

Performance of medicinal plants and spices in coconut based Agroforestry system

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Abstract: An experiment was carried out to investigate the performance of the medicinal plants and spices grown under different agroforestry system. The experiment was laid out in randomized complete block design (RCBD) with three replications. The result revealed that the highest plant growth and the best yield (13.46 t ha⁻¹) in *Aloe vera* was found in guava and coconut based agroforestry system. But the highest dry matter (5.66 g) of leaves was found in open condition. For the asparagus plant the highest morphological growth and yield of tuberous roots (9.36 t ha⁻¹) were observed in coconut and lemon based agroforestry system. But number of leaves and dry matter of tuberous roots (19.26 g) performed best in guava and coconut based agroforestry system. For the turmeric plant, the highest weight of primary finger and secondary finger and fresh rhizome and best yield (38.78 t ha⁻¹) were observed in guava and coconut based agroforestry system. For ginger, weight of primary finger and secondary finger and fresh rhizome and best yield (32.43 t ha⁻¹) were observed in guava and coconut based agroforestry system. But highest morphological growth was in lemon and coconut based agroforestry system.

Key words: Medicinal plants, spices, yield and agroforestry system.

Introduction

Medicinal plants and spices into different agroforestry system is very important because medicinal plants and spices are used in herbal treatments and also important to maintained bio-diversity. But due to their poor marketing facilities, these plants are not widely cultivated (Kirtikar *et al.*, 1987). Studies of medicinal plants and spices help to identify them and also help to know their therapeutic effects and other uses. *Aloe vera* and asparagus are two important medicinal plants' while turmeric and ginger are two important spices of our country (FAO, 1981).

Materials and Methods

This study was conducted on the existing multilayer garden at the Germplasm Centre (GPC) of Fruit Tree Improvement Project (FTIP),

Department of Horticulture, Bangladesh Agricultural University, Mymensingh during December, 2005 to November, 2006 to investigate the performance of medicinal plants and spices in coconut based agroforestry system. Two medicinal plants e.g. *Aloe vera* and Asparagus (*Asparagus recemosus*) and two spices e.g. ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) were laid out on the randomized complete block design (RCBD) with single factor experiment. Twelve treatments were used in this study. Three replications were followed for each treatment for each crop. Total 24 (8×3) plots (3×1m) were set up. Following treatment are: T₁ = Coconut + Guava + *Aloe vera*, T₂ = Coconut + Lemon + *Aloe vera*, T₃ = Coconut + Guava + Asparagus, T₄ = Coconut + Lemon + Asparagus, T₅ = Coconut + Guava + Turmeric, T₆ = Coconut + Lemon + Turmeric, T₇ = Coconut + Guava + Ginger, T₈ = Coconut + Lemon + Ginger, T₉ =

Aloe vera (open condition), T₁₀ = Ginger (open condition), T₁₁ = Asparagus (open condition), T₁₂ = Turmeric (open condition). Treatment T₁, T₂, T₃, T₄, T₅, T₆, T₇ and T₈, were a three layered canopy configuration consisted of coconut, guava, lemon, medicinal plant and spices. The ground layer was covered by medicinal plants and spices. the second layer had guava and lemon plants which were in full bearing condition. The upper layer was covered by coconut trees. Guava + coconut based agroforestry system which allowed to all 65-75% of PRA, lemon + coconut based agroforestry system which permitted 35-45% of light intensity. In treatment T₉, T₁₀, T₁₁, and T₁₂ sun light was allowed to fall over the medicinal plants and spices without any barrier which was considered as 100% light level. Medicinal plants were planted on 15th December, 2004 and spices were planted on 20th March 2005. Intercultural operations were done as and when necessary throughout the whole growing period. Medicinal plants harvested on middle November, 2005 and spices harvested on late November, 2005 when the leaves turned yellow and started drying up. The collected data form the sample of medicinal plants height, canopy volume, number of leaves/plant, leaf length, dry matter of leaves (g) and yield (t ha⁻¹). On the other hand data collected from spices were plant height number of leaves, weight of primary finger, weight of secondary finger and yield t ha⁻¹. The analysis of variance for each of the studied characters was done by F test following randomized completed block design (RCBD).

Results and Discussion

From the result it was evident that the performance of *Aloe vera* in term of growth and yield contributing characters were significantly influenced by the different agroforestry system. The maximum plant height (32.05 cm) was found in guava and coconut based agroforestry system i.e. T₁ and the minimum height (19.21 cm) was found in open condition i.e. T₉ (Table 1). The maximum canopy volume (9438.6 cm³) was found in guava and coconut based agroforestry system T₁ and the minimum canopy volume (1962.9 cm³) was found in open condition i.e. T₉ (Table 1). The highest fresh weight of leaves per plant (351.77 g) was observed in guava and coconut based agroforestry system T₁ and the lowest fresh weight of leaves per plant (112.91 g) was observed in open condition T₉ (Table 1). But the maximum amount of dry matter of leaves (5.66 g) was found in open condition T₉ and minimum amount of total dry matter (4.31 g) was found in Guava and Coconut based Agroforestry system T₁ (Table 1). This finding agrees with (Nair, 1986).

The growth and yield contributing characters of Asparagus were significantly influenced by the different agroforestry system. The maximum plant height (124.90 cm) was found in lemon and coconut based agroforestry system T₄ and the minimum height (62.61 cm) was found in open condition T₁₀ (Table 2). The highest canopy volume (178861.9 cm³) was found in lemon and coconut based agroforestry system T₄ and the lowest canopy volume (20987.6 cm³) was found in open condition T₁₀ (Table 2). The highest

number of tuberous roots per plant (18.43 cm) was found in lemon and coconut based agroforestry system T₄ and the lowest number of tuberous roots per plant (13.36 cm) was found in guava and coconut based agroforestry system T₃ (Table 2). The highest fresh weight of tuberous roots per plant (283.47 g) was observed in Lemon and Coconut based agroforestry system T₄ and the lowest fresh weight of tuberous roots per plant (81.44 g) was observed in open condition T₁₀ (Table 2). But the maximum amount of dry matter of tuberous roots (19.26 g) was found in guava and coconut based agroforestry system T₃ and minimum amount of dry matter (15.24 g) was found in lemon and coconut based agroforestry system T₄ (Table 2).

The growth yield characteristics of turmeric were influenced significantly by different light levels. The shortest (95.94 cm) plant was found in open field condition T₁₁ and the tallest plant (110.10 cm) was recorded in lemon and coconut based agroforestry system T₆ (Table 3). Number of leaves per clump was significantly influenced by reduced light levels. The highest number of leaves (23.36 cm) was found in lemon and coconut based agroforestry system T₆ and lowest number of leaves were observed (14.28) in full sunlight (open condition) T₁₁ (Table 3). Leaf length was increased with the increased of shade levels. The longest leaf (90.49 cm) was found under heavy shade condition in lemon and coconut based agroforestry system T₆. Significantly the highest rhizome yield (570.34 g) was found under partial shade condition in guava and coconut based agroforestry system T₅ (Table 3). The yield of turmeric was also effect by different light levels. The highest yield (38.78 t/ha) was recorded under

partial shade condition in guava and coconut based agroforestry system T₅ and the lowest yield (26.83 t/ha) was found under heavy shade condition in lemon and coconut based agroforestry system T₆ (Table 3). This finding agrees with (Nair, 1993).

In ginger, plant height was increased with the decreased of light levels. The shortest (66.26 cm) was found in full sunlight (open condition) T₁₂. Significantly the tallest (72.62 cm) plant was observed under heavy shade condition in lemon and coconut based agroforestry system T₈ (Table 4). Number of leaves increased with increase of shade levels. The highest number of leaves (24.76) found in lemon and coconut based agroforestry system T₈ and the lowest number (19.58) of leaves found in open condition T₁₂ (Table 4). Leaf length and leaf breadth were increased gradually with the increase of shade levels. The production of primary fingers was found to be significantly influenced by shade. The highest weight of primary finger (129.31 g) was recorded under partial shade condition in guava and coconut based agroforestry system T₇ and the lowest weight (101.32 g) was found in lemon and coconut based agroforestry system T₈ (Table 4). The maximum (380.4g) rhizome weight was observed under partial shade condition in guava and coconut based agroforestry system T₇ and the minimum rhizome weight (265.20 g) was found in Lemon and Coconut based agroforestry system T₈ (Table 4). The yield of ginger significantly increased at partial shade. The highest yield (32.43 t/ha) was obtained from partial shade condition of guava and coconut based agroforestry system T₇ and the lowest yield (17.81 t/ha) was obtained from severe shade

condition of lemon and coconut based agroforestry system T₈ (Table 4).

Conclusion

The findings of the present study were achieved based on one season trial, which may not be sufficient to assess the sustainability of the results. So, similar experiment should be repeated at least in another season so that results should be conclusive.

Reference

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Table 1. Growth and yield contributing characters of *Aloe vera* grown under different agroforestry system.

Treatment	Plant height (cm)	Plant canopy volume (cm ³)	No. of leaves per plant	Leaf length (cm)	Leaf width (cm)	Fresh weight of leaves per plant (g)	Dry matter of leaves (g)	Yield (t/ha)
T ₁	32.05	9438.60	10.78	25.49	2.94	351.77	4.31	13.46
T ₂	29.33	7066.20	9.90	25.27	2.58	230.45	4.51	8.40
T ₉ (Open condition)	19.21	1962.90	8.47	14.83	2.15	112.91	5.66	4.31
LSD (.01)	2.56	13.26	2.42	6.32	0.19	4.26	0.66	2.54

Table 2. Growth and yield contributing characters of *Asparagus* grown under different agroforestry systems.

Treatment	Plant height (cm)	Plant canopy volume (cm ³)	No. of leaves per plant	No. of tuberous root per plant (cm)	Length of tuberous root (cm)	Fresh weight of tuberous root per plant (g)	Dry matter of tuberous root (g)	Yield (t/ha)
T ₃	111.03	110283.30	557.67	52.66	13.36	138.36	19.26	4.10
T ₄	124.90	178861.90	458.30	62.93	18.43	283.47	15.24	9.36
T ₁₀ (Open condition)	62.617	20987.62	244.10	28.30	13.70	81.44	18.16	2.94
LSD (.01)	7.33	8.49	2.66	5.64	2.11	1.86	2.94	1.87

Table 3. Growth and yield contributing characters of *Turmeric* grown under different agroforestry systems.

Treatment	Plant height (cm)	No. of leaves per clump	Leaf length (cm)	Leaf breadth (cm)	No. of tillers per hill	Weight of primary finger (g)	Weight of secondary finger (g)	Weight of fresh rhizome per clump (g)	Yield (t/ha)
T ₅	105.65	19.33	87.55	14.62	3.77	189.11	148.60	570.34	38.78
T ₆	110.10	23.36	90.49	15.49	4.23	136.64	93.15	429.89	26.63
T ₁₁ (Open condition)	95.94	14.28	67.29	11.93	3.11	139.17	108.64	430.80	30.49
LSD (.01)	5.89	6.77	4.46	2.13	0.76	6.88	5.68	9.97	2.67

Table 4. Growth and yield contributing characters of *Ginger* grown under different agroforestry systems.

Treatment	Plant height (cm)	No. of leaves per clump	Leaf length (cm)	Leaf breadth (cm)	No. of tillers per hill	Weight of primary finger (g)	Weight of secondary finger (g)	Weight of fresh rhizome per clump (g)	Yield (t/ha)
T ₇	97.71	20.26	18.33	2.37	17.33	129.31	148.73	380.4	32.43
T ₈	76.62	24.76	24.67	2.67	21.28	101.32	123.19	265.203	17.81
T ₁₂ (Open condition)	66.26	19.58	16.54	2.10	12.78	106.07	124.20	281.8	23.98
LSD (.01)	4.54	7.74	3.43	0.29	2.69	11.27	9.80	12.11	7.76