_{50}+ PM_{50}$	1.193 a	0.155 a	0.247 a	0.063 a
$T_5 = TSP_{75}+ PM_{25}$	1.102 bc	0.148 ab	0.226 bc	0.060 ab
$T_6 = TSP_{50}+ HW_{50}$	1.160 ab	0.149 ab	0.239 ab	0.062 a
$T_7 = TSP_{75}+ HW_{25}$	1.114 bc	0.140 b	0.226 bc	0.057 bc
CV (%)	4.46	5.45	6.80	4.91

Means in a column followed by same letter (s) are not significantly different at 5% level of significance by DMRT
Figures shown as subscript represent percent phosphorus either from triple superphosphate (TSP), cowdung (CD), poultry manure (PM) or household wastes (HW)

Calcium content in grain

Calcium content in grain was significantly influenced by different levels of P through TSP along with cowdung, poultry manure and household wastes (Table 5). Calcium content in grain ranged from 0.77 to 1.16%. The highest calcium content in grain (1.16%) was noted by the treatment T_4 receiving 50% P through TSP and 50% P through poultry manure whose effect was statistically identical to T_2 treatment but superior to the rest of the treatments. The lowest calcium content in grain (0.77%) was found in T_0 (control) and identical with T_1, T_3, T_5, T_6 and T_7 treatments. All the treatments significantly produced higher calcium content in grain over control treatment.

Magnesium content in grain

There was an insignificant effect of different levels of P through TSP along with cowdung, poultry manure and household wastes on magnesium content in grain of T. Aman rice (Table 5). Maximum magnesium content in grain (0.73%) was observed in T_5 treatment. The lowest magnesium content in grain (0.65%) was noted in T_0 (control).

Sodium content in grain

The effect of different doses of P through TSP along with cowdung, poultry manure and household wastes was insignificant in recording sodium content in grain (Table 5). The maximum sodium content in grain (0.48%) was recorded in treatment T_6 receiving 50% P through TSP and 50% P through household wastes. The lowest sodium content in grain (0.41%) was recorded in T_0 (control) treatment.

Table 5. Effects of phosphorus applied through triple superphosphate, cowdung, poultry manure and household wastes on calcium, magnesium and sodium contents in grain of T. Aman rice

Treatment	Ca content (%)	Mg content (%)	Na content (%)
T_0 = Control	0.77b	0.65	0.41
T_1 = Recommended dose	0.78b	0.70	0.44
T_2 = TSP_{50}+CD_{50}	0.98ab	0.70	0.46
T_3 = TSP_{75}+CD_{25}	0.94b	0.70	0.44
T_4 = TSP_{50}+ PM_{50}	1.16a	0.71	0.44
T_5 = TSP_{75}+ PM_{25}	0.78b	0.73	0.46
T_6 = TSP_{50}+ HW_{50}	0.83b	0.67	0.48
T_7 = TSP_{75}+ HW_{25}	0.92b	0.69	0.46
CV (%)	11.61	NS	NS

Means in a column followed by same letter (s) are not significantly different at 5% level of significance by DMRT
Figures shown as subscript represent percent phosphorus either from triple super phosphate (TSP), cowdung (CD), poultry manure (PM) or household wastes (HW)

Nitrogen content in straw

Nitrogen content in straw was significantly influenced by different levels of P through TSP applied along with cowdung, poultry manure and household wastes (Table 6). The maximum nitrogen content in straw (0.543%) was recorded in T_6 treatment receiving 50% P through TSP and 50% P through household wastes which was statistically identical to all the treatments except T_1 (RD) and control (T_0) treatments. The lowest nitrogen content in straw (0.349%) was found in T_0 (control) treatment. Application of P through TSP in combination with cowdung, poultry manure and household wastes increased nitrogen content in straw as compared to only chemical fertilizer and control treatment. Different levels of triple superphosphate along with organic manure exerted increasing effect on nitrogen content in straw. Nitrogen uptake increased significantly as the levels of P and PM increased.

Phosphorus content in straw

A significant difference in phosphorus content in straw was observed at different levels of P through TSP in combination with cowdung, poultry manure and household wastes (Table 6). Maximum P content in straw (0.090%) was recorded in treatment T_4 receiving 50% P through TSP and 50% P through poultry manure whose effect was however, statistically identical with all the treatments except T_1 (RD) and control (T_0) treatments. All the treatments receiving P through TSP in association with cowdung, poultry manure and household wastes performed better in recording phosphorus content in straw over control. The lowest P content in straw (0.071%) was recorded in control treatment. Sharma and Mitra (1991) reported a significant increase in N, P and K uptake with 5t/ha of FYM in rice based cropping system. Gupta (1995) found that the concentration of phosphorus in rice tissue at different stages, and P uptake at maturity, increased with the application of P and/or manure.

Potassium content in straw

The effects of different levels of P through TSP in combination with cowdung, poultry manure and household wastes on potassium content in straw was significant (Table 6). The highest potassium content in straw (1.051%) wasfound in treatment T_4 receiving 50% P through TSP and 50% P through poultry manure which was statistically identical to T_1, T_3, T_5, T_6 and T_7 treatments. The effects of these treatments were more pronounced in increasing potassium content in straw of rice. The lowest potassium content (0.502%) in grain was found in control treatment. These results suggest that poultry manure exerted better performance in increasing K uptake in rice straw.

Sulphur content in straw

Sulphur content in straw was influenced significantly due to the application of P through TSP applied along with cowdung, poultry manure and household wastes (Table 6). The variation in sulphur content in straw ranged from 0.054 to 0.078%. Maximum sulphur content in straw (0.078%) was found in treatment T_4 which was statistically similar to all the treatments except control. The lowest suphur content in straw (0.054%) was found in T_0 control (Treated plot). Rashid (2009) found that poultry manure significantly increased S content in straw. Therefore, all together it suggests that PM increased the S content in rice straw.

Table 6. Effects of phosphorus applied through triple superphosphate (TSP), cowdung, poultry manure and household wastes on nitrogen, phosphorus, potassium and sulphur contents in straw of T. Aman rice

Treatment	N content (%)	P content (%)	K content (%)	S content (%)
T_0 = Control	0.349 c	0.071 c	0.502 c	0.054 b
T_1 = Recommended dose	0.451 b	0.078 bc	0.947 ab	0.071 a
$T_2 = TSP_{50}+CD_{50}$	0.503 ab	0.085 ab	0.941 b	0.075 a
$T_3 = TSP_{75}+CD_{25}$	0.467 ab	0.083 ab	0.976 ab	0.072 a
$T_4 = TSP_{50}+ PM_{50}$	0.513 ab	0.090 a	1.051 a	0.078 a
$T_5 = TSP_{75}+ PM_{25}$	0.487 ab	0.082 ab	0.985 ab	0.077 a
$T_6 = TSP_{50}+ HW_{50}$	0.543 a	0.086 ab	0.999 ab	0.075 a
$T_7 = TSP_{75}+ HW_{25}$	0.483 ab	0.084 ab	0.963 ab	0.074 a
CV (%)	8.21	4.45	6.01	5.54

Means in a column followed by same letter (s) are not significantly different at 5% level of significance by DMRT
Figures shown as subscript represent percent phosphorus either from triple super phosphate (TSP), cowdung (CD), poultry manure (PM) or household wastes (HW)

Calcium content in straw

The concentration of calcium in straw was significantly influenced due to the application of different levels of P through TSP along with cowdung, poultry manure and household wastes (Table 7). Maximum calcium content in straw (0.760%) was noted in treatment T_5 receiving 75% P through TSP in combination with 25% P through poultry manure. The effect of this treatment was statistically similar to T_1, T_4, T_6 and T_7 treatments. The lowest calcium content in straw (0.480%) was recorded in T_1 (control). These results suggest that the organic manures increased the content of Ca with the together application of organic and inorganic fertilizers.

Magnesium content in straw

There was an insignificant effect of P applied through TSP along with poultry manure, cowdung and household wastes in recording magnesium content in straw (Table 7). Treatment T_7 receiving 75% P through TSP and 25% P through household wastes recorded the highest magnesium content (0.228%) in straw. The lowest value of magnesium content in straw (0.204%) was noted in T_0 (control).

Sodium content in straw

Sodium content in straw was also insignificantly influenced by the application of P through TSP in combination with cowdung, poultry manure and household wastes (Table 7). Treatment T_0 (control) receiving no inorganic or organic fertilizer recorded the lowest sodium content in straw (0.512%). Highest sodium content in straw (0.672%) was noted in T_6 treatment receiving 50% P through TSP and 50% P through household wastes. This might be due to the reason that household wastes contain more exchangeable sodium resulting higher sodium concentration in straw.

Table 7. Effects of phosphorus applied through triple super phosphate (TSP), cowdung, poultry manure and household wastes on calcium, magnesium and sodium contents in straw of T. Aman rice

Treatment	Ca content (%)	Mg content (%)	Na content (%)
T_0 = Control	0.480 b	0.204	0.512
T_1 = Recommended dose	0.606 ab	0.223	0.616
T_2 = TSP_{50}+CD_{50}	0.506 b	0.220	0.580
T_3 = TSP_{75}+CD_{25}	0.493 b	0.208	0.640
T_4 = TSP_{50}+ PM_{50}	0.666 ab	0.220	0.616
T_5 = TSP_{75}+ PM_{25}	0.760 a	0.216	0.533
T_6 = TSP_{50}+ HW_{50}	0.540 ab	0.222	0.672
T_7 = TSP_{75}+ HW_{25}	0.560 ab	0.228	0.569
CV (%)	11.61	NS	NS

Means in a column followed by same letter (s) are not significantly different at 5% level of significance by DMRT

Figures shown as subscript represent percent phosphorus either from triple super phosphate (TSP), cowdung (CD), poultry manure (PM) or household wastes (HW)

In conclusion, most of the findings revealed that some valuable benefits of integrated nutrient management over sole application of P fertilizer sources in nutrient uptake. In association with this, the findings of the present study concluded that 50% from organic sources and 50% from inorganic sources is the best combination for P fertilization in T. Aman rice to improve nutrient uptake capacity of rice.

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