Integrated Nutrient Management on Panikachu in Joypurhat

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Abstract
An experiment was conducted at the Multi location Testing (MLT) site, (medium highland under AEZ-25) Pachbibi, Joypurhat, Bogura district during rabi season of 2015-16**.** In the study, to evaluate the response of panikachu to different nutrient management practices under farmer's field condition. There were five treatments viz. T_1=Soil test based fertilizer dose (FRG 2012), T_2=T_1+ 25% NPK, T_3=IPNS with 3 tha^{-1} poultry manure, T_4= IPNS with 5 tha^{-1} cowdung, and T_5= Farmers practice. The experiment was laid out in randomized complete block design (RCBD) with six dispersed replications.T_3= IPNS with 3 t ha^{-1} poultry manure, T_4 = IPNS with 5 t ha^{-1} cowdung, and T_5= Farmers practice. The highest Panikachu rhizome yield (21.71 t ha^{-1}), gross return (TK. 430185ha^{-1}) and BCR (3.61*)* were found from T_3 (IPNS with 3 t ha^{-1} poultry manure) which was followed by T_5 (19.66 tha^{-1}) T_4 (19.45 tha$^{-1)}$, and statistically differed to other treatments. However, from results, it could be recommended that IPNS will be a promising technology for higher crop yields of Panikachu and profit as well as for the improvement of soil fertility and sustain soil productivity in Joypurhat region.

Key words: Fertilizer recommendation, Integrated, IPNS, Panikachu

Introduction

Bangladesh is about 170 million People and the rate of population (about 1.42% annually) is higher than other developing countries (BBS, 2016). In this situation, the major challenges for agriculture sector of Bangladesh are to increase and sustain crop production. It can be possible to overcome this problem through cropping intensification with high yielding variety and used balanced fertilizer. So, that soil fertility will be managed properly. The present soil fertility status of Bangladesh is alarming due to excess use of inorganic fertilizer. The use of inorganic fertilizer is expensive, and also hazardous to the soil environment. Chemical fertilizers cause problems not only to the soil health but also to the human health and environment. To combat this problem, it is necessary to use organic fertilizers along with chemical fertilizers that will not only boost Panikachu production but also save the environment. On the other hand, sustainable soil nutrient enhancing strategies involve the wise use and management of inorganic and organic nutrient (fertilizer) sources in ecologically sound production systems (Roberts, 2007). Used of organic manures to meet the nutrient requirements of crop that would be an inevitable practice to incorporate nutrients into soil, and to make the balance the soil productivity. It helps to develop sustainable agriculture. Organic manures not only improve the soil physical, chemical and biological properties but also improve the moisture holding capacity of soil. In this way, organic manure can enhance crop productivity with better quality yield (BARC, 2012). Organic manure, fertilizers and other amendments either alone or in combinations could be used to develop nutrient supplying capacity of the soil (Dutta and Sangtam, 2014). The application of poultry manure also increasing the pH, P, K, Ca, Mg and Mn in the soil. Poultry manure is more effective compared to other animal manures (Wijejawardena, 2000). Poultry manure could supports root-Knot nematode of *solanaceous* crops such as potato, tomato, brinjal and capsicum (Gaur *et al.*, 1971); (Wijejawardena, 2000). Panikachu is one of the most important tuber crops commercially grown in all parts of the country. The crop has good potential for production in the wet season and can survive a certain period in floodwater. It is a good source of carbohydrate and other nutrients, supplementing a diet that tends to be deficient during this particular period. The whole plant of panikachu including leaves, petioles, lati and rhizomes are edible in spite of their varying degrees of acidity in some minor cases (Saha and Hussain, 1983). It is a popular crop in Joypurhat area but many farmers grow local varieties. Farmers are growing crops without fertilizer recommendation. Determination of fertilizer for the crop is very important for suitable crop production. Since chemical fertilizer alone will not be able to sustain the productivity, integrated use of all potential sources of plant nutrients seems to be the only option to maintain soil fertility and crop productivity. The present study was under taken to find out an integrated fertilizer (inorganic and organic) doses for the cultivation of panikachu, and to increase soil fertility & sustain soil productivity for Joypurhat region.

Materials and Methods

The experiment was conducted at the Multi location Testing (MLT) site, (medium highland under AEZ-25) Pachbibi, Joypurhat, Bogura district during rabi season of 2015-16**.** In the study, to evaluate the response of panikachu to different nutrient management practices under farmer's field condition. The experiment was laid out in randomized complete block design (RCBD)

with six replications. The crop was accommodated in 8 m × 4 m. BARI panikachu-2 variety was used as experimental crop. There were five treatments viz. T_1= Soil test based fertilizer dose (FRG 2012) (90.0-36.4-40.46-7.6 kg ha^{-1} NPKS), T_2= T_1+ 25% NPK (112.5-45.5-50.57-7.6 $kgha^{-1}$ NPKS) T_3= IPNS with 3 tha^{-1} poultry refuse (37.5-21.0-28.5 $kgha^{-1}$ NPK), T_4 = IPNS with 5 t/ha cowdung (30.0-9.0-13.8 kg ha^{-1} NPKS), and T_5=Farmers practice (138.25-51.6-115.5 kg ha^{-1} NPK).The climatic condition was cold and humid at the vegetative stage and moderately hot & high humid with frequent rain during fruiting and harvesting phase (Table 1). The fertilizers were used in treatment wise. Seedlings of BARI panikachu-2 were planted on 29-31 December, 2015. MoP (½) and all others fertilizers (Organic and inorganic) were applied during final land preparation except urea. Remaining MoP and One-sixth urea were applied two equal installments at 45-60 days after transplanting. Rest urea was applied at 15 days intervals at five equal installments after transplanting. Before conducting the experiment soil samples were collected from the experimental fields, and then sent to the Soil Resources Development Institute, Bogura for analysis to know the level of nutrient status. Chemical analysis of soil's results has been presented in (Table2). Weeding, irrigation, crop protection measure and other intercultural operation were taken as and when necessary. The crop was harvested from 30 March to 28 July, 2016. The yield of panikachu per plot was recorded and converted into yield per hectare according to treatment. At maturity, different data were collected in different parameter wise.

Data analysis

The data obtained for yield contributing character and yield 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 Reddy, 1992).

Table 1. Meteorological data recorded at the experimental site during the study period (2015-16)

Months	During 2015-16			
	Average Temperature (^{0}C)		Average Relative Humidity (%)	Average Rainfall (mm)
	Maxi.	Min.		
January	24.50	12.02	93.89	0.22
February	28.83	16.20	91.76	0.0
March	32.45	20.77	87.56	0.0 0.5
April	-	-	-	-
May	-	-	-	-
June	-	-	-	-
July	32.90	26.86	93.31	1.69
August	32.41	26.17	94.42	1.47
September	33.38	25.96	94.53	1.05
October	33.50	23.42	93.72	0.09
November	31.16	18.95	93.99	0.0 0.0
December	25.75	14.01	93.21	

Table 2. Soil analysis values of different samples collected from multi-location testing (MLT) sites at Pachbibi upazila under Joypurhat district during the rabi season, 2015-16

Analysis results							
pH	OM (%)	Total N (%)	(meq/100g soil)	(mg/g soil)			
			K	P	S	Zn	B
5.8	1.77	0.09	0.16	6.00	18.7	0.65	0.29
Slightly acidic	L	VL	L	VL	M	L	L

Nutrient status of cowdung and poultry manure used in the experiment

Organic manure	OC	N	P	K
		%		
Cowdung	3.90	1.0	0.30	0.05
Poultry manure	12.60	0.13	0.07	0.01

Results and Discussion

Yield and yield attributes influenced by different nutrient management practices

The results of yield and yield attributes of Panikachu were presented in (Table 3).There were significant different (P≤0.05) among the treatments in all characters. The highest plant height was observed in T3 (172.50cm) followed by 167.17 cm and 164.66cm, in T_5 and T_4, respectively. The minimum plant height (153.67cm) was recorded in T_2. Chauhan *et al. (*2017) agreement with the results. Dnyaneshwar (2015) and Malewar *et al.* (2012) also found almost similar results. Jeptoo *et al.* (2013) result supported the findings well-decomposed manure enhances the vegetative growth, fresh root yield and quality of root crops. The similar types of results reported by (Phillips *et al.,* 2002) that research trials have indicated increased yield and advanced maturity using poultry manure as a pre-planting treatment without increasing the percentage of root forming. The highest no. of stolons per plant was observed in T_3 (13.90) which was statistically similar with T_5 and T_4. The highest yield of stolon (17.71 t ha^{-1}) was obtained from treatment T_3. It was followed by T_4 and T_5. The lowest yield of stolon (13.80) was recorded from treatment T_1. The maximum rhizome length was observed in T_3 (35.52cm) and the minimum rhizome length was recorded in T_2 (28.57cm). Similarly, the maximum rhizome yield was found in T_3 (27.71 tha^{-1}) which was statistically similar with T_5 and T_4 (19.66 tha^{-1}, and 19.45 tha^{-1}) and the minimum rhizome yield was recorded in treatment T_1 (15.98 tha^{-1}). The present results were in agreement with the results reported by (Alabi, 2006), (Vasuniya, 2010), (Dnyaneshwar, 2015) and (Hangarg *et al.,* 2016).

Economic performance of panikachu

The results of economic performance of Panikachu were presented in (Table 04). The present investigation significantly higher gross returns (Tk. 430185 ha^{-1}), gross margin (Tk. 311152 ha^{-1}) and BC ratio (3.61) were obtained from T_3. whereas, the minimum gross return (331930Tk. ha^{-1}), gross margin (Tk. 213158 ha^{-1}) and BC ratio (2.79) were obtained in T_1. In the present investigation, it is indicated that the efficiency of IPNS with cow dung or poultry manure (organic and inorganic fertilizer) gave higher economic return than other (only chemical fertilizer) treatments. The similar type of reported by (Komal *et al.,* 2019). Chopra *et al. (*2005) also found the superior yield of panikachu with Pariari and Khan (2013) and Komal *et al.* (2019).

Conclusion

Considering the result it was observed that higher yield and economic returns were obtained from IPNS based fertilizer doses compared to farmers practice. IPNS with cow dung or poultry manure gave higher yield and profit. Therefore, from the results, it could be recommended that IPNS will be a promising technology for higher crop yield and profit as well as for the improvement of soil fertility and sustain soil productivity in Joypurhat region for Panikachu production.

Table 3. Yield and yield attributes of Panikachu as influenced by different fertilizer package at the multi-location testing (MLT) sites, at Pachbibi, upazila under Joypurhat district during rabi season 20115-16

Treatment	Plant height (cm)	No of Stolon/plant	Yield of Stolon(t ha^{-1})	Rhizome length (cm)	Yield of rhizome(t ha^{-1})
T_1= STB fertilizer dose (FRG 2012)	157.83ab	11.93b	13.80c	30.32c	15.98c
T_2= T_1+25% NPK	153.67b	11.10b	14.50bc	28.57c	18.89b
T_3 = Poultry refuse @ 3t/ha + IPNS basis inorganic fertilizer dose	172.50a	13.90a	17.71a	35.52a	21.71a
T_4= Cowdung @ 5t/ha +IPNS basis inorganic fertilizer dose	164.66ab	12.58ab	16.60ab	32.60abc	19.45ab
T_5= Farmers practice	167.17ab	12.90ab	16.37ab	33.92ab	19.66ab
CV (%)	8.26	12.00	10.54	11.01	10.30

Table 4. Cost and return analysis of Panikachu as influenced by different fertilizer package at the multi-location testing (MLT) sites at Pachbibi, upazila under Joypurhat district during rabi season 20115-16

Treatment	Gross return (Tk. tha^{-1})			Cost of production (Tk. tha^{-1})	Gross margin (Tk.tha^{-1})	Benefit cost Ratio(BCR)
	Stolon	Rhizome	Total			
T_1	276000	55930	331930	118772	213158	2.79
T_2	290000	66115	356115	121073	235042	2.94
T_3	354200	75985	430185	119033	311152	3.61
T_4	332000	68075	400075	121115	278960	3.30
T_5	327400	68810	396210	124393	271817	3.18

Market price of Stolon of Panikachu @ Tk 20/kg Stolon of localvariety and Rhizome @ Tk 3.50/kg

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