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GROWTH AND YIELD OF MEDICINAL PLANTS AND SPICES UNDER SISSOO BASED AGROFIRESTRY SYSTEM

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ABSTRACT

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The experiment was carried out in the field of the Germplasm Centre, Fruit Tree Improvement Project (FTIP), as well as in the field laboratory of FTIP, Bangladesh Agricultural University, Mymensingh during December 2005 to investigate the growth and yield of medicinal plants and spices grown under Sissoo based Agroforestry system. In open condition, medicinal plants and spices received 100% sunlight; while Guava and Sissoo based Agroforestry system provided 60-65% sunlight for the growth of those plants. The result revealed that the performance of the experimental plants viz. Aloe vera, Asparagus, Misridana, Turmeric, Ginger, Onion, Garlic and Chilli were more significant in Guava and Sissoo based Agroforestry system. All the test plants showed highest results in case of Guava and Sissoo based Agroforestry system compared to that of open condition.

Key words: *agroforestry, multilayered, aloe vera, asparagus, misridana, ginger, turmeric, onion, chilli*

INTRODUCTION

Traditionally and predominantly, Bangladesh is a rural based agricultural country. About 85% of her population directly or indirectly depends on agriculture for their livelihood. To maintain the environmental equilibrium at least 25% area of a country should be covered with forest. In Bangladesh, the total forest area covers 13.36% of the land area (BBS 2004) 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 into agricultural land, aquaculture, homestead, industries and some forest lands were subjected to shifting cultivation. So, the effective area of forest in Bangladesh is neither in a position to fulfill the requirements of the people's for fuel, fodder and timber nor to stabilize the climatic condition. On the other hand demand of food crops increasing rapidly due to increasing population. However, the fertility of our land is decreasing rapidly due to intensive cropping and cropping with poor management. Under this situation, it is necessary to find out the suitable alternate options for raising crops. Recently, some techniques have already been advocated to overcome the future challenges. Agroforestry is one of them. Agroforestry is the integration of the trees, crop and vegetables on the same area of land is a promising production system for maximizing yield (Nair 1990) and maintaining friendly environment. As our land is so limited, we have no scope to increase our land horizontally but have an opportunity to increase it vertically. The cultivation technique at various heights containing different plant on a same land management unit is known as multilayered cropping system. The top and middle layer can provide fruits, timber, and fuel wood and may have an important role to increase biomass production in the soil. The lower layer can provide medicinal and spices raw materials. However, the Agroforestry system is one kind of insurance of the farmers against the risks of total crop failure as observed in case of monocropping system. Introducing medicinal plants into multilayered cropping system is very important because medicinal plants are used in herbal treatments but their making facilities are very poor. So these plants are not widely cultivated and also important to maintain biodiversity. Studies of medicinal plants i.e. Aloe vera (*Aloe vera*), Asparagus (*Asparagus racemosus*), Misridana (*Scoparia dulcis*) help to identify them also help to know their therapeutic effects and other uses. Turmeric (*Curcuma longa*), Ginger (*Zingiber officinale*), Onion (*Allium Cepa* L.), Garlic (*Allium sativum* L.) and Chilli (*Capsicum fruticens*) are the most important and ancient spices of Indian sub-continent. In Bangladesh the total production of these spices crop are very low as compared to demand. Under multilayered Agroforestry system medicinal plants and spices (turmeric, garlic, and ginger) are compatible crop due to their shade loving nature and easily grown habit in all homesteads. With this view, the present investigation was undertaken to know the growth and yield of medicinal plants and spices under Sissoo (Guava and Sissoo based) based Agroforestry system.

MATERIALS AND METHODS

The experiment was conducted in the existing multilayered garden at the Germplasm Centre (GPC) of Fruit Tree Improvement Project (FTIP) of Bangladesh Agricultural University, Mymensingh during April to September, 2005. The experimental field was located between the latitudes of 24º26' to 24º54' north and between the longitudes of 90º15' to 90º30' east and about 7.9 meters to 9.1 meter above the sea level. The experimental site was situated in a high land belonging under Agro Ecological Zone 9. The soil of the experimental area was silty loam in texture. It was a medium high land, fertile, well drained and slightly acidic with pH varying from 5.5 to 6.8 and the amount of C, total N, available P and available K were 0.835%, 0.068%, 18 ppm and 0.28me/100g of the soil samples, respectively. The experiment was conducted in Randomized Complete Block Design (RCBD)

with three replications. The treatments were T_1 = Sissoo + Guava + Aloe vera, T_2 = Sissoo + Guava + Asparagus, T_3 = Sissoo + Guava + Misridana, T_4 = Sissoo + Guava + Turmeric, T_5 = Sissoo + Guava + Ginger, T_6 = Sissoo + Guava + Onion, T_7 = Sissoo + Guava + Garlic, T_8 = Sissoo + Guava + Chilli & T_9 = Open condition. In all treatments were three layered garden consisted of Sissoo at the top layer, Guava at the middle layer and the medicinal plants and spices were at the ground layer and T_9 were in open condition. In open condition (T_9) medicinal plants and spices received 100% sunlight; while Guava and Sissoo based Agroforestry system (T_1 to T_8) allowed 60-65% sunlight. Light interception was measured with lux meter. Spacing between Guava and between rows was 6m×8m, and the spacing between Sissoo and between rows was 5m×8m. The Guava plants were 6 years old and Sissoo plants were 9 years old. The lands was opened in the month of December, 2004 and then clear out of small bushes by scissors and then prepared land thoroughly by ploughing and cross ploughing with power tiller followed by laddering to obtain good tilth. Seedlings of Aloe vera, tuberous roots of Asparagus and mother rhizome of Misridana were planted in the experimental plots in 11th January, 2005 and the spacing was maintain by 60cm×40cm for all the plants. The seeds rhizome (Dimla) were planted 50cm×25cm spacing and within the rows at a depth of 7.5 to 8cm. The seeds rhizomes of Ginger, Onion (Taherpuri), bulb of Garlic and Chilli were planted maintaining spacing 60cm×20cm, 25cm×25cm, 10cm×15cm and 25cm×30cm. Recommended doses of fertilizers i.e. 60kg-17kg-35kg-9kg, 0.35kgha^{-1} as N, P, K, S, Zn for Aloe vera and Misridana; 60kg-17kg-65kg-9kg, 0.15kgha^{-1} as N, P, K, S, Zn for Asparagus; 66kg-22kg-54kg-12kg, 0.6kgha^{-1} as N, P, K, S, Zn for turmeric; 5ton-304kg-267kg-233kg-111kgha^{-1} as Cowdung, Urea, TSP, MP and Gypsum for Ginger; 15ton-148kg-146kg-247kgha^{-1} as Cowdung, Urea, TSP, MP for Onion; 14ton-110kg-140kg-210kgha^{-1} as Cowdung, Urea, TSP, MP for garlic and 15ton-275kg-200kg-200kgha^{-1} as Cowdung, Urea, TSP, MP for Chilli plants were applied to the experimental plots. Half of the nitrogen and full dose of other fertilizer were applied at the time of land preparation. The remaining N was applied at 6 weeks of growth of plants. Crop was raised by following general agronomic practices. Aloe vera, Asparagus and Misridana were harvested on 21th September, 11th September, and 19th September, 2005, respectively. Turmeric, Ginger, Onion, garlic and Chilli were harvested August, 29th September and June, 2005 respectively when the leaves turned yellow and stunted drying up. Ten Plants were selected randomly for each treatment for data collection. Finally, the data on various characters of treatment plants were statistically analyzed to draw a valid conclusion.

RESULTS AND DISCUSSION

Aloe vera

The highest plant height of Aloe vera (34.12 cm) was found in Guava and Sissoo based Agroforestry system. Significantly the minimum height (21.53 cm) was observed in open condition (Fig. 1). Similar results was found incase of number of leaves/plant. Significantly the highest fresh weight of leaves per plant of Aloe vera (347.32 g) was found in Guava and Sissoo based Agroforestry system. The lowest fresh weight leaves per plant of Aloe vera (153.71 g) was found in open condition. The maximum dry matter of leaves of Aloe vera (7.037 g) was found in open condition and the minimum (5.42 g) was found in Guava and Sissoo based Agroforestry system (Table 1). It might be due to the plant of open condition gets more sunlight resulted more dry matter assimilation. Paze *et al.* (2000) investigated that partial shade (30% of full sun) increased the number and length of leaves produced on the primary shoot, but leaf dry mass still reduced to 66% of that in full sun.

There was a great variation on yield performance of Aloe vera plant under different Agroforestry system. Significantly the maximum yield of Aloe vera (13.1 ton/ha) was found in Guava and Sissoo based Agroforestry system. The lowest yield (6.21 ton/ha) was observed in open condition (Fig. 1).

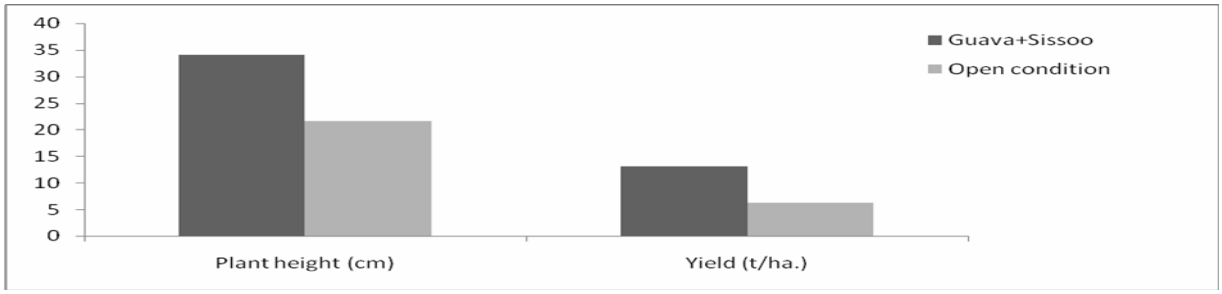

Fig. 1. Plant height and yield of Aloe vera as influenced by agro forestry system

Table 1. Growth and Yield contributing characters of Aloe vera plant under Sissoo based Agroforestry system

Treatment	No. of leaves/plant	Fresh weight of leaves/plant	Dry matter of leaves/plant
Guava + Sissoo	10.72	347.32	5.42
Open condition	9.10	153.71	7.04
$LSD_{(0.05)}$	1.64	8.16	0.11

Asparagus

In Guava and Sissoo based Agroforestry system, the highest plant height of Asparagus (109.92 cm) was observed and the minimum plant height (65.36 cm) was found in open condition (Fig. 2). Similar results was found incase of number of leaves/plant, number of tuberous roots/plant. The fresh weight of tuberous roots of Asparagus (152.73 g) was significantly highest in Guava and Sissoo based Agroforestry system and the lowest (113.34 g) was found in open condition (Table 2).

The yield of tuberous roots (5.64 t/ha) of Asparagus significantly highest in Guava and Sissoo based Agroforestry system and lowest (4.71 t/ha) was found in open condition (Fig. 2).

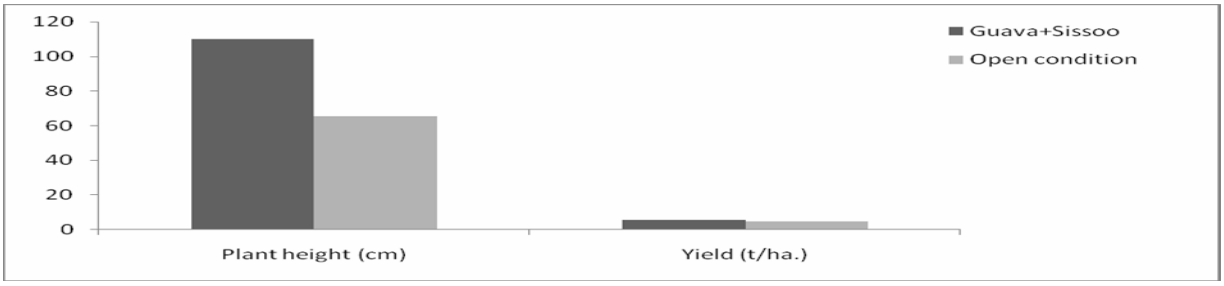

Fig. 2. Plant height and yield of Asparagus as influenced by agro forestry system

Table 2. Growth and Yield contributing characters of Asparagus plant under Sissoo based Agroforestry system

Treatment	No. of leaves/plant	No. of tuberous roots/plant	Fresh weight of tuberous root/plant(g)
Guava + Sissoo	512.26	69.12	152.73
Open condition	233.83	33.51	113.34
$LSD_{(0.05)}$	33.76	10.10	6.63

Misridana

In Guava and Sissoo based Agroforestry system, the plant height of Misridana (69.36 cm) was observed highest and the minimum plant height (34.19 cm) was found in open condition (Fig. 3). Similar results was found incase of number of primary fingers (Fig. 3), number of secondary fingers, weight of primary fingers and weight of secondary fingers (Table 3).

The yield of Misridana was best in Guava and Sissoo based Agroforestry system. It was significantly highest (7.633 t/ha) than others and the lowest yield (4.54 t/ha) was found in open condition (Fig. 3).

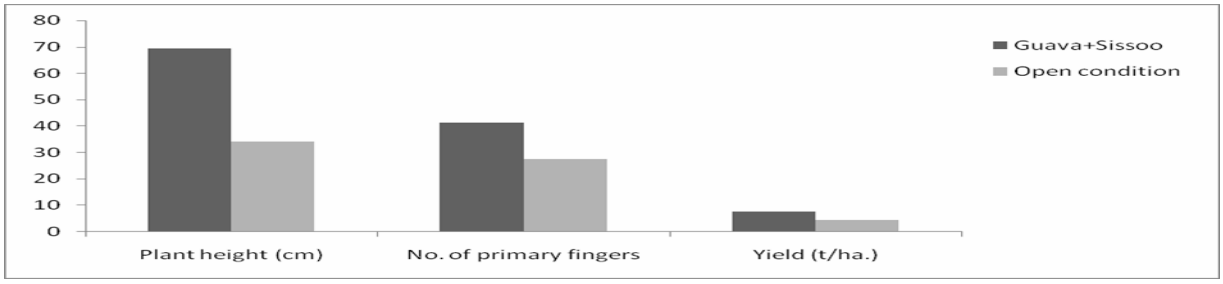

Fig. 3. Plant height and yield of Misridana as influenced by agroforestry system

Table 3. Yield contributing characters and yield of Misridana plant under Sissoo based Agroforestry system

Treatment	No. of secondary fingers	Weight of primary fingers(g)	Weight of secondary fingers(g)
Guava + Sissoo	12.81	149.31	14.41
Open condition	6.03	93.62	4.27
$LSD_{(0.05)}$	2.53	19.75	7.92

Turmeric

Turmeric plant cultivated under shade grew more vigorously than those in open field. The highest plant height of Turmeric (93.43 cm) was found in Guava and Sissoo based Agroforestry system and the minimum height (68.21 cm) was observed in open condition (Fig. 4). Significantly the tallest plant under heavy shade in Okra was reported by Ali (1999). Wang and Zhang (1998) conducted an experiment under reduced light by 0, 20, 60 and 80% and experienced that the height of turmeric plant was maximum at 80% shading. Same results was found incase of number of primary fingers, number of secondary fingers, weight of primary fingers, weight of secondary fingers (Table 4). Singh *et al.* (2001) observed that the effect of three species namely eucalyptus, acacia and poplar on the performance of turmeric was investigated in Karnal, Haryana, India. The mean germination of turmeric was maximum when grown association with acacia and minimum in open condition.

The yield of Turmeric was also affected by different Agroforestry system. The highest yield (35.173 t/ha) was recorded under Guava and Sissoo based Agroforestry system and the lowest yield (12.63 t/ha) was recorded in open condition (Fig. 4).

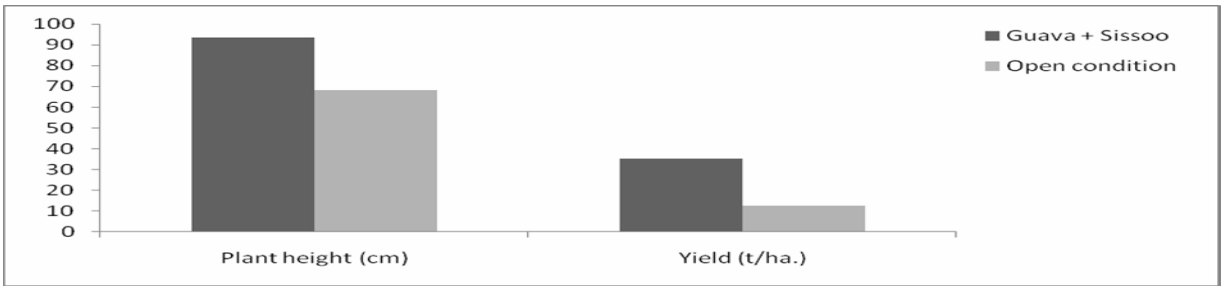

Fig. 4. Plant height and yield of Turmeric as influenced by agro forestry system

Table 4. Growth and Yield contributing characters of Turmeric plant under Sissoo based Agroforestry system

Treatment	No. of primary fingers	Wt. of primary fingers(g)	No. of secondary fingers	Wt. of secondary fingers(g)
Guava + Sissoo	9.013	153.617	13.313	114.22
Open condition	5.493	54.137	6.673	36.877
$LSD_{(0.05)}$	1.024	11.431	2.995	4.738

Ginger

Ginger plant cultivated under shade grew more vigorously than those in open field. The highest plant height of Ginger (76.29 cm) was found in Guava and Sissoo based Agroforestry system. Significantly the minimum height (68.14 cm) was observed in open condition (Fig. 5). Similar result was reported by Amin *et al* (2010). The number of tillers per hill was counted at mature stage of growth. Shade had significant effect on number tillers per hill. The highest number of tillers per hill (22.88) was recorded under reduce sunlight i.e. Guava and Sissoo based Agroforestry system. The lowest number of tellers (14.93) was recorded under open condition. The production of primary fingers was found significantly influenced by shade. The lowest weight of primary fingers of Ginger (98.92 g) was recorded under reduce sunlight i.e. Guava and Sissoo based Agroforestry system. The highest weight (113.31 g) was recorded under open condition. Similar results was found incase of weight of secondary fingers. Significantly difference in rhizome weight per hill was noticed in different Agroforestry system. The maximum (283.67 g) rhizome weight observed in open condition and the minimum (261.29 g) was found Under Guava and Sissoo based Agroforestry system (Table 5). Amin *et al.* (2010) found better result in 50 + 5% shade level.

The yield of Ginger rhizome was significantly influenced by different Agroforestry system. The highest yield (25.15 t/ha) was obtained from open condition. The lowest yield (19.94 t/ha) was obtained from Guava and Sissoo based Agroforestry system (Fig. 5). Rahman (2004) harvested bumper yield of ginger from partial shade conditions. Jayachandra *et al*. (1998) reported in Kerala, India that coconut + ginger system under rainfed conditions gave good returns as ginger performed well under shade. The yield of ginger was 11-27% higher than the open field. Even the yield was better under 50±5% shade than the open field.

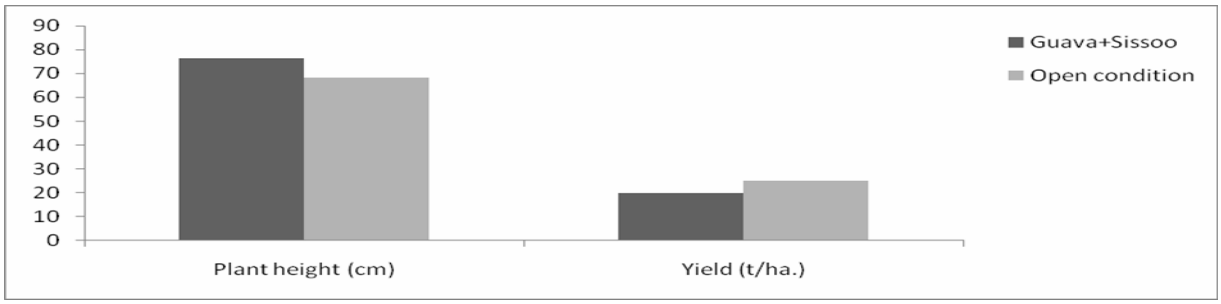

Fig. 5. Plant height and yield of Ginger as influenced by agroforestry system

Table 5. Growth and Yield contributing characters of Ginger plant under Sissoo based Agroforestry system

Treatment	No. of tillers/hill	Wt. of primary fingers(g)	Weight of secondary fingers(g)	Fresh wt. of rhizome/hill(g)
Guava + Sissoo	22.88	98.92	124.70	261.29
Open condition	14.94	113.31	128.06	283.67
$LSD_{(0.05)}$	4.54	12.69	-	-

Onion

The highest plant height of Onion (43.95 cm) was found in Guava and Sissoo based Agroforestry system. Significantly the minimum height (41.89 cm) was observed in open condition (Fig. 6). Similar results was found incase of fresh weight of bulb (Fig. 6) and diameter of bulb per plant. The lowest numbers of leaves counted (6.05) were obtained from Guava and Sissoo based Agroforestry system and the highest (9.06) was found in open condition (Table 6). Similar results was found incase of fresh weight of leaves per plant.

The yield of Onion was significantly influenced by different Agroforestry system. The highest yield (14.28 t/ha) was obtained from Guava and Sissoo based Agroforestry system. The lowest yield (12.21 t/ha) was obtained from open condition (Fig. 6).

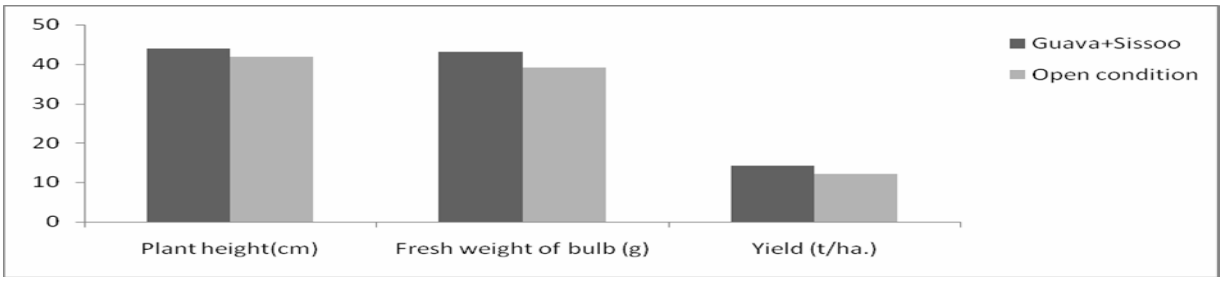

Fig. 6. Plant height and yield of Onion as influenced by agroforestry system

Table 6. Growth and Yield contributing characters of Onion plant under Sissoo based Agroforestry system

Treatment	Number of leaves/plant	Fresh wt. of leaves/plant (g)	Diameter of bulb (cm)
Guava + Sissoo	6.05	11.70	4.03
Open condition	9.06	15.99	3.72
$LSD_{(0.05)}$	1.99	1.24	NS

Garlic

The lowest plant height of Garlic (46.03 cm) was found in Guava and Sissoo based Agroforestry system. Significantly the highest plant height (51.71 cm) was observed in open condition (Fig. 7). The lowest number of leaves of Garlic (6.71) was found under Guava and Sissoo based Agroforestry system. The highest number of Garlic leaves (8.07) found under open condition. The highest fresh weight of bulb (9.17 g) was recorded under Guava and Sissoo based Agroforestry system and the minimum weight of bulb (8.26 g) was recorded under open condition. Similar results was found incase of dry weight of bulb. The highest number of cloves per bulb was counted (14.00) were obtained from Guava and Sissoo based Agroforestry. The lowest number of cloves per bulb (11.76) was found under open condition (Table 7).

The yield of garlic was significantly influenced by different Agroforestry system. The highest yield (5.11 t/ha) was obtained from Guava and Sissoo based Agroforestry system. The lowest yield (4.783 t/ha) was obtained from open condition (Fig. 7).

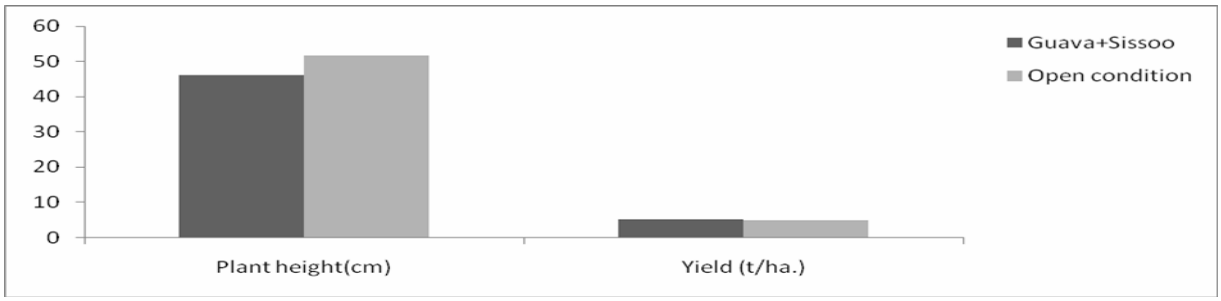

Fig. 7. Plant height and yield of Garlic as influenced by agroforestry system

Table 7. Growth and Yield contributing characters of Garlic plant under Sissoo based Agroforestry system

Treatment	No. of leaves/hill	Fresh wt. of bulb (g)	Dry wt. of bulb (g)	No. of cloves/bulb
Guava + Sissoo	6.71	9.17	2.07	14.00
Open condition	8.07	8.26	1.71	11.76
$LSD_{(0.05)}$	1.53	0.38	0.35	1.24

Chilli

Chilli plant cultivated under shade grew more vigorously than those in open field. The highest plant height of Chilli (68.05 cm) was found in Guava and Sissoo based Agroforestry system (Fig. 8). Significantly the minimum height (49.53 cm) was observed in open condition. Similar results was found incase of fruit length, number fruits

per plant (Fig. 8). The highest number of primary branches of Chilli (7.66) was recorded under Guava and Sissoo based Agroforestry system and the lowest number of primary leaves (6.09) was recorded under open condition. Similar results was found incase of number of secondary branches (Table 8).

The highest yield of Chilli (4.69 t/ha) was obtained from Guava and Sissoo based Agroforestry system. The lowest yield (4.13 t/ha) was obtained from open condition. Contritto *et al.* (1998) studied the effect of shade (0 or 30%) on growth and photosynthetic parameters of Capsicum in Italy and reported that shaded plants exhibited better growth and higher yield than control plants (Fig. 8).

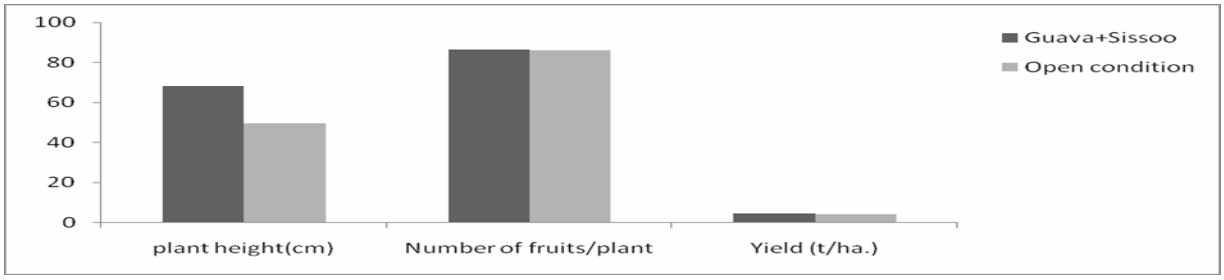

Fig. 8. Plant height and yield of Chilli as influenced by agroforestry system

Table 8. Growth and Yield contributing characters of Chilli plant under Sissoo based Agroforestry system

Treatment	Primary branches	Secondary branches	Fruit length (cm)
Guava + Sissoo	7.66	21.7	8.75
Open condition	6.09	19.57	7.41
$LSD_{(0.05)}$	0.88	NS	2.15

CONCLUSION

It may be concluded that yield attributes and yields Aloe vera. Asparagus, Misridana, Turmeric, Ginger, garlic, Onion & Chilli were increased gradually with the decrease of sunlight. Significantly yield of the treatment plants were higher in Guava and Sissoo based Agroforestry system.

REFERENCES

Ali MA (1999) Performance of Red amaranth and lady's finger growth at different orientation and distances under Guava and Drumstick trees. M.S. diss., BSMRAU, Gazipur, Bangladesh.

Amin MR, Ikbal TMT, Miah MMU, Hakim MA, Amanullah ASM (2010) Performance of ginger underagroforestry system. *Bangladesh Res. Pub. J.* 4, 208-217.

BBS (2004) Statistical Year Book of Bangladesh. Nineteen Edition, Statistics Division. Ministry of Planning. Govt. of the People's Republic of Bangladesh, Dhaka.

Contitto M, Dolphino S, Villian MC, Aluino A, Marco GD (1998) Improved growth of pepper under reduced light intensity, photosynthesis, mechanism and effects. Proceedings of the XIth International Congress on Photosynthesis, Budapest, Hungary, 17-22 August, 1998, 3773-3776.

Hossain SMA, Bari MN (1996) Agroforestry farming system. In: Haque MA (ed) Agroforestry in Bangladesh. Swiss Development Co-operation (SDC), Dhaka and Bangladesh Agricultural University, Mymensingh, pp. 21-28.

Jayachandran BK, Ancy J, Babu P, Nizam SA, Mridula KR (1998) Under the coconut tree: in India, ginger has it made in the shade. Kerala Agril. Univ., Kerala, India, Agroforestry Today, 10(3), 16-17.

Nair PKR (1990) Agroforestry in the context of land clearing and development in the tropics. Nairobi, Kenya.

Paez A, Gebre GM, Gonzalez ME, Tschaplinski TJ (2000) Growth, Soluble carbohydrates and alion concentration of *aloe vera* plants exposed to three irradiance levels. Environmental and Experimental Botany. 44:2, pp. 133-139.

Rahman MA (2004) Growth and development of different vegetable and spices under multilayer agroforestry system. M.S. diss., BSMRAU, Gazipur, Bangladesh.

Singh H, Gurbachan S, Sing G (2001) Performance of turmeric in association with multipurpose tree species. Central Soil Salinity Research Institute, Karnal, Haryana, India. Applied Biological Research, 3(1-2), 57-60.

Wang SH, Zhang ZX (1998) Effect of shade on growth and yield of ginger. China vegetables, 5, 5-8.