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Evaluation of two brinjal cultivars in goraneem based agroforestry system

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Abstract: The present study was conducted to evaluate the performance of two brinjal cultivars in Goraneem (*Melia azedarach*) based agroforestry system. The experiment consisted of two cultivars viz., Singnath and Kantabegun and three cropping system viz., sole cropping, goraneem + lemon based multistoried cropping system and goraneem + guava based three layered agroforestry system. In the three layered cropping systems, goraneem was planted as upperstorey multipurpose trees, guava and lemon was established as middlestorey fruit crops and brinjal was cultivated as groundstorey crops. The study revealed that both the cultivars produced maximum yield in sole cropping and cultiver singnath showed better performance than kantabegun. Yield of singnath and kantabegun cultivars were significantly higher in Goraneem + lemon based agroforestry system (18.49 t/ha and 14.47 t/ha) than Goraneem +Guava based agroforestry system (1.6 t/ha and 5.6 t/ha). Though the plant height and length of leaves were the highest in multistoried agroforestry system but all other parameters were significantly lower than that of sole cropping. The cultivar Kantabegun was found to be the best, as judged, which was followed by Singnath under multistoried agroforestry system. The economic analysis showed that multistoried cropping of cultivar Kantabegun with goraneem+lemon was beneficial in terms of total net return from a unit area and time.

Key words: Goraneem, Lemon, Guava, Agroforestry system, Brinjal,

Introduction

Traditional farming practices and monoculture production system prevalent in Bangladesh often results in subnormal production from the farmland and homestead. Environmental instability, poor soil fertility, soils with very low water holding capacity and organic matter altogether create such a situation that poses threat of occasional crop failure. Therefore, development of appropriate and satisfactory safeguards against such situations should the primary concern for optimal utilization of marginal lands.

Integration of annual crops with fruit and timber trees have shown quite encouraging response in term of multiple out put with assured income generation (Saroj et ai., 2000; Osman, 2003). The guava (*Psidium gusjava*) and lemon (*Citrus lemon*) are two important fruit crops of Bangladesh. *Melia azedarach* Linn, locally known as goraneem, one of the important multipurpose trees, of Bangladesh and goraneem based cropping systems seems to be an alternative to combact the hostile edaphoclimatic conditions for their profitable utilization (Khan and Alam, 1996). Brinjal (*Solanum melongena L.*) is one of the principal vegetables commonly cultivated in Bangladesh. Keeping in view the above mentioned advantages, a study was initiated with goraneem as upperstorey, guava and lemon as middlestorey component and two brinjal cultivar as groundstorey components with the objectives to find out a suitable multilayered agroforestry production system for Bangladesh condition.

Materials and Methods

The study was conducted on the existing goraneem based multistoried garden at the Germplasm centre of Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from October, 2006 to April, 2007. The experimental site is situated under tropical monsoon climate characterized by heavy rainfall during the months from April to September and then scantly rainfall during the rest period of the year. The soil texture was sandy loam with a pH 5.8-6.8. The structure of the soil was fine and the organic matter content was 1.80%. Two cultivars of brinjal (*Solanum melongena* L) V_1 Singnath and V_2 (Kantabegun) were used and each cultivars were laid out using a Randomized Complete Block Design (RCBD) under three treatments and with three replications. Treatments were :

(a) T_1 = Brinjal cultivar under full sunlight (open condition)
(b) T_2 = Goraneem + Lemon + Brinjal cultivar
(c) T_3 = Goraneem + Guava + Brinjal cultivar

In treatment T_1 sunlight was allowed to fall over the vegetables without any barrier which was considered as 100 percent light level. Treatment T_2 was a three layered canopy configuration consisted of goraneem, lemon and brinjal. The brinjal was in ground layer. The middle layer consisted with 5 years old lemon plants which were in fruiting condition (spacing 3m×m) and upper layer occupied by Goraneem (spacing 6m×6m). Like T_2, T_3 were also a three layered, Only exception in middle layer which was occupied by six years old guava plants (spacing 3m×3m) and were in full bearing condition. Both Brinjal cultivars seedlings were collected from USDA Allium field lab, BAU, Mymensingh. The seedlings of brinjal were transplanted on 16 October, 2006, maintaining the spacing of 60cm×50cm. Recommended doses of fertilizer (BARC, 1999) were used for the brinjal. The experimental plots were kept weeds free by weeding frequently. The plots were irrigated whenever needed by using hose pipe and watering cane. Brinjal harvesting was started at 90 days after planting and continued up to 125 days. Economics of various treatments was calculated taking into account the current costs of inputs and produce. The data on various growth and yield performance characters of the tested brinjal cultivars were statistically analyzed to

examine the significant variation of the results due to different shading condition. The analysis of variance for each of the studied character was done by F (Variance ratio) test following Randomized Complete Block Design (RCBD). The treatment means were compared at 1 and 5 per cent level of significance (using MSTAT computer program and Excel program).

Results and Discussions

Effect of varieties on the growth and yield contributing characters of brinjal: The plant height of brinjal was significantly affected by the influence of varieties (Table 1). Results showed that the higher plant was produced (88.44 cm) in V_1 and lower plant height was found (81.78 cm) in V_2. But significantly the higher number of leaves per plant was found (68.13) in V_2 whereas, V_1 possessed shorter number of leaves per plant (24.03). Number of fruits per plant was also significantly affected by the influence of varieties (Table 1). It was found that higher number of fruits per plant was produced (4.64) in V_1 and lower number of fruits per plant was found (2.75) in V_2 . Incase of length of brinjal fruit, Singnath produced longer length of brinjal fruit (18.26 cm) whereas, kantabegun produced shorter length (5.53 cm). Significantly the higher diameter of brinjal fruit was produced (11.66 cm) in V_2 whereas the lower diameter of fruit was found (8.04cm) in V_1 . But the higher weight of fresh fruit was produced (528.88 g) in V_1 whereas the lower weight of fruit was found (486.22 g) in V_2.

Effect of varieties on the yield (ton/ha) of brinjal: The yield of brinjal was found significantly affected by the influence of varieties (Table 1). Results showed that the higher yield was found (17.62 t/ha) in V_1 whereas the lower yield was produced (16.20 t/ha) in V_2.

Effect of multistoried cropping system on the growth and yield contributing characters of brinjal: The effect of multistoried cropping system on growth and yield contributing characters of brinjal were significant (Table 2). The tallest plant was found (89.33 cm) in T_2 (partial shade condition). The smallest plant was found (82.23 cm) in T_3 (Severe shade condition) which was statistically similar with open field. This was probably due to higher apical dominance under shade condition (Hillman, 1984). Again, the highest number of leaves per plant was found (67.73) in T_1 (Open field condition). The lowest number of leaves was found (23.71) in T_3 (severe shade condition). In case of number of fruits per plant, significantly the highest number of fruits per plant was found (6.30) in full sunlight. The lowest number of fruits per plant was found (1.06) in T_3 (severe shade condition). The results showed that the length of fruit was significantly different by the effect of multistoried cropping system. The highest length of brinjal fruit was found (17.46 cm) in 100% high condition whereas the lowest length of fruit was found (4.73 cm) under T_3 (severe shade condition). Similarly, the highest diameter of fruit was found (15.23 cm) in T_1 (control condition). The lowest diameter of fruit was produced (5.90 cm) under T_3 (severe shade condition). Again, the weight of fresh fruit per plant was significantly different by the effect of multistoried cropping system (Table 2). The highest weight of fresh fruit per plant was formed (920.33g) in open field whereas the lowest weight of fresh fruit was found (108.00 g) in T_3 (severe shade condition).

Effect of multistoried cropping system on the yield (ton/ha) of brinjal: The yield of brinjal was also varied greatly by the effect of multistoried cropping system (Table 2). The maximum yield (30.67 t/ha) was recorded under full sunlight. The lowest yield was observed (3.60 t/ha) under T_3 treatment. Similar trend in yield of brinjal was observed by Miah (2001).

Table 1: Effect of varieties on yield and morphological characters of brinjal

Varieties	Plant height (cm)	Number of leaves/ plant	Number of fruits/plant	Length of fruit(cm)	Diameter of fruit (cm)	Weight of fresh fruit/plant (g)	Fresh fruit Yield (t/ha)
V_1	88.44a	24.03b	4.64a	18.26a	8.04b	528.88a	17.62a
V_2	81.78b	68.13a	2.75b	5.53b	11.66a	486.22b	16.20b
Level of significance	**	**	**	**	**	**	**
CV (%)	3.39	4.84	3.82	5.24	4.55	4.71	2.27

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT.
** = Significant at 1% level of probability.

Table 2. Effect of multistoried on yield and morphological characters of brinjal

Multistoried	Plant height (cm)	Number of leaves/ plant	Number of fruits/plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fresh fruit/plant(g)	Yield (t/ha)
T_1	83.78b	67.73a	6.30a	17.46a	15.23a	920.33a	30.67a
T_2	89.33a	47.10b	3.73b	13.50b	8.43b	494.33b	16.47b
T_3	82.23b	23.71c	1.06c	4.73c	5.90c	108.00c	3.60c
Level of significance	**	**	**	**	**	**	**
CV (%)	3.39	4.48	3.82	5.24	4.55	4.71	2.27

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT
** = Significant at 1% level of probability,

Interaction effect of varieties and multistoried cropping system on the growth and yield contributing characters of brinjal: Plant height of brinjal varieties was significantly different due to interaction effect of multistoried cropping and varieties (Table 3). Variety kantabegun produced the highest plant height (101.26 cm) under T_3 treatment which was statistically similar to Singnath in full sunlight. Singnath showed the shortest plant under T_3 treatment which was identical to kantabegun under T_1 treatment. Number of leaves per plant of kantabegun was the highest in number (93.33) under T_1 treatment. The lowest number of leaves per plant of Singnath was found (7.03) under T_3 treatment. In case of number of fruits per plant of brinjal varieties, significantly the highest number of fruits (7.60) was produced in open field condition. The variety Singnath that had the lowest number of fruits per plant (1.00) under T_3 treatment which was identical to kantabegun under T_3 treatment. The highest length of fruit of singnath was found (26.33 cm) under T_1 treatment. The lowest length of fruit of kantabegun was found (3.73 cm) under T_3 treatment which was identical to kantabegun under T_2 treatment. Again, the variety kantabegun produced the highest diameter of fruit (19.33 cm) in open field and the singnath variety showed the lowest diameter of fruit (4.06 cm) under T_3 treatment The highest weight of fresh fruit was found (984.00 g) in Singnath. The lowest weight of fresh fruit was found (48.00g) in singnath under T_3 treatment (severe shade condition).

Interaction effect of varieties and multistoried cropping system on the yield (ton/ha) of brinjal: Yield of brinjal varieties was significantly different due to interaction effect of multistoried cropping and varieties (Table 3). Variety singnath produced the maximum yield (32.80 t/ha) under T_1 treatment (severe shade condition) whereas this variety produced the minimum yield (1.60 t/ha) in treatment T_3.

Economic analysis of brinjal production under multistoried cropping system: Economic analyses of data indicated considerable variation was present among the cultivars as well as the different multistoried cropping system (Table 4). As sole cropping growing of Signath cultivar of brinjal was remunerative in comparison to cultivar Kantabegun. Maximum Benefit Cost Ratio (BCR) 4.56 was noted in Singnath cultivar of brinjal in sole cropping system. But incase of cultivar Kantabegun, the highest BCR (4.17) was obtained from goraneem+lemon based multistoried cropping system, indicating that multistoried cropping of cultivar Kantabegun with goraneem+lemon was beneficial in terms of total net return from a unit area and time.

The observations in the present study revealed that the yield was maximum in cultivar Singnath and minimum in Kantabegun. But, among the two cultivars, Kantabegun is superior over Singnath under multistoried cropping system. So, Kantabegun is suitable for multistoried agroforestry systems.

Table 3. Interaction effect of variety and multistoried tree arrangement on yield and morphological characters of brinjal

Interaction	Plant height (cm)	Number of leaves/plant	Number of fruits/plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fresh fruit (g)	Yield (t/ha)
V_1T_1	101.00a	42.13c	7.60a	26.33a	11.13b	984.00a	32.80a
V_1T_2	101.13a	22.93e	5.33b	22.27b	8.93c	554.66c	18.48c
V_1T_3	63.20c	7.03f	1.00e	5.73d	4.06e	48.00f	1.60f
V_2T_1	66.56c	93.33a	5.00c	8.60c	19.33a	856.66b	28.55b
V_2T_2	77.53b	71.26b	2.13d	4.26e	7.93d	434.00d	14.47d
V_2T_3	101.26a	39.80d	1.13e	3.73e	7.73d	168.00e	5.60e
Level of significance	**	**	**	**	**	**	**

In a column, figures having the similar letter (s) or without letter (s) do not differ significantly as per DMRT.
** = Significant at 1% level of probability,
NS = Not significant

Table 4. Economics of brinjal production under goraneem based multistoried cropping system

Cultivar	Treatments	Return from brinjal (Tk/ha)	Return from lemon (Tk/ha)	Return from guava (Tk/ha)	Return from goraneem (Tk/ha)	Gross return (Tk/ha)	Total cost of production (Tk/ha)	Net return (Tk/ha)	BCR
V_1	T_1	262400	-	-	-	262400	57499	204901	4.56
	T_2	147840	33012	-	83400	264252	58071	206181	4.55
	T_3	12800	-	36192	83400	132392	58589	73803	2.26
V_2	T_1	171300	-	-	-	171300	57499	113801	2.98
	T_2	125760	33012	-	83400	242172	58071	184101	4.17
	T_3	33600	-	36192	83400	153192	58589	94603	2.61

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