Performance of sweet gourd and bitter gourd in charland based agroforestry farming system

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Abstract: The present study was conducted at Char Kalibari under Sadar upazilla of Mymensingh during the period from October 2013 to March 2014 to evaluate the performance of sweet gourd (*Cucurbita moschata*) and bitter gourd (*Momordica charantia*) in association with 4 years old lambu (*Khya sp.)*tree at different distances of the tree base. The experiment was consisted of four different treatments *viz.* T_0 (open field referred as control), T_1 (<50 cm distance from the tree base), T_2 (50-100 cm distance from the tree base) and T_3 (>100 cm distance from the tree base). The experiment was laid out in a Randomized Complete Block Design with three replications. Data were collected on morphological and yield contributing characters of vegetables and were analyzed for evaluation of the treatment effects. In this study, different growth parameters *viz.* vine length, number of primary branches per plant, number of leaves per primary branch, number of fruit per plant, individual fruit weight and yield of sweet gourd and bitter gourd were observed separately in association with lambu trees. The result shows that growth and yield of sweet gourd and bitter gourd was better in the open field condition compare to that of association with lambu tree. Morphological parameters of sweet gourd and bitter gourd such as vine length, no. of primary branches per plant, no. of leaves per primary branch, no. of fruits per plant, weight per fruit (g) etc. were affected significantly by different distances from tree base. Among the different distances highest yield of sweet gourd (19.7 t ha^{-1}) and bitter gourd was (3.2 t ha^{-1}) recorded in treatment T_3 i.e., over 100 cm distance from tree base. Therefore, cultivation of sweet gourd and bitter gourd in association with 4 years old lambu tree will be profitable at above 100 cm distance from the tree base.
Key words: Sweet gourd, Bitter gourd, Lambu (*Khya sp.)* tree, Char land, Agroforestry system.

Introduction

Agroforestry combines agriculture and forestry technologies to create more integrated, diverse, productive, profitable, healthy and sustainable land-use systems. Small scale agriculture plays an important role in Bangladesh economy. It provides nearly 50% of cash flow to the rural poor (Leuscher and Khaleque, 1987; Haque, 1996). Due to increasing population, land holdings are being fragmented and area devoted to small scale agriculture is decreasing. It is important that small scale agriculture be maintained so that sustainable local vegetable production is continued in Bangladesh. The goal of sustainable agriculture should be to maintain production at levels necessary to meet the increasing needs and aspirations of an expanding world population without degrading the environment (TAC, 1989), and thus it will create a balance condition. In Bangladesh, scope of agroforestry is vast. The major venues of agroforestry are homestead, roadside, railway side, embankment side, charland, coastal area, deforested area, institutional premises, riverside, etc. Among them charland is the most important venue for practicing agroforestry systems. 'Char' a tract of land surrounded by the waters of an ocean, sea, river, lake, or stream; it usually means any accretion in a river course or estuary (Chowdhury, 1988). Lambu (*Khya sp.*) is tall, evergreen, very fast growing and vital tree species of the world. Most of wood radish brown which is used in furniture making, boat building and others. Among the different winter vegetables, sweet gourd is the important winter vegetables in Bangladesh. Sweet gourd is important for its quick growing nature and high yielding potential. It is easily cultivated as a companion crop or inter crop sweet gourd is a well-known and a very popular vegetable grown successfully throughout Bangladesh. Sweet gourd or pumpkin is a tender tendril bearing and vine like plant from genus *Cucurbita* belonging to the family Cucurbitaceae of gourd family. Sweet gourd or pumpkin is very versatile in their uses for cooking. Most parts of the pumpkin are edible, including the fleshy shell, the seeds, the leaves, and even the flowers. When ripe, the pumpkin can be boiled, baked, steamed, or roasted. The young and tender shoots make good vegetable salads. Leaves and even flowers could be used as vegetables which are rich in various nutrients (Gopalan *et al.,* 1982). The main nutrients are lutein and both alpha and beta carotene, the later of which generates vitamin A in the body (Tecson, 2001). Bitter gourd is a tropical and sub tropical vine of the family cucurbitaceae. This herbaceous, tendril bearing vine grows to 5 m. It bears simple, alternate leaves 4-12 cm across, with three to seven deeply separated lobes. Each plant bears separate yellow male and female flowers. Even these vegetables can successfully growing in association with Agroforestry trees. The present study was undertaken to observe the growth performance and evaluate the yield and yield characteristics of the sweet gourd and bitter gourd grown under lambu tree at the Char kalibari in the bank of Old Brahmaputra river.

Materials and Methods

Experimental site: The experiment was carried out at char Kalibari belongs to the Mymensingh sadar upazila during the period from November 2013 to March 2014. The district Mymensingh is located between 24°38'3" North and 90°16'4" East Latitude. The experimental site belongs to the agro ecological region of Old Brahmaputra and field was medium high land belonging to Non-calcareous Black Grey Flood Plain Soil type.

Planting material: In this study previously established 4 years old lambu (*Khya sp.)* trees were used as tree components and sweet gourd *(Cucurbita moschata)* and bitter gourd (*Momordica charantia*) was used as plant materials. BARI misti kumra-2 as sweet gourd variety and BARI hybrid korola-1 as bitter gourd variety were used and seeds were collected from Vegetable Research Division, of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur.

Crop establishment: Sweet gourd seeds were sown on 10th of October and Bitter gourd seeds were sown in the experimental plot on 1st November in separated small seed bed of each plot where each seed bed distance was 0.5 ×

0.5 m length and width, respectively. Ten to twelve seeds of sweet gourd and bitter gourd were sown in each seed bed.

Design and layout of the experiment: Sweet gourd and bitter gourd were laid out separately following the Randomized Complete Block Design (RCBD) with double factorial arrangement of multistoried production system. Four treatments were used in this study and three replications were followed for each treatment for each crop. Each plot was 4.5 m width and 2.0 m length at both sides of selected tree species.

Growth measurement of tree species: Ten tree samples were selected randomly from all treatments of the plots for data collection. Sample trees were selected at before and after of vegetables cultivation. Tree height (cm) and tree girth (cm) were recorded. Girth of all trees were measured 8 inch above from the ground.

Sampling and Data collection: Five plant samples were collected randomly from all treatments of the plots for data collection. In case of sweet gourd, plant length (cm), no. of primary branches per plant, no. of fruits per plant, single fruit weight (g), yield of sweet gourd (t/ha) were recorded at each harvest time. In case of bitter gourd, vine length, number of primary branches per plant, number of leaves per primary branches, number of fruits per plant, weight per fruits (kg), fresh and Dry weight of fruits (t/ha) was recorded.

Statistical analysis: The data on various growth and yield contributing characters of the vegetables was statistically analyzed to examine the significant variation of the results due to different parameters. The analysis of variance for each of the character under study was done by F (variance ratio) test for Randomized Complete Block Design (RCBD). The treatments means were compared by LSD (Least Significance Test) at 5% level of significance.

Results and Discussion

Morphological characteristics of sweets gourd: Sweet gourd was cultivated under different distance from the tree. It grew more vigorously in the open field than those grew close distance to the tree. Morphological characteristics such as vine length, number of branches per plant, number of fruits per plant and weight per fruit of sweet gourd in association with lambu tree are influenced by lambu tree in a similar pattern where highest values of all above parameters was in open field condition (Table 1).

Table 1. Morphological characters of sweet gourd in association with lambu tree

Treatments	Morphological Characteristics				
	Vine length (cm)	No. of primary branches per plant	No. leaves per primary branch	No. of fruits per plant	Individual fruit weight (g)
T0	296.5 a	7.77 a	18.38 a	13.77 a	1989.0 a
T1	176.5 d	4.37 b	10.86 d	8.80 c	1186.0 d
T2	244.4 c	5.50 ab	12.36 c	10.20 b	1640.0 c
T3	286.8 b	7.20 ab	14.89 b	13.10 a	1875.0 b
LSD ().0%)	3.56	3.18	2.12	0.86	2.43
CV (%)	0.71	8.11	5.65	3.77	0.07

Means in column followed by the different letter are significant by LSD at P≤0.05, T_0=Control, T_1=<50cm from tree from tree base, T_3=>100 cm from tree base.

Among different distances the highest vine length of sweet gourd was (286.8 cm) at harvest and the lowest average vine length of sweet gourd was (123.6 cm) at harvest. The highest number of branches per plant (7.77) at harvest was produced by T_0 (open field referred as control). The second highest number of branches per plant (7.2) at harvest and the lowest (4.37) at harvest was observed in T_1 (<50 cm distance from the tree). The highest no. of leaves branch^{-1} (18.38) was recorded in T_0 (open field referred as control) and the lowest (10.86) was recorded at T_1 (<50 cm distance from the tree).The second highest no. of leaves plant^{-1} (14.89) was produced under T_3. The maximum number of fruits per plant (13.77) at harvest was observed at T_0. The lowest 8.80 at harvest number of fruits per plant was found under close contact of the tree referred as T_1. The trend of weight of fruit per plant was almost similar to that of number of fruits plant. The highest weight per fruit (1989.0g) at harvest was recorded in the open field T_0 referred to as control followed by T_3 (1875.0g) at harvest. Due to high competition between tree and crop the lowest weight per fruit (1186.0g) at harvest was found in T_1.

Yield of Sweet gourd: The highest yield of sweet gourd 24.1 t ha^{-1} was obtained from treatment T_0. In association with Lambu, the highest 19.7 t ha^{-1} yield was recorded at treatment T_3 and the lowest 13.3 t ha^{-1} yield was observed under the close contact of tree which referred as T_1 (Fig.1). Near the tree base growth of all morphological parameters was less vigorous compare to distant plant from tree base. This might be due to negative interaction between tree-vegetable root systems for growth resources like water and nutrients. Close the tree base growth of morphological parameters of sweet gourd were less vigorous compare to distant plant from tree base.

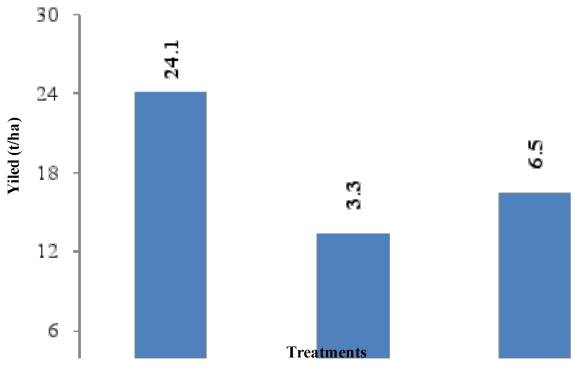

Fig. 1. Yield of sweet gourd with lombu (*Khya sp.*) tree

Morphological characteristics of Bitter gourd: Morphological behaviors of bitter gourd significantly influenced by lambu tree from tree base. Morphological characteristics such as vine length, number of leaves per primary branch, number of fruits per plant and weight per fruit of bitter gourd in association with lambu tree are influenced by lambu tree in a similar pattern where highest values of all above parameters was in open field condition. Vine length of bitter gourd was significantly affected by lambu tree at different distance from tree base (Table 2).

Table 2. Morphological characters of bitter gourd in association with lambu tree

Treatments	Morphological Characteristics				
	Vine length (cm)	No. of primary branches per plant	No. leaves per primary branch	No. of fruits per plant	Individual fruit weight (g)
T0	127.5 a	7.63 a	45.27a	26.67 a	44.37 a
T1	77.53 d	3.89 d	27.72 d	15.73 d	26.86 d
T2	93.19 c	4.85 c	33.19 c	18.92 c	32.31 c
T3	118.5 b	6.33 b	41.17 b	23.57 b	39.30 b
LSD ().0%)	0.46	0.23	0.35	0.49	0.63
CV (%)	0.22	1.70	0.47	1.06	0.83

Means in column followed by the different letter are significant by LSD at P≤0.05, T_0=Control, T_1=<50cm from tree from tree base, T_3=>100 cm from tree base.

It was found that the maximum vine length of bitter gourd (129.50 cm) was produced by T_0 which is followed by T_3 (120.50 cm). Treatment T_2 observed the statistically third highest vine length (95.19 cm). The lowest vine length of bitter gourd (79.53 cm) was observed in T_1. Branching and growth of bitter gourd was more vigorously in the open field than that of other closest distance to the associated lambu tree in this study. As a result, the maximum average number of primary branches (8.63) per plant was observed in T_0 while treatment T_3 produces statistically close number of primary branches (7.33) per plant. Different treatments showed significant effect on number of leaves per primary branch of bitter gourd. The result revealed that the maximum number of leaves per primary branch of bitter gourd (46.27) was produced by T_0 treatment while second maximum number of leaves per primary branch (42.17) was produced under T_3 treatment. The minimum number of leaves per primary branch (28.72) was observed at T_1 treatment. Number of fruits per plant is the most important yield contributing character, which was significantly influenced by different distance of growing bitter gourd from the sample lambu tree (Table 2). The maximum number of fruits per plant (28.67) was found in T_0 while treatment T_3 produces the second maximum and statistically close number of fruits/plant (25.57). The lower number of fruits per plant (17.73) was found under close contact of the tree condition (T_1). Weight of single fruits of bitter gourd was also significantly influenced by different planting distance from the tree. The highest weight of single fruit (46.37 g) was recorded in T_0 and the lowest weight of single fruit (28.86 g) was found in T_1.

Yield of Bitter gourd: The variation in yield of bitter gourd (t/ha) was affected significantly due to effect of different treatment. The highest fresh (3.8 t/ha) yield of bitter gourd were obtained from the treatment T_0 and the lowest fresh (2.10 t/ha) was found from closest distance treatment T_1 (Fig. 2). Near the tree base growth of all morphological parameters was less vigorous compare to distant plant from tree base. This might be due to negative interaction between tree-vegetable root systems for growth resources like water and nutrients. Close the tree base growth of morphological parameters of sweet gourd were less vigorous compare to distant plant from tree base.

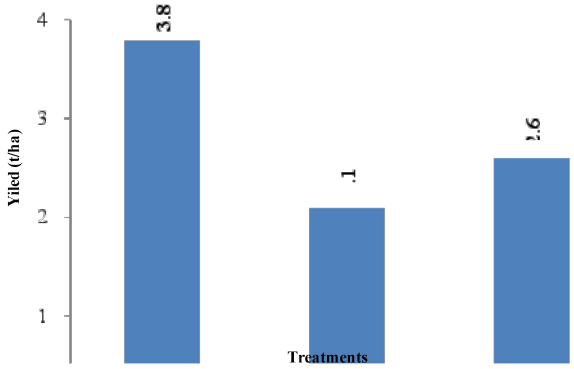

Fig. 2. Yield of bitter gourd with lombu (*Khya sp.*) tree

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