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EFFECT OF BIO-SLURRY ON THE YIELD OF POTATO

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ABSTRACT

A field experiment was conducted at the farmers' field of the MLT (Multi location testing) site at Joypurhat and Gabtoli, Bogura during 2015-16. The aim of the study was to verify the effect of managed bio-slurry on potato yield. There were three treatments viz. T_1= Inorganic basis fertilizer dose for HYG, T_2 = Cow dung bio-slurry @ 5 t ha^{-1}+ IPNS basis inorganic fertilizer dose for HYG and T_3 = Farmer's practices. The results revealed that the yield and yield contributing characters of potato were significantly influenced by the treatments, where integrated plant nutrient management system and cow dung slurry produced a better yield of potato. In both of the locations, the highest yield and higher gross return were obtained from T_2 (Cow dung bio-slurry @ 5 t ha^{-1}+ IPNS basis inorganic fertilizer). Hence, the IPNS with bio-slurry will be a promising technology for higher crop yield and profit as well as for the improvement of soil fertility & sustain soil productivity in Joyipurhat and Gabtoli region (AEZs-25 and 4).
Key words: Cowdung, bio- slurry, IPNS, Potato.

Introduction

Nutrient overuse for tuber crops is particularly dramatic in some developing countries (Mueller *et al.,* 2012). So, decreasing chemical input by balanced fertilization and nutrient management options can significantly minimize its use and subsequently, reduce GHG (Greenhouse gas) emissions (Zhang *et al.,* 2012). Although science-based agricultural research studies have made considerable contributions to crop genetics and thus boosted both the quantity and quality of the global food supply (Wu *et al.,* 2014), the actual yields of farmers' fields are typically less than one-third of the potential yields found in many field studies (Mueller *et al.,* 2012). In addition, in many regions of the world, agricultural production increases have been accompanied by a significant degradation of natural resources, including soil nutrient and organic carbon depletion. Several studies indicated that combined use of chemical fertilizer with manure could increase tuber yield and economic returns compared with fertilizer or manure alone (Rahman *et al.,* 2011; Sarker *et al.,* 2010). But in Bangladesh, most of the soils have less than 1.7%, and some soils have even less than 1% organic matter. The average organic matter content of top soils has declined by 20-46% over past 20 years due to intensive cropping without the inclusion of legume crops, imbalanced use of fertilizer, use of modern varieties and scanty use of organic manure (Jeptoo *et al.,* 2013; Dada *et al.,* 2015). It is agreed that decreases in soil fertility are a major constraint for higher crop production in Bangladesh. Application of by-product of the recently popularized biogas technology named 'bio-slurry' is a good source of plant nutrients and can improve soil properties (Garg *et al*., 2005; Asadul *et al.,* 2015). It contains appreciable amounts of organic matter (20 to 30%) very much needed for our hungry soils. Bio-slurry provides both macro and micro-nutrients such as zinc, iron, manganese and copper that are also essential for plants but required in a trace amount to crops (Jeptoo *et al.,* 2013). There is enough scope to work with bio-slurry linked on soil fertility and crop yield. Therefore, the present study was undertaken to evaluate the effect of bio-slurry on the yield and yield components of Potato in Joyipurhat and Gabtoli region (AEZs-25 and 4) of Bangladesh.

Materials and Methods

The experiment was carried out at the Multi-location testing (MLT) site (AEZs-25 and 4) at Joypurhat district and Gabtoli Upazila under Bogura district during *rabi* season of 2015-16. The soil characteristics are illustrated in Table 1-2. The experiment was laid out in RCB design with 3 dispersed replications at all

locations. There were three treatments viz. T_1= Inorganic basis fertilizer dose for HYG, T_2 = Cow dung bio-slurry @ 5 t ha^{-1}+ IPNS basis inorganic fertilizer dose for HYG and T_3 = Farmer's practices. The nutrient contents of bio-slurry are shown in the Table 3. The unit plot size was 10m ×10m. Tubers (var. Lal Pakri for Joypurhat and Cardinal for Gabtoli) were planted on November 20 to 25, 2015 at the spacing of 50□25 cm^2. A full dose of bio-slurry (for treatment T_2) TSP, MoP, Gypsum, Zinc sulphate, Boric acid and half of Urea was applied at the time of final land preparation. Remaining urea was applied at the side row and covered with soil about 30-35 days after sowing (DAS) at the time of earthling up followed by irrigation. Irrigation was provided after 15-20 and 35-40 DAS, fungicide was sprayed three times during the whole growth period. Other intercultural operations (weeding, rouging etc.) were done when necessary. At maturity, different data were collected accordingly and subjected to statistical analysis. The gross economic return was calculated on the basis of the prevailing market price of the commodities. The crop was harvested on February 3 to 21, 2016. The data obtained for yield and yield contributing characters were statistically analyzed to find out the significance of differences among the treatments. The mean values of all the characters were evaluated and analysis of variance was performed by MSTAT-C software package and the mean differences were adjudged by Duncan·s Multiple Range Test (Gomez and Gomez, 1984). The gross economic return was calculated on the basis of prevailing market price of the commodities. Economic analysis was done on the basis of existing market prices of input and output (Reddy and Reddi, 1992).

Table 1. Soil analysis values of different samples collected from at Joypurhat district during the *rabi* season of 2015-16

pH	OM (%)	Total N (%)	K	P	S	Zn	B
			(meq/100g soil)	(mg/g soil)			
5.5	1.31	0.07	0.04	4.15	19.5	0.05	0.23
Acidic	L	VL	VL	VL	M	VL	L

Table 2. Soil analysis values of different samples collected from at Gabtoli Upazilla under Bogura district during the *rabi* season of 2015-16

pH	OM (%)	Total N (%)	K	P	S	Zn	B
			(meq/100g soil)	(mg/g soil)			
6.2	1.61	0.07	0.12	15.20	21.4	0.50	0.21
Slightly acidic	L	VL	L	M	M	L	L

Table 3. Nutrient supply from bio-slurry

Organic material	Nutrient supply (kg) from 1 bio-slurry		
Cowdung slurry	N	P	K
	4.5	1.5	5

Results and Discussion

Joypurhat: The yield and yield attributes of potato have been presented in Table 4. The highest plant height was observed in T_2 (59.8cm) and the minimum plant height (58.4cm) was recorded in T_3. The maximum no. of tuber per plant was observed in T_2 (18.1) whereas, the minimum no. of tuber per plant was recorded in treatment T_3. The highest weight of tuber was obtained from T_2 (251gm) which differed significantly from other treatments. The highest tuber yield was obtained from T_2 (24.70 tha^{-1}) and it was statistically similar with T_1 (23.06 tha^{-1}) but differed from treatment T_3 (22.23 tha^{-1}). The results of the economic performance of potato were presented in (Table 5). From the cost and return analysis, the highest gross margin (Tk. 157545 ha^{-1}) was also obtained from the treatment T_2 followed by T_1 (Tk. 140825 ha^{-1}) and T_3 (Tk. 133105 ha^{-1}).

Gabtoli: The yield and yield attributes of potato have been presented in Table 6. All the characters were varied significantly among the treatments. The highest plant height was observed in T_2 (76.73cm) and the minimum plant height (75.034cm) was recorded in T_3. The maximum no of tuber per plant was observed in T_2 (5.3) whereas, the minimum no. of tuber per plant was recorded in treatment T_3. The highest weight of tuber was obtained from T_2 (383.3gm) which differed significantly from other treatments. The highest tuber yield was obtained from T_2 (29.96tha^{-1}) and it was statistically differed from T_1 (27.93 tha^{-1}). The lowest tuber yield (25.39tha^{-1}) was recorded in treatment T_3. The results of the economic performance of potato were presented in (Table 7). From the cost and return analysis, the highest gross margin (Tk. 146825 ha^{-1}) was also obtained from the treatment T_2 followed by T_1 (Tk. 133353 ha^{-1}) and T_3 (Tk. 102690 ha^{-1}).The present result is in agreement with that of Hossain (2018), where he found the good effect of cow dung slurry on boro rice. Variable effect on tuber weight plant^{-1} was also reported by Haque (2015) who noticed that tuber weight plant^{-1} was higher with the application of cow dung bio-slurry and IPNS basis inorganic fertilizers. The present result clearly indicated that integrated nutrient management had a distinct impact to produce the good size & quality of potato.

Table 4. Effect of bio-slurry on yield and yield attributes of potato at Multi location Testing (MLT) sites Joypurhat district during the *rabi* season of 2015-16

Treatment	Plant height (cm)	No. of branch/ Plant	No. of tuber/ Plant	Wt. of tuber/ Plant (g)	Tuber Yield (tha^{-1})
T_1	58.4	3.5	17.5	235	23.06
T_2	59.8	3.6	18.1	251	24.70
T_3	58.0	3.3	17.0	230	22.23
LSD (0.05)	0.67	NS	0.56	17.03	1.81
CV (%)	7.16	7.69	8.34	8.71	9.04

Table 5. Economic performance of potato as influenced by bio-slurry at Multi location Testing (MLT) sites, Joypurhat district during the *rabi* season of 2015-16

Treatment	Gross return (Tk ha^{-1})	Cost of production (Tk ha^{-1})	Gross margin (Tk ha^{-1})
T_1	230600	89775	140825
T_2	247000	89455	157545
T_3	223300	90195	133105

Price (Tk kg^{-1}): potato @10, Cow dung slurry @ 01

Table 6. Effect of bio-slurry on yield and yield attributes of potato at Multi location Testing (MLT) sites Gabtoli Upazilla under Bogura district during the *rabi* season of 2015-16

Treatment	Plant height (cm)	No. of branch/ Plant	No. of tuber/ Plant	Wt. of tuber/ Plant (g)	Tuber Yield (tha^{-1})
T_1	74.56	4.9	343.3	27.92	74.56
T_2	76.73	5.3	383.3	29.96	76.73
T_3	75.03	4.37	316.7	25.39	75.03
LSD (0.05)	1.53	0.665	0.058	3.718	1.53
CV (%)	7.08	8.47	7.53	9.32	7.08

T_1= Inorganic basis fertilizer dose for HYG,

T_2 = Cow dung bio-slurry @ 5 t ha^{-1}+ IPNS basis inorganic fertilizer dose for HYG

T_3 = Farmer's practice

Table 7. Economic performance of potato as influenced by bio-slurry at Multi location Testing (MLT) sites, Gabtoli Upazilla under Bogura district during the *rabi* season of 2015-16

Treatment	Gross return (Tk ha^{-1})	Cost of production (Tk ha^{-1})	Gross margin (Tk ha^{-1})
T_1	223360	90007	133353
T_2	239680	92855	146825
T_3	188720	86030	102690

Price (Tk kg^{-1}): potato @ 8 (Cardinal), Cow dung slurry @ 01

Conclusion

Considering the above result of two locations, it was observed that higher yield and economic returns were obtained from IPNS with cow dung slurry compared to farmers practice. IPNS with cow dung slurry gave higher yield and profit. Therefore, it could be recommended that IPNS with bio-slurry will be a promising technology for higher crop yield and profit as well as for the improvement of soil fertility & sustain soil productivity in Joyipurhat and Gabtoli region (AEZs-25 and 4).

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