

Bottle gourd cultivation along with Akashmoni (*Acacia auriculiformis*) tree as agroforestry system

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Abstract: To maximize the production in agroforestry system it is needed to explore the best possible tree-crop interactions. Therefore, an experiment was conducted at the Char Kalibari which is situated by the side of Brahmaputra River Sadar Upazila, Mymensingh, during the period from November 2012 to March 2013, under the Department of Agroforestry, Bangladesh Agricultural University, Mymensingh. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications having four treatments. Different distances from the tree base were considered as different treatments. There was a control treatment i.e. bottle gourd was cultivated in the open field condition (without tree). Four treatments of this study were viz., T₀ (open field condition referred as control), T₁ (0-1.5 feet distance from the tree base), T₂ (1.5-3.0 feet distance from the tree base) and T₃ (3.0-4.5 feet distance from the tree base). One tree species viz., Akashmoni (*Acacia auriculiformis*), which is 3 years old was used as test species in this experiment. The result showed that morphological characteristics viz. plant height, no. of leaves per plant, leaf size, leaf area (cm²), number of flower per plant, number of fruit per plant, fruit length (cm), fruit girth (cm), fruit weight (g) of bottle gourd was less vigorous near the Akashmoni tree base. The results also showed that in association with Akashmoni, tree both fresh and dry yield of bottle gourd was gradually increased with increasing distance from the tree base; while it were 29.83 t/ha and 3.59 t/ha, respectively in open field condition. Fruit yield of bottle gourd in association with Akashmoni tree reduced 64.93%, 48.43% and 15.47% in 0-1.5 feet, 1.5-3.0 feet and 3.0-4.5 feet distant area, respectively. Thus it comes into the point that the yield performance of bottle gourd was better in open field condition comparing to Akashmoni.

Key words: Bottle gourd, Akashmoni (*Acacia auriculiformis*), Agroforestry system.

Introduction

Agroforestry is an age-old practice of integrated farming practices, preferably on the same unit of land on sustainable basis. Agroforestry systems have received increasing emphasis in the recent years because of their potential to yield fodder, fuel wood and small timber in addition of food. Agroforestry is rapidly gaining interest of many farmers in Bangladesh and it is widely thought that it can make a significant contribution towards addressing the high levels of poverty and associated land degradation in the country.

In Bangladesh, the total forest area covers about 17.08% of the total land area (BBS, 2011). Small scale agriculture plays an important role in Bangladesh economy. It is important that small scale agriculture can be maintained for sustainable local vegetable production in a country like Bangladesh. As a result, continuous transformation of forest land which about 8000 ha to agriculture, aquaculture, homestead and other purposes is decreasing per year through practicing agroforestry (FAO, 2007).

Bangladesh is a very densely populated country with a population of more than 161 million with an annual growth rate of 1.37%. About 19.41% of the gross domestic product of Bangladesh is contributed from agriculture. Of the total agricultural product about 10.86% comes from various crops, 2.51% from livestock, 4.39% from fishes and 1.66% from forests (BBS, 2012). The capacity of our land is decreasing day by day due to intensive cropping and use of high input technologies. Agroforestry can help to overcome shortcomings of traditional agriculture that are often characterized by low output, relatively high investment and a deterioration of the environment (Francis, 2001). The climate of Bangladesh is favorable for cultivating trees and crops. The average consumption of vegetable in Bangladesh is only 70g per head per day including potato and sweet potato. Except tuber crops, it is only 30g as

against the FAO recommendation of 200g. Most of the vegetables are grown in the rabi season of which bottle gourd is very common, popular and quick growing having high nutritional value and grown easily. It is rich in, thiamin, vitamin C, zinc, iron and magnesium thus helping in improving health condition. Including bottle gourd in our regular diet reduces fatigue and maintains freshness especially in the summer. The juice from bottle gourd leaf helps in curing baldness and aids in preventing tooth decay, (Faccicola, 1998). Akashmoni is an important exotic legume tree species in Bangladesh. *Acacia auriculiformis* is an evergreen tree that grows between to 15-30 m tall, with a trunk up to 12 m long and 50 cm in diameter. It exhibits the ability to grow in a variety of soils including calcareous sands and black cracking clays, seasonally waterlogged soils, sandy loams and coral rag. It can also tolerate highly alkaline and saline soils. Acacia is a good source of firewood and good quality charcoal (does not smoke), as well as timber for furniture and pulp for making paper (acacia produces high yields of pulp and produces strong paper). To meet up the demand of vegetable as well as timber and fuel wood, farmers will be cultivate these plant species combindly as agroforestry system.

Materials and Methods

Location of the study area: The experiment was carried out at char Kalibari belongs to the Mymensingh sadar upazila during the period from November 2012 to March 2013. The district Mymensingh is located between 24°38'3" North and 90°16'4" East Latitude. Total area of this district is 4363.48 km² and situated on the west bank of Brahmaputra River. The geographical position of char Kalibari located between 24°45' - 24°45'40" North and 90°24'4" - 90°24'44" East Latitude.

Tree and plant materials: In this study the three years old previously established Akashmoni (*Acacia auriculiformis*), trees was used as test tree components and Bottle gourd (*Lagenaria vulgaris*) was used as plant materials. On the others hand the seeds of bottle gourd

were collected from International Seed Fair in Bangladesh Agricultural University Campus.

Tree management: The study was done under 3 years old Akashmoni, tree saplings. At first soils of the base of trees were loosening very well. Weeds were removed from the surrounding of the tree base; insect infected leaves were also removed. Irrigation was done two times in a day by the watering cane.

Experimental design and treatment combination: The Experimental design was Randomized Complete Block Design (RCBD) with three replications. Four treatments were used in this study which is were T_0 = Open field referred to as control, T_1 = 0-1.5 feet distance from the tree T_2 = 1.5-3.0 feet distance from the tree and T_3 = 3.0-4.5 feet distance from the tree. A characteristic feature of the experimental lay out around each tree has been grown in open field without vegetables.

Land preparation: The experimental land was first opened on 01 November, 2012 and the operation was done by spade. Then the land was fallow for few days. All crop residues and weeds were removed from the field and finally the land was properly leveled. The land should be prepared thoroughly by five to six ploughings.

Crop establishment and management

Seed Sowing: Bottle gourd seeds were directly sown in the experimental plot on 5th November 2012.

Intercultural operations: Weeding, thinning, irrigation, fertilization, pest and disease management were done necessarily when required.

Harvesting and data collection: Plant samples of Bottle gourd were collected from all the respective plots. Four plants of bottle gourd were selected from each 1m² plot for data collection. Data were collected at 35, 55 and 120 Days after sowing. The following plant characters of bottle gourd were recorded as vein length, no of leaf, no of flower (male and female), no of branch, fruit length, no. of fruit, fruit diameter, fruit weight, fresh weight of stem and leaf, dry weight of stem and leaf.

Data analysis: Data regarding various parameters were statistically analyzed by the computer using statistical package programme MSTAC-C. Mean comparisons were done by DMRT (Duncan's

Multiple Range Test) at 5% level of significance, (Gomez and Gomez, 1984).

Results and Discussion

Morphological Characteristics of bottle gourd:

Morphological characteristics such as plant height, no. of leaves plant⁻¹, no. of branches plant⁻¹, no. of fruits plant⁻¹, average no. of male and female flower plant⁻¹, average weight of fruit, length of fruits, girth of fruit of bottle gourd in association with akashmoni tree are presented in the Fig. 1, Table 1 and Table 2. Effect of trees on the morphological behavior of bottle gourd is as follows:



Fig. 1. Bottle gourd cultivation as vegetable with akashmoni tree

As vegetable purpose:

Plant Height: Bottle 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. Among different distances the highest average plant height of bottle gourd was 42.88 cm found in T_3 (3.0-4.5ft distance from the tree). The highest average plant height of bottle gourd was 44.67cm found in T_0 (open field referred as control) and the lowest average plant height of bottle gourd was 37.52cm found in T_1 (0.0-1.5 ft from the tree) (Table 1). The plant height of T_0 and T_3 was statistically similar.

Table 1. Morphological characteristics of bottlegourd as leafy vegetables/shak along with Akashmoni tree

Treatments	Plant height (cm)	No. of leaves /plant	Stem girth (cm)	Weight /plant (g)		
				Leaves	Stem	Total
T_0	44.67a	11.33a	6.0a	123.3a	25.77a	149.07a
T_1	37.52c	9.63b	4.5b	103.6c	19.35c	122.95c
T_2	41.1b	10.42ab	5.0ab	113.5b	22.13b	135.59b
T_3	42.88ab	10.88a	5.5a	122.4a	26.41a	148.81a

Means in column followed by the different letter are significantly different by DMRT at $P \leq 0.05$, T_0 = Control, T_1 = upto 1.5 feet from tree base, T_2 = 1.5-3.0 feet from tree base, T_3 = 3.0 -4.5 feet from tree base.

No. of Leaves Plant⁻¹: Good foliage indicates higher growth, development and productivity of plant. The result of experiment showed that the number of leaves plant⁻¹ gradually increased with the increasing of distance from the tree. The highest number of leaves plant⁻¹ was 11.33 when plants were grown under treatment T_0 (Open field referred as control). The lowest number of leaves plant⁻¹ (9.63) was found under treatment T_1 (0.0-1.5 feet distance

from the tree) (Table 1). Second highest number was obtained 10.88 from T_3 (3.0-4.5 feet distance from the tree). Number of leaves plant⁻¹ showed significant variation due to different distance of bottle gourd plant from the tree. Due to this type of competition leaf area of coriander decreased near the base of Telsur tree which was reported by Islam *et al.*, (2009).

Stem girth: Stem girth of bottle gourd was affected significantly by the different distance from the tree (Table 1). The lowest stem girth (4.5cm) was noted in T₁ (0.0-1.5 feet distance from the tree) and highest stem girth was noted in T₀ (Open field referred as control).

Stem weight Plant⁻¹, Leaf weight plant⁻¹ and Total weight plant⁻¹: Distance of bottle gourd plant from the tree base has significant effect on weight. The highest stem weight plant⁻¹, leaf weight plant⁻¹ and total weight plant⁻¹ were 25.77g, 123.3g, 149.07g, respectively found in T₀ (Open field referred as control) and the second highest stem weight plant⁻¹, leaf weight plant⁻¹ and total weight plant⁻¹ were 26.41g, 122.4g, 148.81g, respectively found in T₃ (3.0-4.5ft distance from the tree) (Table 1). The lowest stem weight plant⁻¹, leaf weight plant⁻¹ and total weight plant⁻¹ were 19.35g, 103.6g, and 122.95g, respectively recorded in T₁ (0.0-1.5 feet distance from the tree). The stem weight plant⁻¹, leaf weight plant⁻¹ and total weight plant⁻¹ showed significant variation due to different distance of bottle gourd plant from the tree.

Table 2. Morphological characteristics of bottlegourd during fruit production along with Akashmoni tree

Treatments	Average no. of branches/plant	Average no. of leaves/branch	Average no. of flower/plant		Average no. of fruit/plant	Fruit size		Av. weight /fruit (kg)
			Male	Female		Length (cm)	Girth (cm)	
T ₀	7.00a	28.67a	58.67a	25.67a	6.3a	46.33a	42.67a	2.77a
T ₁	4.33c	24.50c	31.67d	17.00d	3.4c	32.53d	34.17d	1.80b
T ₂	5.67b	25.67b	37.67c	21.33c	4.5b	39.50c	37.33c	2.00ab
T ₃	6.00b	27.33a	51.33b	22.67b	5.9a	45.40b	39.70b	2.50a

Means in column followed by the different letter are significantly different by DMRT at P ≤ 0.05, T₀ = Control, T₁ = upto 1.5 feet from tree base, T₂ = 1.5-3.0 feet from tree base, T₃ = 3.0 -4.5 feet from tree base.

Average no. of flower plant⁻¹ (male and female): Flower is an important factor for producing fruit. Average no. of male and female flower produced 58.67, 25.67, respectively in T₀ (open field referred as control). The lowest number of male and female flower plant⁻¹ 31.67, 17.00, respectively was found under close contact of the tree base referred as T₁ (0.0-1.5 ft distance from the tree). The second highest no. of male and female flower plant⁻¹ 51.33, 22.67, respectively was produced under T₃ (3.0-4.5 ft distance from the tree) (Table 2).

Average no. of fruits plant⁻¹: The maximum number of fruits plant⁻¹ (6.3) was observed at T₀ (open field referred as control). The lowest (3.4) number of fruits plant⁻¹ was found under close contact of the tree referred as T₁ (0.0-1.5 ft distance from the tree) (Table 2) and it was probably due to poor photosynthetic capacity and nutrients competition between tree and crops. Basak *et al.* (2009) also showed that the yield contributing characters of the vegetables increased gradually with the increase of planting distance from the tree.

Fruit size (length and girth): Average size (length and girth) of fruits plant⁻¹ is one of the important yield contributing character, which was also significantly influenced by different distance of growing bottle gourd plant from the tree. The maximum average length and girth of fruits were 46.33, 42.62 cm, respectively were observed at T₀ (open field referred to as control) and the lowest number of length and girth of fruits plant⁻¹ were 32.53, 34.17 observed under the close contact of tree

As fruit purpose:

Average no. of branches plant⁻¹: It was noted that no. of leaves of bottle gourd was meaningfully enlarged with the increase of distance from saplings. The result revealed that the highest no. of branches plant⁻¹ (7.0) was produced by T₀ (open field referred as control). The second highest no. of branches plant⁻¹ (6.0) was produced under T₃ (3.0-4.5ft distance from the tree) and the lowest (4.33) was observed in T₁ (0.0-1.5 ft distance from the tree), (Table 2).

Average no. of leaves branch⁻¹: Different treatments had significant effect on no. of leaves branch⁻¹ of bottle gourd (Table 2). The result showed that the highest no. of leaves branch⁻¹ (28.67) was recorded in T₀ (open field referred as control) and the lowest (24.50) was recorded at T₁ (0.0-1.5 ft distance from the tree). The second highest no. of leaves plant⁻¹ (27.33) was produced under T₃ (3.0-4.5 ft distance from the tree) which was statistically similar with T₀, (Table 2).

which referred to as T₁ (0.0-1.5 ft distance from the) (Table 2).

Average weight fruit⁻¹: The trend of weight of fruit plant⁻¹ was almost similar to that of number of fruits plant⁻¹. The highest weight fruit⁻¹ (2.77 kg) was recorded in the open field (T₀) referred to as control. Due to high competition between tree and crop the lowest weight fruit⁻¹ (1.80 kg) was found in T₁ (0.0-1.5 ft distance from the) and second highest weight fruit⁻¹ was 2.50 kg which was statistically similar as T₀ (Table 2).

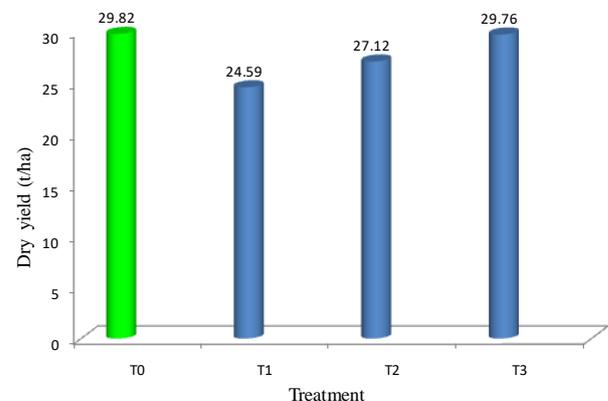


Fig. 2. Yield of Bottle gourd as vegetable

Yield of Bottle gourd: As vegetables there was significant variation in fresh yield of bottle gourd grown under different distances from the tree base in association with different trees. As evident from the results, the highest fresh yield of bottle gourd (29.82t/ha) was

obtained from treatment T₀ (Open field referred as control) (Fig. 2). In association with akashmoni the highest (29.76 t/ha) fresh yield was recorded at treatment T₃ (3.0-4.5 ft distance from the tree) and the lowest (24.59 t/ha) fresh yield was observed under the close contact of tree which referred as T₁ (0.0-1.5 ft distance from the). Similar result also observed by Hasan (2012) in different summer vegetables grown in association with lambu tree.

Fruit yield of bottle gourd: It was perceived that yield of bottle gourd was exaggerated by saplings. The best fruit yield of bottle gourd hectare⁻¹ (43.63t) was recorded in without tree saplings (Fig.3). In association with akashmoni the highest fruit yield recorded was (36.88 t/ha) at treatment T₃ (3.0-4.5 ft distance from the tree) and the lowest fruit yield (15.3t/ha) observed under the close contact of tree which referred as T₁ (0.0-1.5 ft distance from the). Similar result also observed by Hasan (2012) in different summer vegetables grown in association with lambu tree.

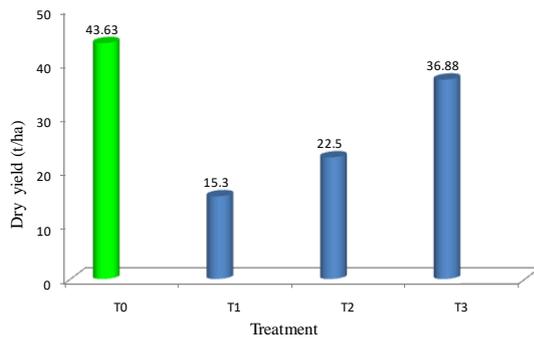


Fig. 3. Yield of Bottle gourd cultivation as fruit vegetable

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