

SELECTION OF IDEAL FERTILIZER DOSES IN BANANA-POTATO INTERCROPPING

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ABSTRACT

An experiment was conducted to detect the ideal fertilizer doses in Banana-potato intercropping during *rabi* season of 2015-16. The location for the study was at the Multi location Testing (MLT) site, (medium highland under AEZ-03) Goneshpur of Shibganj upazilla of Bogura district. The experiment was laid out in randomized complete block design (RCBD) with six dispersed replications. There were five nutrient packages viz. T₁ = Recommended fertilizer dose (FRG, 2012), T₂=T₁+ 25% higher NPK, T₃=75% of NPK, T₄= Farmers practice and T₅=Control. The highest banana equivalent yield (86.74 tha⁻¹) and higher gross return (Tk.867400 tha⁻¹) were found from T₂ (T₁+ 25% higher NPK) which was statistically similar with treatment T₁. The lowest banana equivalent yield (46.14 tha⁻¹) and gross margin received from treatment T₅. In the study, T₂ treatment overall showed the better performance in respect of banana yield, potato yield, gross return as well as gross margin, so the fertilizer dose N_{287.5}-P₁₀₀-K₃₇₅-S-36. Zn 1.2- B_{1.0} with cowdung 15000 Kg ha⁻¹ was optimum for maximizing the yield as well as economically profitable and viable for banana intercropping with potato cultivation in Bogura region of Bangladesh.

Key words: Fertilizer, intercrop, Banana, potato.

Introduction

Bangladesh, an agro-based country is facing the major challenges for agriculture sector. It can be possible to overcome this problem through cropping intensification with high yielding variety and using balanced fertilizations. People of Bangladesh not only suffer from food deficit, but also suffer from different nutritional deficiency like protein and calories as well as vitamins and minerals. Here the importance of intercropping has high demand due to increases of total production, profitability per unit area without affecting the production of the sole crops (Islam *et al.*, 2013). It offers more stability, less risk, better utilization of limited resources and wide diversity in the production of food (Islam *et al.*, 2006). Banana is a leading tropical fruit in the world market with highly organized and developed industry (Anonymous, 1999). It is richer in carbohydrate and mineral (K, Ca, Mg, and P) and even richer in caloric value (Bhan, 1977). To be assured the better performances from those targeted crops, balance fertilization is prerequisite. Imbalance use of fertilizers is a serious problem for the country. Bangladesh Agricultural Research Council published fertilizer recommendation guide in 2012, which was found to be very useful for the extension agents and farmers. But with the progress of time there have been considerable changes in crops and cropping patterns including soil, physical and chemical characteristics, some new crops and cropping patterns are emerged as promising, many areas became deficient in Zinc, Boron and other nutrients and farmers are growing those crops without any fertilizer recommendation. So, the rescheduled fertilizer dose may keep in great role for sustainable crop production and may include in the new national fertilizer recommendation guide. Location specific AEZ based fertilizer management for crops and cropping patterns are also very useful in this regard. The present study was undertaken to find out the optimum fertilizer doses for banana intercropping with potato in Bogura region (AEZ-3) of Bangladesh.

Materials and Methods

The experiment was conducted to detect the ideal fertilizer doses in Banana-potato intercropping during *rabi* season of 2015-16. The location for the study was at the Multi location Testing (MLT) site, (medium

highland under AEZ-03) Goneshpur of Shibganj upazilla of Bogura district. The climatic condition of the experimental site was cold and humid at the vegetative stage and moderately hot & high humid with frequent rain during fruiting and harvesting phase (Table 1). The soil characteristics are illustrated in Table 2. The experiment was laid out in randomized complete block design (RCBD) with six dispersed replications. The crop was accommodated in 8m × 4 m with banana and potato spacing were 1m × 1.25 m and 45 cm × 15cm. The variety of banana and potato were Rangin meher sagar and Lal Pakri. Thirty to forty days aged banana sword suckers were transplanted on October 20, 2015. Potato seed tubers were planted on 5 November to 10 November 2015 between banana plants. There were five treatments viz. T₁ = Recommended fertilizer dose as per FRG (2012) (230-80-300-36-1.2-1.0-15000 N-P-K-S-Zn-B and cow dung Kgha⁻¹), T₂ = T₁+ 25% higher NPK,(287.5-100-375-36-1.2-1.0-15000 N-P- K- S- Zn- B and cow dung Kgha⁻¹), T₃=75% of NPK, (172.5-60-225-36-1.2-1.0-15000 N- P- K- S- Zn- B and cow dung Kgha⁻¹), T₄ = Farmers practice (346-100-300-81-5000 N P KS Zn B and cowdung kgha⁻¹) and T₅ = Control. The entire quantity of P, K, S, Zn, B and cowdung were applied during pit preparation at 4 to 5 days prior to planting in treatment wise. Nitrogen was applied in three equal splits at 20, 60, and 90 days after planting (DAP) of banana. The crop of banana was weeding in two times as vegetative and fruiting stage, whereas the intercrop potato was weeding only in vegetative stage. Diathane M-45@ 2g/L was sprayed at 45 and 65 days after planting to control late blight of potato. For controlling banana leaf and fruit beetle, Savin 85 Sp was sprayed @ 0.5g/L of water. Tilt (0.05%) was sprayed to protect Sigatoka disease. Potato was harvested during 10 January to 7 February 2016 and banana was harvested on 28 Sep. to 13 Oct. 2016 irrespective of farmers. At harvest, data were collected from 10 randomly selected plants. The yield per plot was recorded and converted into yield per hectare. The gross economic return was calculated on the basis of prevailing market price.

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 Duncans 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).

System productivity: Total system productivity was calculated as summation of individual crop yield of each cropping cycle. The productivity of different crop sequences was compared by calculating their economic banana equivalent yield (BEY) using formula given by Ahalawat and Sharma (1993), where

$$BEY = \frac{\text{Yield of each crop (t ha}^{-1}) \times \text{Economic value of respective crop (TK. ha}^{-1})}{\text{Price of banana (Tk. ha}^{-1})}$$

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

Months	Average Temperature (°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
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
December	25.75	14.01	93.21	0.0

Table 2. Soil analysis values of different samples collected from MLTs, Shibganj, Bogura 2015-16

pH	OM (%)	Total N (%)	(mg/g soil)				
			(meq/100g soil)	P	S	Zn	B
6.07	1.66	0.08	K	10.66	16.05	0.72	0.31
Slightly acidic	L	VL	L	M	M	L	M

Results and Discussion

The yield and yield contributing characters of Banana: The yield and yield attributes of banana have been presented in Table 3. There was significant difference among the treatments for all studied characters. The highest length of bunch (91.32cm) and number of hands/bunch (9.05) were observed in T₂ those were statistically similar with all treatments except T₅ (control plot) treatment. Similarly, the highest number of finger/hand (17.48) was also obtained from treatment T₂ followed by T₁ and T₃. The lowest number of finger/hands was found in T₅ (control plot). Similar observation was found in banana yield in case of all treatments. The highest yield of banana was 68.87 (tha⁻¹) was recorded in T₂. It was statistically similar with T₁ and T₄. The lowest yield of banana was (36.53tha⁻¹) was found in control plot (T₅).

Yield of intercrop (Potato) and equivalent yield: The highest yield of intercrop (potato) 17.87 (tha⁻¹) was found in treatment T₂ followed by treatment T₁. The lowest intercrop yield was (9.61 tha⁻¹) in treatment T₅. The highest equivalent yield of banana (86.74 tha⁻¹) was also detected in treatment T₂ and the lowest equivalent yield of banana was obtained from T₅ (control plot).

Table 3. Yield contributing characters of Banana with potato under intercropping situation and equivalent yield of banana at the MLT site of Shibganj upazilla under, Bogura district during 2015-16

Treatment	Length of bunch (cm)	No of hands/ bunch	No of fingers/ hand	Yield of banana (tha ⁻¹)	Yield of intercrop (tha ⁻¹)	Banana equivalent yield (tha ⁻¹)
T ₁	88.11 a	8.62a	16.72ab	64.62 ab	16.32 a	82.19 ab
T ₂	91.32 a	9.05 a	17.48a	68.87 a	17.87 a	86.74 a
T ₃	85.13a	8.32a	15.75bc	59.72b	13.83 b	73.55 c
T ₄	87.68 a	8.68 ab	16.59 ab	66.15ab	13.09 b	79.46bc
T ₅	69.01b	7.71 b	14.34 c	36.53 c	9.61 c	46.14 d
CV(%)	8.43	9.89	9.4	10.12	11.45	8.39

T₁ = Recommended fertilizer dose (FRG 2012) (230-80-300-36-1.2-1.0-15000 N-P-K-S-Zn-B-with cow dung Kg^{ha}⁻¹)

T₂ = T₁+ 25% higher NPK (287.5.-100-375-36-1.2-1.0-15000 N-P- K- S- Zn- B with cow dung Kg^{ha}⁻¹)

T₃ = 75% of NPK (172.5-60-225-36-1.2-1.0-15000 N- P- K- S- Zn- B- with cow dung Kg^{ha}⁻¹)

T₄ = Farmers practice (346-100-300-81-15000 N P KS Zn B with cowdung Kg^{ha}⁻¹)

T₅ = Control

Economics performance: The economic performances of banana potato intercropping system have been presented in Table-04. The highest gross return (TK.867400 ha⁻¹) and gross margin (Tk. 638906 ha⁻¹) was also achieved by treatment T₂. It was followed by T₁ (Tk.821900 ha⁻¹, Tk. 598401ha⁻¹), T₄ (Tk.794600ha⁻¹, Tk.552100ha⁻¹) and T₃ (TK.735500ha⁻¹, Tk.517449ha⁻¹). The lowest gross return and gross margin (Tk.461460ha⁻¹) was found in treatment T₅ (control plot). In the present investigation, it was observed that judicious application of fertilizer is essential for yield and income maximization of intercropping system. Mandal *et al.* (2004) reported that intercropping system produced the highest yield of individual crop. In another experiment, Mitra *et al.* (2001) reported that all intercropping system generated higher return than sole crop. A similar result was also reported by Mahfuza *et al.* (2012).

Table 4. Economic performance of potato in banana-potato intercropping at Shibganj, upazilla under, Bogura district during 2015-16

Treatment	Gross return (Tkha ⁻¹)	Cost of treatment (Tkha ⁻¹)			Gross margin (Tkha ⁻¹)
		Banana	Potato	Total	
T ₁	821900	163348	60151	223499	598401
T ₂	867400	166149	62345	228494	638906
T ₃	735500	160094	57957	218051	517449
T ₄	794600	181300	61800	242500	552100
T ₅	461460	-	-	-	461460

Market price of potato @ 10 and banana @ 10 Tk./kg

Conclusion

From result of this investigation, it may be concluded that the treatment T₂ was found economically profitable and viable for intercropping banana with potato production in the Medium High land under AEZ-03. So, the fertilizer dose N_{287.5}-P₁₀₀-K₃₇₅-S₃₆-Zn_{1.2}-B_{1.0} with cow dung 15000 Kgha⁻¹ was optimum for growing as well as economic benefit of in an intercropping system in Bogura region (AEZ-3).

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