

INTERCROPPING OF BANANA WITH POTATO AND VEGETABLES

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Abstract

An intercrop-based experiment was conducted for two consecutive years during September 2012 to October 2014 at farmer's field of MLT site, Shibganj, Bogra to find out the performance of banana intercropped with potato and vegetables. There were three intercrop-based treatments i.e. Banana + Potato, Banana + Radish + Potato and Banana + Cauliflower + Potato were tested along with Sole Banana. The results revealed that all the intercrops produced higher banana equivalent yield over the sole banana in both the years. However, among the intercrop combinations, Banana + Cauliflower + Potato provided the highest equivalent yield (104.04 tha^{-1} in 2012-13 and 122.50 tha^{-1} in 2013-14) followed by Banana + Radish + potato. Sole banana produced the lowest equivalent yield in both the cropping seasons. Higher gross margin was also obtained from the intercrop combinations. Among the intercrops, Banana + cauliflower + Potato provided higher gross margin (Tk.656898 ha^{-1}) but due to higher cost, this treatment failed to show higher BCR than Banana + Radish + Potato.

Keyword: Intercrop, banana equivalent yield, potato, radish, cauliflower.

Introduction

Banana (*Musa sapientum* L.) is one of the popular and major fruits in Bangladesh in respect of acreage and production. It is one of the cheapest, most plentiful and nourishing of all fruits which is available throughout the year. It ranks top position among the major fruit crops grown in the country, which comprises about 42% of the total fruit production. Banana is largely grown in well drained high land, which is also suitable for growing other cash crops. The inter row space of Banana remains under utilized in the early growing period. During this period, short duration crops may be grown as intercrops with Banana (Bose, 1990). Intercropping with banana is more profitable without much investment (Haque, 1984). The success of intercropping systems depends mostly on selection of component crops as well as agronomic modification of resources used (Midnare, 1993). Selection of intercrops should be done in such a way that, they have no or little adverse effect on the main crop. Therefore, this experiment has been undertaken to optimize the productivity and economic return of Banana based intercropping system.

Materials and methods

The intercrop-based experiment carried out for the two consecutive years during September 2012 to October 2014 at farmer's field of the MLT site, Shibganj in

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the medium highland under AEZ-3. The trial laid out in Randomized Complete Block (RCB) design with six dispersed replications. The treatments were- T₁: Sole Banana, T₂: Banana + Potato, T₃: Banana + Radish + Potato and T₄: Banana + Cauliflower + Potato. The fertilizers used @ 277-96-300-90-5-1.5 kg ha⁻¹ NPKSZnB and Cowdung 15 t ha⁻¹. N was applied in three equal splits at 20, 60 and 90 days after planting (DAP). The entire quantity of P, K, S, Zn, B and Cowdung applied during pit preparation at 4 to 5 days prior to planting.

Table 1. Crop management practices adopted for different crops in field experiments

Crops and their management	Banana	Radish	Cauliflower	Potato
Variety	Rangin maher sagar	Roki	Thirty-three	Granola
Date of sowing	15 Sept. 2012 and 10 Oct. 2013	20 Sept. 2012 and 12 Oct. 2013	20 Sept. 2012 and 12 Oct. 2012	06 Nov. 2012 and 02 Dec. 2013
Planting materials	Sucker	Seed	Seedling	Tuber
Spacing	1m x 1.25m	45cm line sowing	60 x 45cm	45 x 15cm
Fertilizer as basal (NPKSZnB+15 t/ha CD)	277-96-300-90-5-1.5	64-25-51-0-0-0	60-15-45-0-0-0	20-12-50-15-0-0
Pesticides used	Imitaf for banana leaf and fruit beetle (1 times)	Carate for flee beetle (2 times)	Cythrine for aphid (1 times)	Dithane M-45 for Late blight (2 times)
Irrigation	1 st irrigation during sucker plantation and rest irrigations were done in intercrops	1 st and 2 nd Irrigation at germination and root development stage	1 st 2 nd and 3 rd Irrigation at seedling, vegetative and head initiation stage	1 st 2 nd and 3 rd Irrigation at vegetative, stolon formation and tuber development stage
Weeding	2 times (vegetative and fruiting stage)	2 times (vegetative and root development stage)	2 times (vegetative and prior to fruiting stage)	vegetative stage
Date of harvest	20 Oct. 2013 and 19 Oct. 2014	11 Nov. 2012 and 30 Nov. 2013	22 Nov. 2012 and 19 Dec. 2013	16 Jan. 2013 and 15 Feb. 2014

The gross economic return was calculated on the basis of prevailing market price of the products. All the data were statistically analyzed and the mean comparisons were made by LSD at 5% level (Gomez and Gomez, 1984).

Thirty to forty days aged suckers were transplanted on 20 September. Radish and cauliflower were sown at five days after planting of banana. First weeding was done at 15 days after radish and cauliflower sowing/transplanting while the banana was 20 days old after planting. Second weeding was done at 40 DAS especially during root development stage of radish as well as prior to head initiation of cauliflower. Potato tubers were planted after harvest of radish and cauliflower as intercrop with banana. Weeding followed by earthing up was done at 25 days after planting of potato. Irrigation was done for banana 10 days (radish and cauliflower at 5 DAS) and 25 days (radish and cauliflower at 20 DAS) after sucker planting. The 3rd irrigation for cauliflower was done at 40 DAS (before head initiation) while the banana plant was 45 days old. Potato was irrigated at 25, 50 and 65 days after planting (age of banana plant was 81, 106 and 121 DAS respectively). Karate (Lambda-Cyhalothrin) 25EC @ 1ml/L of water was sprayed at 5 and 12 days after germination (DAG) to control flea beetle of Radish. Cythrine (Cypemethrine) @ 1ml/L of water was sprayed at 15 days after germination (DAG) to control aphid of Cauliflower. Dithane M-45 @2g/L was sprayed at 45 and 55 days after sowing to control late blight of potato. Imitaf (Imidachloprid) @0.5ml/L was sprayed at fruiting stage of banana to control banana leaf and fruit beetle. Banana equivalent yield and production efficiency was calculated.

Results and Discussion

Yield contributing characters of banana:

The results presented in Table 2 indicated that yield contributing characters of banana were not varied significantly among the treatments in both the years. It was noticed that there was no significant adverse effect of the intercrops on the performances of banana regarding yield and yield contributing characters. This probably due to the advantages came from root and canopy structures of the main crop banana and all intercrops grown at early stages of planting.

Yield of banana and component crops:

Slightly higher yield was observed from the sole banana cultivation. Banana grown in association with intercrops like potato, radish and cauliflower contributed to slightly lower yield (9-12%). This might be due to the competition by the intercrops for the same resources i.e. space, nutrition, water etc grown in association with banana. However, banana yield ranged from 55.66 to 62.49 tha^{-1} in 2012-13 and 51.25 to 57.5 tha^{-1} in 2013-14. Radish and cauliflower yield was recorded as 33.88 to 33.18 tha^{-1} and 30.59 to 38.48 tha^{-1} in the corresponding years 2012-13 and 2013-14. However, tuber yield was far below the potential yield of potato but it contributed to the higher system productivity with the same management practices. Similar observation was noticed by Rahman *et al.* (2006). Potato yield ranged from 8.54 to 12.64 tha^{-1} and 10.82 to 12.02 tha^{-1} in 2012-13

and 2013-14 respectively. It was observed that potato grown after radish and cauliflower produced slightly lower tuber yield than that of potato and banana grown only. The reason might be that, the preceding intercrops radish and cauliflower delayed the optimum sowing time for potato cultivation. Therefore, growing potato after radish and cauliflower as intercrop with banana might be involved in comparatively lower tuber yield as well as acted as a risk factor for exposing diseases to the next crop potato. When two crops (Banana + Potato) grown showed 9% yield reduction while three crops (Banana + Radish/Cauliflower + Potato) resulted in 9-12% reduction than sole banana.

Table 2. Yield contributing characters of banana under intercropping system at Shibganj, Bogra during 2012-13 and 2013-14.

Treatment combination	Length of hands (cm)		No. of hands/ bunch		No. of finger /hands		Wt. of hands (Kg)		Wt. of bunch (Kg)	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T ₁ : Sole Banana	91.03	90.68	9.00	10.00	17.00	16.00	2.72	2.74	25.00	23.41
T ₂ : Banana + Potato	88.91	87.37	9.00	9.00	15.00	15.00	2.51	2.43	22.66	21.91
T ₃ : Banana +Radish + Potato	89.21	88.24	9.00	9.00	15.00	15.00	2.54	2.48	22.83	21.00
T ₄ : Banana + Cauliflower + Potato	88.80	88.17	9.00	9.00	16.00	15.00	2.51	2.15	22.66	20.50
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV(%)	3.18	4.16	3.57	9.80	9.56	8.28	5.01	8.57	9.26	9.12

System productivity:

System productivity was measured in terms of banana equivalent yield from different treatment combinations (Table 4). Though the yield of banana was not differed remarkably but component crops yield played a significant role for increasing system productivity in terms of banana equivalent yield. Yield of intercrops i.e. radish, cauliflower as well as potato contributed to higher system productivity over the only banana cultivation. In case of banana equivalent yield, all the intercropping treatments showed better performance than sole crop cultivation. The highest equivalent yield (104.04 tha^{-1}) was obtained from the treatment T₄ (Banana + Cauliflower + Potato) which was statistically similar with T₃ (Banana + Radish + Potato) but differed from other treatments. The lowest yield (62.49 tha^{-1}) was obtained from sole banana. In 2011-12, the highest equivalent yield (122.50 t/ha) was obtained from the treatment T₄ which was

statistically similar with T₃ but differed from other treatments. The lowest system equivalent yield (59.49 tha⁻¹) was obtained from sole banana which was statistically similar with T₂ (71.14 tha⁻¹). Higher productivity from the intercrop combinations indicated the consequences of higher production from the component crops under intensified land use systems. Musa *et al.* (2013) reported the higher system productivity from the intercrop based systems over the sole crop. Nazrul *et al.* (2007) also showed higher system productivity in Banana intercrop with vegetables combinations than sole banana.

Table 3. Yield of banana and component crops at Shibganj, Bogra during 2012-13 and 2013-14.

Treatment combination	Fruit yield of banana (tha ⁻¹)		Tuber yield of potato (tha ⁻¹)		Yield of radish & cauliflower (tha ⁻¹)		Crop index (%)*	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T ₁ : Sole Banana	62.49	57.5	-	-	-	-	100.00	100.00
T ₂ : Banana + Potato	57.08	54.79	12.64	12.02	-	-	91.34	95.29
T ₃ : Banana + Radish + Potato	56.66	52.08	10.97	11.25	33.88	33.18	90.67	90.57
T ₄ : Banana + Cauliflower + Potato	55.13	51.25	8.54	10.82	30.59	38.48	88.22	89.13
LSD (0.05)	7.83	6.95	1.72	1.17	-	-	-	-
CV(%)	7.83	10.48	12.49	8.03	-	-	-	-

*Crop index (%) means percent reduction or increase of yield as compared to sole crop in intercrop situation.

Production efficiency:

Production efficiency was measured for the treatments and presented in the Table 4. Production efficiency was found always higher from intercrop combinations than that of sole crop cultivation (only banana). The intercrops based results supported the findings of Rahman *et al.* (2006) and Bantie (2015). The maximum production efficiency (260.10 kg/ha/day in 2012-13 and 327.54 kg/ha/day in 2013-14) was recorded from T₄ (Banana + Cauliflower + Potato) followed by T₃ (Banana + Radish + Potato) and the minimum (156.23 kg/ha/day in 2012-13 and 153.74 kg/ha/day in 2013-14) from sole (Banana). Higher production efficiency from the intercropping systems indicated the suitability, productivity as well as profitability of the systems over the sole crop cultivation.

Table 4. System productivity (banana equivalent yield) and production efficiency of banana at Shibganj, Bogra during 2012-13 and 2013-14

Treatment	Banana equivalent yield (tha ⁻¹)		Production efficiency (kg ⁻¹ ha ⁻¹ day ⁻¹)		Crop duration (days)	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T ₁ : Sole Banana	62.49	57.50	156.23	153.74		
T ₂ : Banana + Potato	72.47	69.81	181.18	186.66		
T ₃ : Banana +Radish + Potato	96.21	107.62	240.53	287.75	400	374
T ₄ : Banana + Cauliflower + Potato	104.04	122.50	260.10	327.54		
LSD (0.05)	9.21	13.46	-	-	-	-
CV(%)	10.59	12.24	-	-	-	-

Table 5. Economic performance of banana with potato and vegetables in intercropping system (Av. of 2012-13 and 2013-14)

Treatment	Gross return (Tk ha ⁻¹)	Total cost (Tk ha ⁻¹)	Gross margin (Tk ha ⁻¹)	BCR
T ₁ : Sole Banana	479960	123550	356410	3.88
T ₂ : Banana + Potato	569120	166252	402868	3.42
T ₃ : Banana +Radish + Potato	815320	192527	622793	4.23
T ₄ : Banana + Cauliflower + Potato	906160	249262	656898	3.63

Price of output (Tk/kg): Banana @ Tk 8/kg, Radish @ Tk 6/kg (2012-13) and Tk 10/kg (2013-14), Potato @ Tk 10/kg and Cauliflower @ Tk 10/kg (2012-13) and Tk 12/kg (2013-14)

Input cost (Tk/kg): Urea @ 16, TSP @22, MoP @15, Gypsum @10, Zinc sulphate @180, Boric acid @400

Cost and Return Analysis

Considering the prevailing market price, cost and return analysis were presented in the Table 5. It was noticed that all the intercrop combinations resulted in higher gross return than that of sole banana produced. Similar statement regarding higher yield from intercropping system was given by Grimes *et al.* (1983) and Kurata (1986). Higher gross return (Tk. 906160 ha⁻¹) was achieved by intercropping of banana with cauliflower + potato followed by banana + radish + potato (Tk. 615320 ha⁻¹). Similar trend was followed in case of gross margin. If considered benefit cost ratio, intercrop potato with banana and potato + cauliflower with banana failed to show higher returns than sole banana as higher

cost was involved. But only Banana + Radish + Potato showed higher BCR (4.23) than sole banana though reasonable cost was increased. So, cost of cultivation should be considered while growing intercrops with the main crop.

Conclusion

The result showed that Banana with radish and potato as intercropped combination gave higher economic return than sole and other combination. So, this combination could be advocated to Banana growing area of Shibganj, Bogra.

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