J. Agrofor. Environ. 3 (1): 1-4, 2009 ISSN 1995-6983

Agroforestry practices with three winter vegetables during the early establishment period of Civit (*Swintonia floribunda*) plantation

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Abstract: A field experiment was conducted to determine the influence of *Swintonia floribunda* on three winter vegetables during the early establishment period of plantation at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh, from November 2008 to March 2009. Influence of vegetables on the growth parameters of civit also determined. Three vegetables were brinjal (*Solanum melongena*), tomato (*Lycopersicon lycopersicum*) and coriander (*Coriandrum sativum*). Every vegetable were laid out using the Randomized Complete Block Design (RCBD) with three replications as separate experiment. In each experiment vegetables are grown at different distance from tree base which were treated as different treatment. Performance of winter vegetables in terms of morphological parameters as well as yield was influenced significantly by the distance from the tree base. The result showed that production of all vegetables was gradually increased with increasing distance from tree base. Highest production was observed in control condition (without tree) which was significantly similar with 3 and 4 feet distance from the tree base and the lowest was under 1 feet distance which was almost similar with 2 feet distance. The growth characteristics of *Swintonia floribunda* was significantly influenced by the all vegetables and condiment. The highest growth was recorded in control condition which was statistically similar with coriander combination. The lowest tree growth was found under the civit-brinjal and civit-tomato combination. Interactions between the components were prominent within 1-2 feet distance from tree base in all tested vegetables and it was more prominent under the civit-brinjal and civit-tomato combination.
Key words: Agroforestry practice, winter vegetables, *Swintonia floribunda*, early establishment

Introduction

To maintain the environmental equilibrium at least 25% area of a country should be covered with forest. In Bangladesh the total forest area covers about 13.36% of the land area (BBS, 2001) but the actual tree covered area is estimated at around 5.4% which is decreasing at an alarming rate (Hossain and Bari, 1996). Due to continuous transformation of forest land to agricultural land, aquaculture, homestead and other purposes about 8000 ha of forest land is decreasing per year (FAO, 1981). On the other hand, in Bangladesh the demand of food crops increasing rapidly due to ever increasing population. The country has only 8.29 million hectares of arable land is to feed 134.3 million people (BBS, 2003). However, the fertility of our land is decreasing rapidly due to intensive cropping and use of high input technologies. Under this alarming condition it is necessary to find out a suitable alternative to overcome this situation. Since there is neither scope for expanding forest area nor sole crop areas, the country has to develop combined production system integrating trees and crop which is now being called multilayer agroforestry system. It is generally assumed that the total production of agroforestry system is several times higher than that of an annual crop system or forestry alone, because growth resources viz. light, nutrient, water are used efficiently in this system. In fact, it is highly productive and sustainable systems provide continuous production round the year. Vegetables are grown in Bangladesh throughout the year but the production is not sufficient. The demand for vegetable is increasing but the area under vegetable production is decreasing. Unfortunately these limited areas are decreasing due to increasing the area of boro rice and wheat in winter season. Tomato (*Lycopersicon lycopersicum*), brinjal (*Solanum melongena*) and coriander (*Coriandrum sativum*) are the common and popular vegetable in Bangladesh, which are rich in vitamins and minerals specially vitamine A, B_2, Iron and calcium (Shankaracharya and Natarajan, 1971). In Bangladesh especially in late summer the availability of vegetables becomes very limited. In that period Tomato, brinjal and coriander can partially overcome this limited condition.

In Bangladesh, timber scarcity is a common phenomenon almost in every year. Teak, Civit, Sal, Garjan, Telsur, Lohakat, Boilam etc. are dominant timber species and grown in natural moist forest areas of Bangladesh. The natural moist forest areas of Bangladesh decreased gradually due to illegal settlements. During the early establishment period (3-4 years) of the above trees vegetables can easily grown in their surrounding areas. In the early establishment period of tree plantation, competition for growth resources (Light, water and nutrients between trees and associated crops are minimum or absent. So, Plantation of above trees in association with different vegetables and spices as agroforestry practice would be beneficial for socioeconomic development as well as sound environmental condition. Therefore, it would be wise to conduct experiments during the early period of tree plantation in association with different vegetables and spices at different spacing in terms of their growth and yield performance for identifying the best tree-vegetable combination.

Materials and Methods

The experiment was carried out at the experimental farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh during the period from November, 2008 to March, 2009. The experimental site is geographically located at about 24º75´ North latitude and 90º50´ East longitudes (Khan, 1997). In this study three winter vegetables, such as: tomato (*Lycopersicon lycopersicum*), brinjal (*Solanum melongena*) and coriander (*Coriandrum sativum*) were grown in association with 8 months old Civit (*Swintonia floribunda*) saplings. Each vegetable were laid using the Randomized Complete Block Design (RCBD) with three replications as separate experiment. Individual plot size was 9ft x 2ft. In each experiment vegetables are grown at different distance from tree base which were treated as treatment. For every

experiment treatments were as; T_0 = Open field (without trees) - control; T_1 = 1 feet distance from the tree; T_2 = 2 feet distance from the tree; T_3 = 3 feet distance from the tree; T_4 = 4 feet distance from the tree and T_5 = 5 feet distance from the tree. *Swintonia floribunda* saplings are also grown without vegetables association as control.

After land preparation coriander seeds were directly sown in the experimental plot on 6th November 2008. The seeds were sown continuously 30 cm apart lines. After emergence of coriander seeds it was thinned out maintaining 30-35 plants per row (with in 1m length). Tomato and brinjal seedlings (30 days old) were transplanted on 12th November 2008 in the experimental plot maintaining the spacing of 50 cm x 50 cm. Seedling planted in all plots were watered immediately after transplanting. Necessary cultural operations were done for all vegetables. Ten plant samples for each plot of brinjal and tomato were randomly selected for data collection. Coriander was harvest after 40 days of sowing all at a time. Different morphological parameters such as, plant height (cm), number of leaves per plant, Leaf size (Length x breadth, cm^2), stem girth (cm), number of fruit per plant, fruit weight (g) were recorded at every harvesting period of tomato and brinjal. Plant height (cm), number of leaves per plant, Leaf size (Length x breadth, cm^2), stem girth (cm), weight per plant (g) of coriander were recorded from all plants after harvest. Yields of all vegetables calculated as t/ha from recorded data of respective vegetables. Height (cm), girth (cm), leaf size (cm^2) and number of leaves per *Swintonia floribunda* saplings also measured during the harvesting period of vegetables.

The data were analysed by using computer package programme MSTAT-C (Russell, 1986) to find out the statistical significance and the mean differences were evaluated by least significance difference (Gomez and Gomez, 1984).

Results and Discussion

Influence of Civit (*Swintonia floribunda*) saplings on the growth and yield of brinjal, tomato and coriander

Growth: Different growth parameters of brinjal, tomato and coriander were significantly influenced by *Swintonia floribunda* saplings (Fig. 1a, 1b, 1c) these were as:

Plant height: Plant height of brinjal, tomato and coriander was significantly influenced by increasing distance from *Swintonia floribunda* sapling basal area (Table 1). In all tested vegetables and condiments taller plants were observed under control condition which was statistically similar with the plants observed at 3 and 4 feet distance from saplings base (Table 1). Relatively shorter plants were found at 1 feet distance from *Swintonia floribunda* sapling base which is statistically similar with the plants at 2 feet distance from sapling base (Table 1). It was found that plant height within the 1-2 feet from sapling base was relatively shorter as compared with control condition and other treatments i.e. more than 2 feet distance from sapling base. This may be due to the competition for moisture and nutrients between the roots of *Swintonia floribunda* saplings and vegetables because saplings age was only eight months, within one year, tree roots can spread only 1-2 feet distance area. Similar type results were also observed by Dhukia *et al.* (1988) who found that closer plant from tree base has severely affected by root competition.

Fig. 1a. Brinjal in Civit (*Swintonia floribunda*) plantation

No. of fruits per plant: Effect of *Swintonia floribunda* saplings on fruit setting of brinjal and tomato were also significant with increasing distance from sapling basal area (Table 1). Like plant height similar trend of variation was observed in case of fruit setting where highest numbers fruit were obtained from control condition and lowest at 1 feet distance from saplings base. No. of fruit per plant in brinjal and tomato at 3 and 4 feet distance from saplings base were statistically similar with control condition. Fruit setting was almost similar at 1 and 2 feet distance areas from sapling basal areas but numerically it was higher in 2 feet distant areas from basal area. So, it is clear that near the saplings base i.e. closest to the saplings there was a competition for moisture and nutrients between the roots brinjal, tomato and *Swintonia floribunda*, as a results fruit setting within 1-2 feet from sapling base was lower compare to 3-4 feet distance area. Similar result was also reported by Ali *et al.* (1998) who observed that fruit setting of okra was gradually increased with increasing distance from the trees.

Fig. 1b. Tomato in Civit (*Swintonia floribunda*) plantation

Fig. 1c. Coriander in Civit (*Swintonia floribunda*) plantation

Fruit size: Fruit size of both brinjal and tomato were significantly influenced by increasing distance from *Swintonia floribunda* sapling basal area (Table 1). Among the different distance category big size fruit was obtained from the 4 feet distance and small size from 1 feet distance from the sapling basal areas of civit plantation (Table 1). Fruit size at 3 feet distance from tree base and under control condition was statistically similar with 4 feet distant plants. Similar result was also reported by Dhukia *et al.* (1988) who observed that fruit size of food crops gradually increased with increasing distance from tree base.

Leaf number and length: Number of leaves plant^{-1} and leaf length of coriander were gradually increased with increasing distance from sapling base (Table 1). Among the different treatments large sized leaves were found at 4 feet distance and small sized at 1 feet distance (Table 1). Leaf length at 3 feet distance from tree base and under control condition was statistically similar with 4 feet distant plants. Like leaf length, almost similar result also observed in case of leaf number. Near the basal area of civit plants both leaf length and number of coriander was lower may be due to the competition for moisture and nutrients between the roots of civit and coriander.

Table 1: Morphological characters of brinjal, tomato and coriander in association with *Swintonia floribunda*

Treatments	vegetables										
	Brinjal				Tomato				Coriander		
	Plant height (cm)	No. of fruit plant^{-1}	Fruit length	Fruit diameter	Plant height (cm)	No. of fruit plant^{-1}	No. of fruit cluster^{-1}	Fruit diameter	Plant height (cm)	No. of leaves of plant	Leaf length (cm)
T_0	42.1a	11.55a	20.05a	18.15a	67.1a	13.35a	3.55a	25.26a	20.10a	11.32a	16.00a
T_1	37.44c	8.50c	12.25d	12.53d	61.77c	9.50c	3.08d	17.35d	18.49c	9.50c	13.50c
T_2	39.95b	9.60b	13.74c	14.75c	62.77c	10.70b	3.25cd	18.67c	19.19bc	10.25b	14.65ab
T_3	40.77b	10.50a	18.25b	17.55b	65.77b	12.50a	3.35abc	23.15b	19.75a	11.05a	15.70a
T_4	41.77a	11.08a	19.40a	18.30a	66.77ab	13.00a	3.45ab	24.70a	20.14a	11.25a	16.10a
Level of significance	**	**	**	**	**	**	**	**	**	**	**
LSD	1.756	0.711	1.324	1.243	1.756	1.756	0.176	1.337	1.642	0.65	1.684

In a column, figures having common letter(s) do not differ significantly as per DMRT, ** significant at 1% level of probability

Yield: Yield of Brinjal, tomato and coriander were increased with increasing distance from sapling base (Fig. 2). Yield of all three vegetables were significantly influenced by *Swintonia floribunda* saplings at closer distance from the base (Fig. 2).

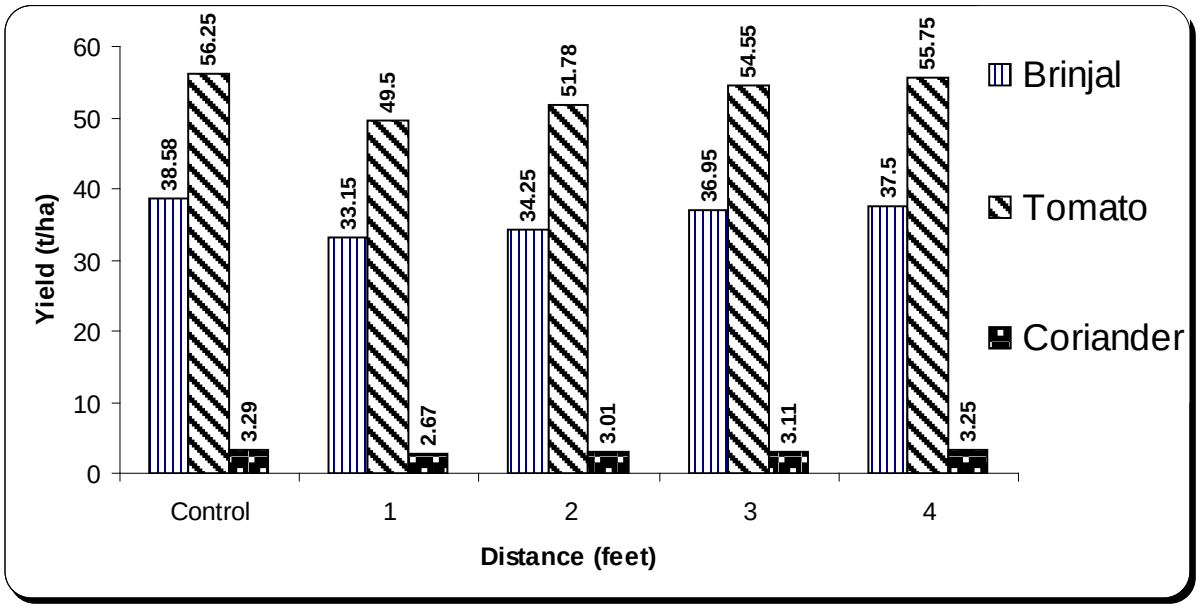

Fig. 2. Yield of Brinjal, tomato and coriander in association with *Swintonia floribunda*

Lowest yield of these vegetables were recorded at 1 feet distant area from the base of the sapling which were statistically similar with yield at 2 feet distance areas but numerical values of 2 feet distance areas were higher than 1 feet distance areas yield. Yield of brinjal, tomato and coriander at 1 feet distance from tree base were only 14, 12, and 18%, respectively lower compared with control condition. Yield at 3 and 4 feet distance from sapling base were statistically similar with control condition (Fig. 2). This indicates that during the early stage of plantation i.e. sapling stage, competition for growth resources is occurring only in closest to the basal areas of sapling. For this reason some yield reduction of all three vegetables were observed near the basal area (1-2 feet distance) of *Swintonia floribunda*. Ali *et al.* (1998) was also reported similar result. According to them the yield of red amaranth and okra were lowest at the closest areas from Drumstick tree base.

Influence of brinjal, tomato and coriander on the growth characteristics of *Swintonia floribunda*:

Different growth parameters of *Swintonia floribunda* were significantly influenced by the influence of brinjal and tomato (Fig. 3). Height, stem girth, leaf numbers and leaf area of *Swintonia floribunda* were significantly reduced when it was in association with brinjal and tomato (Fig. 3). Both brinjal and tomato is the long time durable, has large size canopy and their root system is more spreading than coriander. For this reason competition may be dominant between civit-brinjal and civit-tomato roots for growth resources especially for nutrients and moisture, as a result civit growth was relatively suppressed. On the other hand, coriander is short durable, lower volumes both shoot and root system where *Swintonia floribunda* growth was almost similar with control condition during the early establishment period of *Swintonia floribunda* tree species.

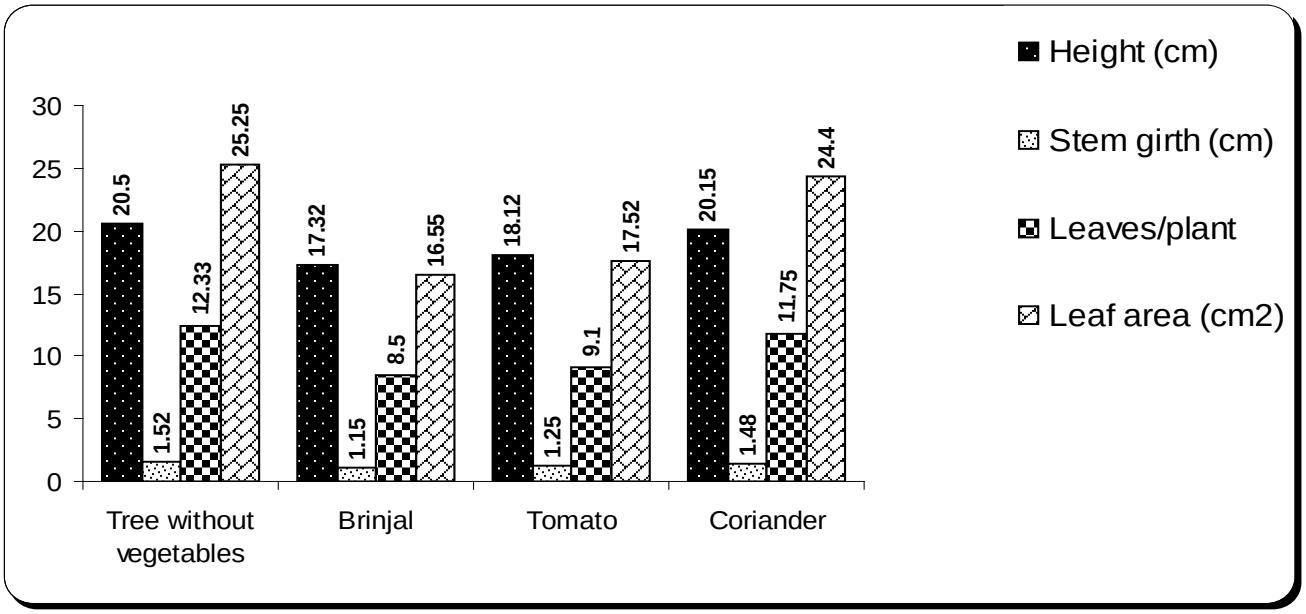

Fig. 3. Effect of Brinjal, tomato and coriander on the growth characteristics of *Swintonia floribunda*

Yield of binjal, tomato and corinder were significantly lower with in the 1-2 feet distance from tree base i. e., during the first year of *Swintonia floribunda* plantation all above vegetables can be grown successfully more than 2 feet distance from tree base. The lowest tree (civit) growth was found under the civit-brinjal and civit-tomato combination. Interactions between the components were prominent within 1-2 feet distance from tree base in all tested vegetables and it was more prominent under the civit-brinjal and civit-tomato combination.

References

Ali, M.A. 1998. Performance of red amaranth and lady's finger grown at different orientation and distances under Guava and Drumstick Trees, M.S. Thesis, BSMRAU, Gazipur, Bangladesh.

BBS (Bangladesh Bureau of Statistics). 2003. Statistical Yearbook of Bangladesh. Bangladesh Bur. Stat. Divn., Minist. Plan. Govt. People's Repub. Bangladesh, Dhaka.

Dhukia, R.S., Lodhi, G.P., Jatasra, D.S. and Ram, S. 1988. Productivity of forage and food crops in agroforstry system under shisharn and sit-is tress. Indian J. Range Management, 9:53-57.

FAO. 1981. Land Resource Appraisal of Bangladesh for Agricultural Development Report. No. 2. Agro-ecological Regions of Bangladesh.FAO. pp. 212-221.

Gomez, K.A. and Gomez, A.A. 1984. Duncan's Multiple Range Test. Statistical Procedures for Agricultural Research. 2nd End. John Wiley and Sons. p. 207-215.

Hossain, S.M.A. and Bari, M.N. 1996. Agroforestry farming system. In: Haque, M.A. (ed) Agroforestry in Bangladesh. Swiss Development Co-operation (SDC, Dhaka and BAU, Mymensingh, pp.21-28.

Khan, W.A. 1997. Developing multiple use silviculture practices of forest of arid regions. Proc. IUFRO/MAB, Lonf. Res. On Multiple use of forestry resources. May 18-23. 1980. Flag Staff, Arizona, U.S.A.

Russel,D.F.1986.MSTAT-C package progrom .Crop and soil science Department. Michigan State University,USA.

Shankaracharya, N. B. and Natarajan C.P. 1971. Turmeria chemistry, technology and uses. Indian Spices, 10(3):7-10.