

## PERFORMANCE OF INDIAN SPINACH AND AMARANTH IN ASSOCIATION WITH FOUR YEARS OLD LOHAKAT TREE (*Xylia dolabriformis*)

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### ABSTRACT

A field experiment was conducted at the Bonpara field area near Natore town during the period from 10 February 2017 to 30 May 2018 to observe the performance (growth and yield) of Indian spinach and amaranth grown at different distances from the lohakat tree (*Xylia sp.*). Different treatments of the experiment were T<sub>1</sub> (3 feet distance from tree), T<sub>2</sub> (6 feet distance from tree) and T<sub>3</sub> (9 feet distance from tree) T<sub>4</sub> (open field referred as control). The experiment was laid out in RCBD for all crops with 3 replications. In indian spinach the highest value of yield (52.08 t/ha) was found under open field which was statistically similar to treatment T<sub>3</sub> (9 feet distance from tree). In case of amaranth it was also found that open field also produced the highest yields (12.70 t/ha) which were statistically similar to treatment T<sub>3</sub>. The growth characters of lohakat tree (*Xylia dolabriformis*) tree are not satisfactory in association with indian spinach and amaranth at 9 feet distance from lohakat tree (*Xylia dolabriformis*) tree.

**Key words:** Performance, vegetables, indian spinach, amaranth.

### Introduction

In Bangladesh, a large number of vegetable are grown throughout the year including summer season. About 30 per cent of vegetable are produced in summer and rainy seasons. The average consumption of vegetable in Bangladesh is only 70 g per head per day including potato and sweet potato. To supply the minimum daily requirement of 200g vegetable head day<sup>-1</sup>, national production of vegetable should be over 10 million ton in addition. The effective area of forest in Bangladesh is neither in a position to fulfill the requirements of the people's fuel and timber nor to stabilize the climatic condition. So, conflict for land use between agriculture and forestry are prevalent in Bangladesh. Under these circumstances it is necessary to find out a suitable alternative to overcome this situation. Recently, some techniques have already been advocated to overcome future food challenges, vegetable agroforestry is one of them. The integration of tree and crop or vegetable on the same area of land is a promising production system for maximizing yield and maintaining friendly environment (Nair, 1990). In Bangladesh; different crops are cultivated in summer season. Among the different summer vegetables indian spinach and amaranth are the important summer vegetables in Bangladesh. These are well known and very popular vegetables grown successfully during summer season in Bangladesh. Indian spinach provides cool to the body, it prevents cough, asthma and its related diseases. Cooked amaranth grains are a complementing source of thiamine, niacin, riboflavin, and foliate, and dietary minerals including calcium, iron, magnesium, phosphorus, zinc, copper, and manganese-comparable to common grains such as wheat germ, oats and others. For identifying the compatible tree-crop combination, particularly under storey species i.e. different crops should be screened out in terms of their adaptability and yield in association with the early stage of tree. Therefore, it would be wise to conduct experiments under different tree crop or vegetable combination at different spacing for screening of different crops in terms of their growth and yield performance. The specific objectives of the study were to observe the performance of indian spinach and amaranth in association with lohakat tree tree and to observe their interaction effects.

### Materials and Methods

The study was made to evaluate the performance of vegetables in association with four years old lohakat tree. The soil of the experimental area was a medium high land. The texture of the soil was silty loam having pH 6.7 (Amir and Bhuiya, 1994).The topography of the field was medium high land above flood. In

this study the four years old previously established lohakat tree (*Xylia dolabriformis*) tree were used as tree component. The seeds of indian spinach variety viz., BARI Puishak-1 (Chitra) were purchased from BRAC seed center; seeds of amaranth variety viz., BARI Data -2 were collected from International Seed Fair in BAU campus Mymensingh.

**Experimental design and treatment combination:** The study for indian spinach and amaranth was laid out following the Randomized Complete Block Design with single factorial arrangement and three replications. Individual plot size was 9 ft x 2 ft. Four treatments were used in this study which is as follows: T<sub>1</sub>= 3 feet distance from the tree base, T<sub>2</sub>=6 feet distance from the tree base, T<sub>3</sub>=9 feet distance from the tree base and T<sub>4</sub>=Open field referred to as control.

**Land preparation:** The experimental land was first opened on 10 February 2017 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.

**Crop establishment and management:** Seeds of Indian spinach and amaranth were directly sown in the experimental plot on 20 February 2017. The seeds of Indian spinach were sown continuously; spacing was 20 cm x 30 cm. Seeds of Amaranth were sown following broadcasting method of seed sowing. After the emergence Amaranth seedlings were thinned out. Only recommended dose of cowdung were applied for the all crop species. No chemical fertilizer was applied considering the suitable fertility status of the soil. Full amount of well decomposed cowdung was incorporated during the final land preparation. The plots were irrigated seven times by using water cane to supply sufficient soil moisture for the vegetable. Finally, Indian spinach was harvested 3 times; first harvesting was done after 60 days of seed sowing. Amaranth was harvested 3 times and first harvesting was done 25 days after the emergence of the seedlings.

The data were collected from the experiment at different stages of various growths and then analyzed statistically by using PC- MASTAT software package to find out the statistical significance of the experimental results. The means for all the treatments and analysis of variance of yields of the summer vegetables were calculated by Duncan's Multiple Range Test (DMRT).

## Results and Discussion

### *Performance of Indian spinach in association with Lohakat tree (Xylia olabriformis)*

**Number of branch:** Indian spinach was cultivated under different distance from the tree. It grew more vigorously in the open field than those grew close distance to the tree. The first harvesting was done at 60 days after seed sowing by cutting the main branch and the number of branch was increased later. Branching and growth were more vigorous in the open field than those grew close distance to the tree. The highest average number of branching was 5, found in T<sub>4</sub> (Open field referred as control) and lowest average number of branching was 2, found in T<sub>1</sub> (3 feet distance from the tree). Other than the T<sub>4</sub> (Open field referred as control) highest average number of branching was 4, found in T<sub>3</sub> (9 feet distance from the tree).

**Average length of branch (cm):** Branching and growth of Indian spinach were more vigorous in the open field than those grew close distance to the tree. The highest average length of branch was 51 cm, found in T<sub>4</sub> (Open field referred as control) and lowest average length of branch was 38 cm, found in T<sub>1</sub> (3 feet distance from the tree). The second highest average length of branch was 45 cm, found in T<sub>3</sub> (9 feet distance from the tree).

**Number of leaves plant<sup>-1</sup> at harvest period:** Good foliage indicates higher growth, development and productivity of plant. The result of the experiment showed that the number of leaves per plant gradually increased with time being highest at 60 DAS. The highest number of leaves was 30 when plants were grown under treatment T<sub>4</sub> (Open field referred as control). The lowest number of leaves (12) was found under treatment T<sub>1</sub> (3 feet distance from the tree), (Table 1). Number of leaves per plant showed significant variation due to different distance of Indian spinach plant from the tree.

**Stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup>:** Distance of Indian spinach plant from the tree had significant effect on weight at final harvest. The highest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 90 g, 142 g and 232 g respectively, found in T<sub>4</sub> (Open field referred as control) and the second highest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 68 g, 116 g and 184 g respectively, found in T<sub>1</sub> (3 feet distance from the tree), (Table 1). The lowest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 30 g, 52 g and 82 g respectively, found in T<sub>1</sub> (3 feet distance from the tree). The stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> showed significant variation due to different distance of Indian spinach plant from the tree.

Table 1. Morphological characteristics of indian spinach in association with *Xylia dolabriformis* tree

Treatment	No. of branch/plant	Branch length (cm)	No. of leaves/Plant (cm)	Stem weight/plant (g)	Leaf weight/plant (g)	Total weight/plant (g)
T <sub>1</sub>	2d	38c	12c	30c	52c	82d
T <sub>2</sub>	3c	41b	21b	58b	101b	159c
T <sub>3</sub>	4b	45a	25b	68b	116b	184b
T <sub>4</sub>	5a	51a	30a	90a	142a	232a
CV	0.22	0.89	1.02	0.67	2.11	1.12
Level of sig.	**	**	**	**	**	**

\*\*= Significant at 1% level of probability

T<sub>1</sub>= 3 feet distance from the tree base, T<sub>2</sub>=6 feet distance from the tree base, T<sub>3</sub>=9 feet distance from the tree base and T<sub>4</sub>=Open field referred to as control.

**Yield (t/ha):** The highest yield of Indian spinach (55.20 t/ha) was obtained from treatment T<sub>4</sub> (Open field referred as control). On the other hand, the lowest yield of Indian spinach (25.20 t/ha) was found from treatment T<sub>1</sub>. The second highest yield of Indian spinach (53.30 t/ha) was obtained from T<sub>3</sub>.

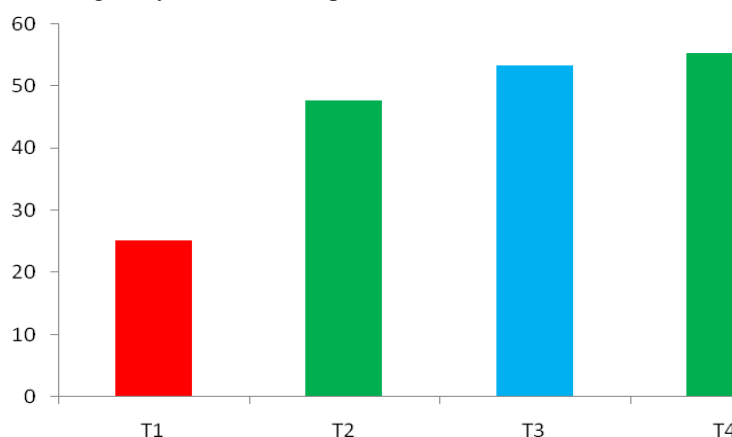


Fig. 1. Yield of Indian spinach in association with *Xylia dolabriformis* tree

**Performance of Amaranth in association with Lohakat tree (*Xylia olabriformis*)**

**Plant height:** The highest average plant height of Amaranth was 91 cm, found in T<sub>4</sub> (Open field referred as control) and lowest average plant height of Amaranth was 56 cm, found in T<sub>1</sub> (3 feet distance from the tree). Other than the T<sub>4</sub> gave the highest average plant height of Amaranth was 88 cm, found in T<sub>3</sub>.

**Number of leaves plant<sup>-1</sup> at harvest period:** Good foliage indicates higher growth, development and productivity of plant. The result of the experiment showed that the number of leaves per plant gradually increased with time being highest at 55 DAS. The highest number of leaves was 19 when plants were grown under treatment T<sub>4</sub>. The lowest number of leaves (12) was found under treatment T<sub>1</sub> (Table 2).

**Stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup>:** The highest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 160 g, 80 g and 240 g respectively, found in T<sub>4</sub> and the second highest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 148 g, 75 g and 223 g respectively, found in T<sub>1</sub> (Table 2). The lowest stem weight plant<sup>-1</sup>, leaf weight plant<sup>-1</sup> and total weight plant<sup>-1</sup> were 60 g, 44 g and 104 g respectively, found in T<sub>1</sub>. Islam *et al.*, (2009) reported that morphological characteristics of winter vegetables decreased consistently with the decrease of distance from the tree.

Table 2. Morphological characteristics of amaranth in association with *Xylia dolabriformis* tree

Treatment	No. of branch/plant	Branch length (cm)	No. of leaves/Plant (cm)	Stem weight/plant (g)	Leaf weight/plant (g)	Total weight/plant (g)
T <sub>1</sub>	56c	12c	60d	44d	104d	56c
T <sub>2</sub>	78b	16b	122c	68c	190c	78b
T <sub>3</sub>	88a	17b	148b	75b	223b	88a
T <sub>4</sub>	91a	19a	160a	80a	240a	91a
CV	0.67	2.89	1.12	4.11	2.45	0.67
Level of sig.	**	**	**	**	**	**

\*\*= Significant at 1% level of probability

T<sub>1</sub>= 3 feet distance from the tree base, T<sub>2</sub>=6 feet distance from the tree base, T<sub>3</sub>=9 feet distance from the tree base and T<sub>4</sub>=Open field referred to as control.

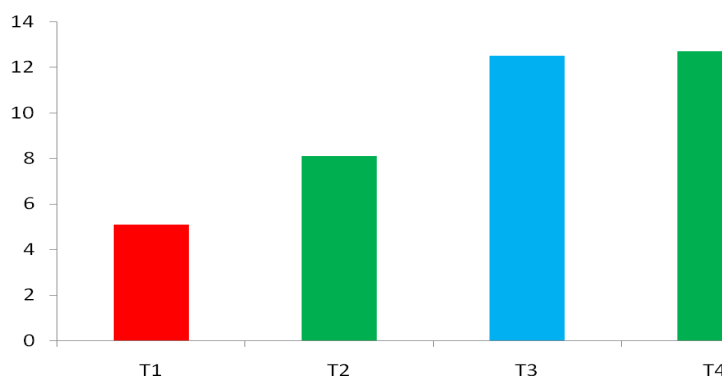


Fig. 2. Yield of Indian spinach in association with *Xylia dolabriformis* tree

**Yield (t/ha):** The variation in yield of Amaranth ton per hectare due to different treatments was found significant. As evident from results, the highest yield of Amaranth (12.70 t/ha) was obtained from treatment T<sub>4</sub> (Fig. 2). On the other hand, the lowest yield of Amaranth (5.20 t/ha) was found from treatment T<sub>1</sub>.

### Conclusion

The result revealed that among the tree-crop interaction, tree- Indian spinach and tree-amaranth gives highest value of yield and other morphological characters in T<sub>3</sub>(9 feet distance from tree) which is statistically similar to T<sub>4</sub> (open field referred as control).

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