Performance of sweet gourd in association with three timber tree species

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Abstract: An experiment was conducted at the Kalibari char which is situated by the side of Brahmaputra river adjacent to the Bangladesh Agricultural University, Mymensingh, during the period from November 2012 to March 2013 to evaluate the performance of sweet gourd in association with Akashmoni, Mahogoni & Lambu tree saplings. Four different treatments were used in this experiment viz. <50 cm, 50-100 cm, >100 cm distance from tree sapling bases and in open field condition referred as control. The experimental design was laid out in a Randomized Complete Block Design (RCBD) with three replications. Sweet gourd is cultivated along with Akashmoni, Mahogoni & Lambu trees. The result showed that yield of Sweet gourd was highest in the open field. The second highest yield of Sweet gourd was obtained under >100 cm distance and the lowest yield was recorded within <50 cm distance from sapling base. Morphological parameters of Sweet 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 sapling base. Yield of sweet gourd as vegetable along with Akashmoni tree (24.2 t/ha) was highest in open field condition. Compare to control i.e., without tree condition yield were 35.72%, 21.66% and 7.98% reduced in the. <50 cm, 50-100 cm, >100 cm distance from Akashmoni tree base respectively. Again in case of Mahogoni tree, compare to control i.e., without tree condition yield were 39.14%, 25.46% and 12.54% reduced in the. <50 cm, 50-100 cm, >100 cm distance respectively. Compare to control i.e., without tree condition yield were 42.18%, 29.64% and 17.1% reduced in the. <50 cm, 50-100 cm, >100 cm distances from Lambu tree base respectively. Compare to control i.e., without tree condition yield were 21.79%, 25.71% and 29.64% reduced in the Akashmoni, Mahogoni and lambu tree respectively. Growth of both tree species was also influenced with sweet gourd and without sweet gourd condition. Height and Girth increment of both trees were higher in combination with sweet gourd.

Key words: Sweet gourd, timber trees, charland, agroforestry system.

Introduction

Forestry with agricultural crop can provide a sound ecological basis for increased crop and animal productivity, more dependable economic returns, and greater diversity in social benefits on a sustained basis (Khan, 1997). 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). Lundgren and Raintree (1982) stated that agroforestry is a collective name for all land use systems and technologies where woody perennials are deliberately used on the same land management units as agricultural crops and/or animals in some form of spatial arrangement or temporal sequence.

Acacia auriculiformis used for fuel wood plantations as an ornamental and shade tree, quite tolerant of heat, the Australian species is widely planted in loceana and southeast Asia. The wood is also employed for making farm tools and furniture (NAS, 1983). The tannin produces good quality leather, inclined to redden upon exposure to sunlight (NAS, 1980). The plant is amazing in its ability to recolonize wastes, paper mill sludge, pH *ca* 9.5; even uranium spoils, pH *ca* 3.0; the only tree found on 20-year old uranium spoil. This tree is used for the cultivation of the lac insect in India. The gum contains 5.3% ash, 0.92% N, and 1.68% methoxyl, and *ca* 27.7% uronic acid. The sugar from the gum after hydrolysis, contained 10.1% 4-0-methylglucuronic acid, 17.6% glucuronic acid, 59% galactose, 8% arabinose, and 5% ramose (Anderson, 1978). Average amount of dead litter is 4800 kg/ha.

Lambu 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. It has a generally straight grain and free of voids and pockets. Lambu also resists wood rot, making it attractive in boat construction.

Mahogoni has a generally straight grain and is usually free of voids and pockets. Its reddish-brown color darkens over time, and displays a reddish sheen when polished. It has excellent workability, and is very durable. Historically, the tree's girth allowed for wide boards from traditional Mahogoni species. These properties make it a favorable wood for crafting cabinets and furniture.

In Bangladesh a large number of vegetables are grown of which most of them are grown in winter season. Financial returns from vegetables showed that winter vegetables production is more profitable than the production of most field crops (BBS, 1998). Among the different winter vegetables, Sweet gourd is the important winter vegetable 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.

During this early period of tree establishment farmers can produce annual crops (like vegetables) at the base area and surrounding area of the saplings. Cultivation of vegetables can ensure optimizing use of our land resources and ultimately increases total yield. The competition between crop and sapling for growth resources such as light, water and nutrients are minimum at the early stages of tree establishment. Traditionally, farmers grow shade loving species and vegetables under different trees in their cropland, homesteads and surrounding areas. Therefore, the present study was undertaken to observe the performance sweet gourd grown along with Akashmoni, Mahogoni and Lambu tree.

Materials and Methods

The experiment was carried out at Kalir char which is situated by the side of Brahamaputra river adjacent to the Bangladesh Agricultural University, Mymensingh during the period from 01 November 2012 to march 2013.The soil texture was sandy loam with a pH 6.6. The structure of the soil was fine and the organic matter content was 1.80%. The seeds of Sweet gourd were collected from BRAC seed centre, Mymensingh. The study was done under two year's Akashmoni tree saplings. At first 0.04 feet deep pits were dug at 9 feet distance in the experimental field then the

pits were fallow for few days. Then the pits were filled with surrounding soils and then the seedlings of the tree were placed into the central portion of the pits. After the tree plantation sufficient irrigation was applied at the base of the tree. Irrigation was done two times in a day by the watering cane.The Experimental design was Randomized Complete Block Design with three replications. Three plots each of 13.2m x 35.80m were laid around the tree. Four tree-crop distance treatments were used. These are T_0=Open field referred to as control, T_1= <50 cm distance from the tree, T_2=50-100 cm distance from the tree, T_3=>100 cm distance from the tree.

Emergence of sweet gourd seedling was started after 15 days from the date of sowing. Seedlings of were thinned out two times. First thinning was done after 55 days of sowing. The second thinning was done after 70 days of sowing. Using leafy vegetable we thinned out 75% of the crop. Remaining 25% crop, we use fruit purpose. After thinning, we maintain 50 cm plant-to-plant distance.Insect pests like leaf fodder, fruit fly, and yellow beetle can be controlled by spraying Malathion 50 EC 1 ml/lit or Dimethoate 30 EC 1 ml/lit or Methyl demeton 25 EC 1 ml/lit. As well as foliar disease like downy mildew can be controlled by spraying Dinocap 1 ml/lit Or Carbendazim 0.5 g/lit. Powdery mildew can be controlled by spraying Dinocap 1 ml/lit or Carbendazim 0.5 g/lit. Monitoring for pests should be done regularly. Remove infected fruits and leaves to avoid build-up of pest population. Observe strict sanitation to control insect pests and diseases.Considering its high market value the fruits were harvested at tender stage and before 100 % maturity when they were still green. Harvesting is done by hand picking.

Plant samples of Sweet gourd were collected from all the respective plots. Four plants of sweet gourd were selected from each $1m^2$ plot for data collection. Data were collected at 35, 55 and 120 Days after sowing. The following plant characters of sweet gourd were recorded as vine 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. Data regarding various parameters were statistically analyzed by the computer using statistical package programme MSTAT-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 sweet gourd along with Akashmoni, Mahogony and lambu tree:

Vine length: Sweet gourd was cultivated under different distance from the Akashmoni, Mahogoni and Lambu tree. It grew more vigorously in the open field than those grew close distance to the tree. Among different distances the highest average vine length of sweet gourd was 294.24 cm, 273.64 cm, 264.82 cm found in Akashmoni, Mahogoni and Lambu tree respectively at T_3 (>100 cm distance from the tree).The highest average vine length of sweet gourd was 319.83cm found in T_0 (open field referred as control) and the lowest average vine length of sweet gourd was 220.68cm, 205.23 cm, 198.61 cm found in Akashmoni, Mahogoni and Lambu tree respectively at T_1 (<50 cm from the tree) (Table 1, 2, 3). 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. Khatun *et al.* (2009) showed the similar results.

Table 1. Morphological characteristics of sweet gourd in association with Akashmoni tree

Treatments	Morphological Characteristics				
	Vine length (cm)	No. of primary branches /plant	No. of leaves /primary branch	No. of fruit /plant	Weight /fruit (g)
T_0	319.83a	11.34a	18.38a	13.13a	2074.59a
T_1	220.68c	7.64c	12.07d	8.42c	1296.2d
T_2	250.1b	8.67c	13.73c	9.56c	1478.77c
T_3	294.24a	10.32b	16.54b	11.69b	1825.64b

Means in column followed by the different letter are significantly different by DMRT at $P \leq 0.05$, T = Control, T = <50 cm from tree base, T = 50-100 cm from tree base, T = > 100 cm from tree base.

Table 2. Morphological characteristics of sweet gourd in association with Mahogoni tree

Treatments	Morphological Characteristics				
	Vine length (cm)	No. of primary branches /plant	No. of leaves /primary branch	No. of fruit /plant	Weight /fruit (g)
T_0	319.83a	11.34a	18.38a	13.13a	2074.59a
T_1	205.23d	7.1c	11.23d	7.83c	1205.47d
T_2	232.59c	8.06c	12.77c	8.89c	1375.26c
T_3	273.64b	9.6b	15.38b	10.87b	1697.85b

Means in column followed by the different letter are significantly different by DMRT at $P \leq 0.05$, T = Control, T = <50 cm from tree base, T = 50-100 cm from tree base, T = > 100 cm from tree base.

Average no. of primary branches plant^{-1}: It was noted that no. of leaves of sweet gourd was meaningfully enlarged with the increase of distance from saplings. The result revealed that the highest no. of branches plant^{-1} (11.34) was produced by T_0 (open field referred as control). The second highest no. of branches plant^{-1} (10.32, 9.6, 9.29) was produced under Akashmoni, Mahogoni and Lambu tree respectively at T_3 (>100 cm distance from the tree) and the lowest (7.64, 7.1, 6.88) was observed in Akashmoni, Mahogoni and Lambu tree respectively at T_1 (<50 cm distance from the tree), (Table 1, 2, 3). 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. Khatun *et al.* (2009) showed the similar results.

Table 3. Morphological characteristics of sweet gourd in association with Lombu tree

Treatments	Morphological Characteristics				
	Vine length (cm)	No. of primary branches /plant	No. of leaves /primary branch	No. of fruit /plant	Weight /fruit (g)
T_0	319.83a	11.34a	18.38a	13.13a	2074.59a
T_1	198.61d	6.88c	10.86d	7.58c	1166.58d
T_2	225.09c	7.8bc	12.36c	8.6c	1330.89c
T_3	264.82b	9.29b	14.89b	10.52b	1643.08b

Means in column followed by the different letter are significantly different by DMRT at P ≤ 0.05, T = Control, T = <50 cm from tree base, T = 50-100 cm from tree base, T = > 100 cm from tree base.

Average no. of leaves branch^{-1}: Different treatments had significant effect on no. of leaves branch^{-1} of sweet gourd (Table 1, 2, 3). The result showed that the highest no. of leaves branch^{-1} (18.38) was recorded inT_0 (open field referred as control) and the lowest (8.42, 11.23, 10.86) was recorded in Akashmoni, Mahogoni and Lambu tree respectively at T_1 (<50 cm). The second highest no. of leaves plant^{-1} (16.54, 15.38, 14.89) was produced under T_3 (>100 cm distance from the tree) (Table 1, 2, 3). 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. Khatun *et al.* (2009) showed the similar results.

No. of fruits plant^{-1}: The maximum number of fruits plant^{-1} (13.13) was observed at T_0 (open field referred as control). The lowest (8.42, 7.83, 7.58) number of fruits plant^{-1} was found under close contact of the tree referred in Akashmoni, Mahogoni and Lambu tree respectively as T_1 (<50 cm distance from the tree) (Table 1, 2, 3) 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.

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}(2074.59g) was recorded in the open field (T_0) referred to as control. Due to high competition between tree and crop the lowest weight fruit^{-1} (1296.2g, 1205.47g, 1166.58g) was found in Akashmoni, Mahogoni and Lambu tree respectively at T_1 (<50 cm distance from the) and second highest weight fruit^{-} was 1825.64g, 1697.85g, 1643.08g was found in Akashmoni, Mahogoni and Lambu tree respectively at T_3 (>100 cm distance from the) (Table 1, 2, 3). 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. Khatun *et al.* (2009) showed the similar results.

Yield: Mahogoni, Lambu and Akashmoni tree significantly influenced yield of Sweet gourd in different treatments at different rate (Fig. 1).

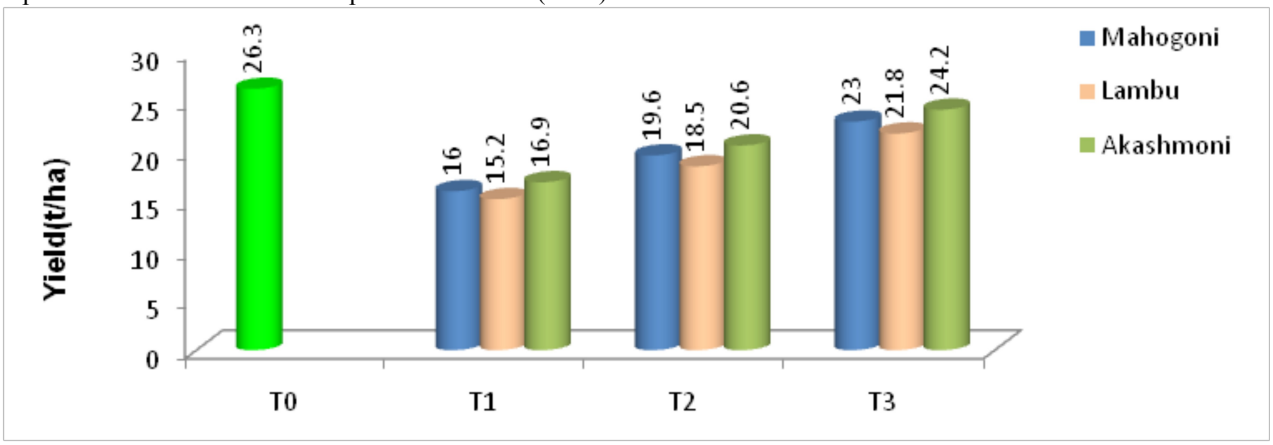

Fig. 1. Yield comparision of sweet gourd as vegetable

Yield of sweet gourd gradually decreased with decreasing distance towards the base of Mahogoni, Lambu and Mahogoni tree. Yield of Sweet gourd was lowest in association with Lambu tree and almost similar trend of yield variation was found in association with Mahogony and Akashmoni tree. Due to competition for nutrients and moisture towards tree base of these trees, gradual yield reduction may be occurred. Lambu is a very first growing tree. For this reason yield of Sweet gourd was lowest under Lambu tree. Due to its fast growing habit obviously it required more moisture and water for its growth and development. It was perceived that yield of sweet gourd was exaggerated by saplings. The best fruit yield of sweet gourd hectare^{-1} (26.3 t/ha) was recorded in without tree saplings (Fig. 1). In association with Akashmoni the highest fruit yield recorded was (24.2 t/ha) at treatment T_3 (>100 cm distance from the tree) and the lowest fruit yield (16.9 t/ha) observed under the close contact of tree which referred as T_1 (<50 cm distance from the tree). In association with Mahogoni the highest fruit yield recorded was (23.0 t/ha) at T_3 (>100 cm distance from the tree) (Fig. 9) and the lowest fruit yield found (16.0 t/ha) under the close contact of tree which referred as T_1 (<50 cm distance from the tree). Similarly in association with Lambu the highest fruit yield was recorded (21.8 t/ha) at treatment T_3 (>100 cm distance from the tree) and the lowest fruit yield found (15.2 t/ha) under the close contact of tree which referred as T_1 (<50 cm distance from the tree). 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. Khatun *et al.* (2009) showed the similar results.

Tree growth: The best growth of tree height in association with sweet gourd which was 43.8 cm in case of Akashmoni tree and lowest growth of tree height was 19.6 cm in Mahogoni tree (Table 4).

Table 4. Growth of Akashmoni, Mahogoni and Lombuin association with Sweet gourd and control

Tree Species	Condition	Height (cm)			Girth(cm)		
		Before	After	Increment	Before	After	Increment
Akashmoni	With sweet gourd	298.1	318.4	20.3	7.6	9.4	1.8
	Without sweet gourd	313.2	330.7	17.5	8.4	10	1.6
Mahogoni	With sweet gourd	135.8	153.5	17.7	9.9	12.8	2.9
	Without sweet gourd	144.3	158.5	14.2	10.6	12.9	2.3
Lombu	With sweet gourd	130.6	147	16.4	10.1	12.4	2.3
	Without sweet gourd	141.1	155.4	14.3	10.8	12.8	2

The best girth of tree in association with sweet gourd was 2.9cm in Mahogoni tree and lowest girth of tree was 1.4 cm in Akashmoni tree. on the other hand, best growth of tree height in control plot without sweet gourd was 53.7 cm in Akashmoni tree plot and lowest growth of tree height was 22.2 cm in case of Mahogoni tree. The best girth of tree without sweet gourd was 3.7 cm in Mahogoni tree plot and lowest girth of tree was 1.8 cm in Akashmoni tree control plot.

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