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PERFORMANCE OF BILATI DHONIA (*Eryngium foetidum* L.) UNDER THE CANOPY OF DIFFERENT TREE SPECIES

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Abstract

Performance of 'Bilati Dhonia' *(Eryngium foetidum* L.) grown under the shades of different tree species, namely guava, jackfruit, mango, jujube, and farmers' practice (grown under artificial shade) was evaluated at the Agricultural Research Station, Raikhali, Rangainati Hill District during two consecutive years of 2004-05 and 2005-06. The results revealed that plant height, leaf length, number of leaves per plant and fresh weight per plant were significantly higher under the canopies of various trees and farmers' practice than those grown under direct sun light. Different growth characters were better under the shades of jackfruit and guava trees than those of other species. Periods to first and 50% flowering under tree species were longer than that under direct sunlight. The highest fresh yield (mean of two years) of 'Bilati Dhonia' was found in the farmers' practice (27.58 t/ha), which was similar to those under guava (27.31 t/ha) and jackfruit trees (27.51 t/ha).

Keywords: Bilati Dhonia (*Eryngium foetidum* L.), tree shades, hilly area..

Introduction

'Bilati Dhonia' *(Eryngium foetidum* L.) is a horticultural crop belonging to the group of spices and condiments. It belongs to the family Apiaceae and originated mainly in tropical America, West Indies, Vietnam, Asam and Bangladesh (Nienga, 1995; Rashid, 1999; Rubatzky *et al.,* 1999). It is also known as 'Bhandhonia' (Sankat and Maharaj, 1996) in West Indies and 'Culantro' (Rubatzky *et al.,* 1999) in Spain. In some English literature, it has been referred to as spiny coriander. The plant is very popular in central America, northern part of South America and the West Indies as well as South-East Asia, where it is mainly used as a condiment for flavouring rice dishes (Leclercq *et al.,* 1992 ; Rubatzky *et al.,* 1999; Lugo-M-de and Santiago, 1996).The crop is mainly cultivated as a condiment in Bangladesh. Its tender leaves and stems are used for consumption.

It is a shade tolerant crop. When *grown* under direct sun light, the plants *become* dwarf, the leaves lose their softness, attractive green colour and aroma, and the spines on either side of the leaf become hard (Moniruzzaman *et al.,* 2007). Ultimately the plants grown in full sun light are unfit for human consumption. On the other hand, under shaded habitat, 'Bilati Dhonia' plant

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produces dense green, soft and succulent leaves, which are the indicators of high quality leaves (Moniruzzaman, 2004). Until recently, the cultivation of 'Bilati Dhonia' was concentrated in the hilly areas of Bangladesh, but it is gradually gaining popularity among the farmers of plains. 'Bilati Dhonia' is usually cultivated under shades created by split bamboo with coconut leaves, dhaincha stalk and sun grass (Moniruzzaman *et al.,* 2006). It has been reported that this crop grows well in those places where 50-75% PAR (photosynthetically active radiation) is available (Moniruzzaman *et al.,* 2007). Generally 25-75% PAR (25-75% shade) are is available under the canopy of tree orchards. There is 50-75% PAR available under the canopy of trees containing small leaves like drumstick, whereas, 25- 60% PAR available under the canopy of the trees which have a little more broad leaves, such as mango, jackfruit, guava, jujube etc. (Ali, 1999). The land under different orchard trees is often remaining underutilized. These places are suitable for growing 'Bilati Dhonia'. Research information regarding the potentiality of growing 'Bilati Dhonia' under tree canopy is almost nil in Bangladesh. Therefore, the present study was undertaken to determine the feasibility of growing 'Bilati Dhonia' crop under the shades of tree fruit species.

Materials and Method

The experiment was conducted at the Agricultural Research Station, Raikhali, Rangamati Hill District during two consecutive years 2004-05 and 2005-06. The treatments consisted of shades of Guava trees (T_1), Jackfruit trees (T_2), Mango trees (T_3), Jujube trees (T_4) and farmers' practice (T_5) and direct sun light (T_6). Different fruit orchards were located in different places of the same research station. The two treatments, direct sun light and farmers' practice *were* placed in hill *valley* close to each other. In the treatment of farmers' practice, the shade was provided over the crop by trellises made with coconut leaf and bamboo slices. The experiment was laid out in RCB with 5 replications. The unit plot consisted of two beds, each measuring 2 m × I m with 30 cm distance between two beds. The crop was fertilized with 150 kg nitrogen (in the form of Urea), 72 kg P_2O_5 (in the form of TSP), 100 kg K_2O (in the form of MP) and 10-ton cowdung per hectare. Seeds were sown on 12 December 2004. Soon after sowing, seed beds were covered by rice straw. Full amount of cowdung, TSP, and half the quantity of MP were applied during final land preparation. The remaining Urea was applied in 6 equal installments. First top dressing of urea was done when the plants attained 2-3 cm in height and next 5 top dressings, after 1st, 2nd, 3rd 4th and 5th harvests of the crop. In each harvest, the taller plants were harvested by uprooting. Necessary cultural operations were done as and when required. 'Bilati Dhonia' was harvested from all the plots at an interval of 25 days. Samples (10 plants from each plot) were collected at 115, 150, 175, 200, 225 and 250 days after sowing (DAS), respectively, for measuring plant height, number of leaves

per plant, leaf size (length x width), fresh weight per plant. Then the average of each parameter from 6 harvests was calculated. Plant population was measured from cumulative number of 6 harvests from $1m^2$ area. Data for 1st and 50% flowering were also recorded. For every harvest, plot yield was calculated and then converted to per hectare yield. The cumulative yield of 6 harvests was regarded as total yield of 'Bilati Dhonia'. Data were analyzed statistically and the treatment means were separated by LSD test at 5% level of probability.

Results and Discussion

'Bilati Dhonia' plant height, leaves per plant, leaf length and fresh weight differed significantly due to different treatments, but plant population per square meter, days to 1st flowering and days to 50% flowering were insignificant (Table 1). Plants grown under the canopy of different fruit tree shades and farmers' practice were significantly taller than those grown under direct sun light (Table 1). In 2004-05, significantly taller plants were observed in jackfrult shade (15.09 cm) closely followed by farmers' practice treatment, whereas in 2005-06, the tallest plants were found in farmers' practice treatment closely followed by jackfruit shade. There was no significant differences among guava, mango, and jujube trees treatments in both the years and the mean data. In the mean data of 2004-05 and 2005-069, plant height was the same in jackfruit shade and farmers' pratice. Wadud and Miah (2000) reported that the tallest plant of kangkong was produced under reduced light levels compared to full sun light. Reduced light levels encouraged higher apical dominance resulting in taller plants under shade condition (Hillman, 1984).

Different shade treatments had significant influence on the number of leaves per plant of 'Bilati Dhonia' in the 1st and 2nd year as well as in the mean data (Table 1). Maximum number of leaves (8.59) was recorded from guava shade closely followed by farmers' practice (8.54) and jackfruit shade (8.50), and the lowest number of leaves (5.88) from full sun light in 2004-05. In 2005-06, farmers' practice gave the highest number of leaves per plant (8.63) and that was at par with those of guava and jujube shade. In the mean data of 2004-05 and 2005-06, there were no significant differences among farmers' practice, guava and jackfruit shades. The maximum leaf length was obtained from farmers' practice (13.88 cm in 2004-05 and 13.75 cm in 2005-06 wIth an average of 13.81 cm). However, in the 2nd year's and mean data, no significant difference was observed among guava shade, jackfruit shade, and farmers' practice in terms of leaf length followed by other shade systems. The lowest leaf length was noticed from direct sun light. This might be attributed to the stimulation of cellular expansion and cell division under shaded conditions produced trees and farmers' practice (Anon., 1999 and Schoch, 1972).

Table 1. Number of plant population and growth characters of 'Bilati Dhonia' as influenced by the shades of different trees.

Treatment	Plant population (m^2)			Plant height (cm)			Leaves/ plant (no.)			Leaf length (cm)			Fresh wt/ plant (g)			Days to 1st flowering			Days to 50% flowering		
	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean
Guava trees	596	550	576	13.06b	13.61b	13.60b	8.58a	8.59a	8.58a	13.56b	13.66a	13.61a	4.58a	4.60a	4.59a	89	89	89	96	96	96
Jackfruit trees	598	590	593	15.09a	15.07a	15.08a	8.50a	8.61a	8.55a	13.58b	13.65a	13.62a	4.65a	4.88a	4.66a	88	88	88	96	94	95
Mango trees	595	585	590	13.45b	1343b	13.44b	7.52c	7.60b	7.56b	12.77d	12.75b	12.76c	4.37b	4.20c	4.28b	88	89	89	96	96	96
Jujude trees	599	592	596	13.42b	13.45b	13.43b	7.02d	7.00c	7.0lc	13.20c	13.27b	13.23b	4.40b	4.38b	4.3gb	88	89	88	95	95	95
Farmers' practice	597	594	596	15.07a	15.l0a	15.08a	8.54a	8.63a	8.58a	13.88a	13.75a	13.81a	4.66a	4.70a	4.68a	89	89	89	96	96	96
Direct sun light	599	550	550	10.53c	10.45	10.49c	5.88c	5.00d	5.29d	9.66c	9.50c	9.58e	2.49c	2.40d	2.44c	81	81	81	88	90	89
LSD (0.05)	NS	NS	NS	0.23	0.21	0.20	0.08	0.07	0.06	0.29	0.31	0.27	0.14	0.11	0.13	3.1	3.3	4.1	4.0	5.6	5.2
CV (%)	4.46	5.13	5.03	10.01	10.32	10.06	9.21	5.53	6.51	8.21	5.03	6.30	5.36	5.46	8.56	8.7	9.03	9.58	5.8	5.3	6.13

NS = non-significant

In 2004-05, significantly higher fresh weight (4.66 g/plant) was recorded from farmers' practice closely followed by jackfruit and guava shades. Similar trend was also noticed in fresh weight per plant in 2005-06 and also in the mean data. There were no significant differences between mango and jujube shades in 2004-05 and mean data in respect of fresh weight per plant, but a significant difference arose between mango and jujube trees in 2005-06. The lowest fresh weight per plant was recorded from direct sun light in both the years as well as in the mean data.

Days to 1st and 50% flowering differed significantly in different treatments (Table 1). The plants grown under direct sun light reached 1st and 50% flowering stage earlier than in other treatments. Plants under different tree shades and farmers' practice took the maximum number of days to reach 1st and 50% flowering stage compared to those under direct sun light in both the years and also in the mean data. However, there was no significant difference among different tree shade treatments and farmers' practice treatment in both the years as well as in the mean data in respect of 1st and 50% flowering. These results indicated that shading delayed flowering in 'Bilati Dhonia' plants. The results are in agreement with the observation of Haque (2001). He observed that the minimum time was required for the first flowering under full sun light, whereas the maximum time was taken by 75% shaded condition (25% PAR) in yard long bean. Under the shaded condition, leaf senescence is delayed (Sheidrake and Saxena, 1979) which might delay the reproductive phase of plants.

There was significant variation in fresh yield of 'Bilati Dhonia' grown under different tree shades and farmers' practice treatments over direct sun light during both the years and in the mean data (Table 2). The direct sun light gave poor fresh yield in all harvests and in total also. In the 1st harvest of 2004-05, higher fresh yield was recorded under jackfruit shade closely followed by farmers' practice and guava shade, but in the 2nd year, guava shade gave the highest fresh yield which was at par with jackfrult, jujube shades and farmers' practice. In mean data of the two years (2004-05 and 2005-06), guava shade produced the highest fresh yield of 'Bilati Dhonia'. In the 2nd harvest of year, higher fresh yield was obtained from jackfruit shade closely followed by guava shade and farmers' practice, but in the 2nd year, maximum fresh yield was observed in farmers' practice closely followed by guava shades, but significantly higher than mango shade and jujube shade, those bearing no significant difference between two. However, in the mean data, farmers' practice, jackfruit and guava shades had no difference. In the 3rd harvest of the first year, jackfruit shade gave the highest fresh yield of 4.46 t/ha, which was at par with guava shade and farmers' practice. The mango and jujube shades gave identical fresh yields, which were significantly higher than direct sunlight, but in the 2nd year, the highest similar fresh yields were obtained from jackfruit shade and farmers' practice. The same

2. Fresh yield of 'Bilati Dhonia' as influenced by the shades of different trees.

Treatment	Fresh yield (t/ha)																				
	1st harvest			2nd harvest			3rd harvest			4th harvest			5th harvest			6th harvest			total		
	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean	2004-05	2005-06	Mean
Guava trees	2.47a	2.87a	2.67a	3.03a	3.00a	3.02a	4.41a	3.28	3.84	4.68	4.76a	4.72a	5.78	5.58a	5.68a	7.35a	7.41a	7.38a	27.52ab	27.l0a	27.31a
Jackfruit trees	2.51a	2.71a	2.61b	3.07a	2.98ab	3.03a	4.46a	4.07	4.27	4.74	4.62a	4.68a	5.86	5.42b	5.64a	7.25a	7.32a	7.28a	27.89a	27.12a	27.51a
Mango trees	2.33b	2.46b	2.40d	2.85b	2.71c	2.78b	4.14b	3.64	3.89	4.39	4.19b	4.29c	5.43	4.92d	5.17c	6.72c	6.64b	6.68c	25.86c	24.56b	25.21b
Jujude trees	2.33b	2.74a	2.54c	2.88b	2.86b	2.87b	4.21b	3.13	3.67	4.46	4.52th	4.49c	5.51	5.29c	5.40b	7.02b	6.96b	6.99b	26.4lbc	25.51b	25.96b
Farmers' Practice	2.48a	2.76a	2.62ab	3.03a	3.03a	3.03a	4.40a	4.15	4.27	4.68	4.71a	4.70a	5.79	5.52a	5.65a	7.16ab	7.45a	7.31a	27.54a	27.62a	27.58a
Direct sun light	1.29c	1.41c	1.35d	1.58c	1.51d	1.56c	2.29c	2.07	2.28	2.44	2.33c	2.38c	3.03	2.13e	2.58d	3.72d	3.64c	3.68d	14.35d	13.12c	13.73c
LSD (0.05)	0.11	0.23	0.05	0.13	0.14	0.12	0.17	NS	NS	NS	0.31	0.17	NS	0.11	0.21	0.29	0.33	0.26	1.12	1.45	1.34
CV (%)	7.32	7.85	8.51	9.01	10.0	10.2	7.58	8.98	10.5	10.2	5.91	3.54	9.86	7.65	8.7	9.54	9.68	9.9	10.7	11.2	10.5

NS = non-significant

trend of fresh yield was also noticed in the mean data. In the 4th harvest except the 1st year's result, the guava shade produced the maximum fresh yield (4.76 and 4.72 t/ha in 2005-06 and mean data, respectively, that was statistically similar to those of farmers' practice and jackfruit shade. In 5th harvest of 2004-05, maximum fresh yield was obtained from jackfruit shade closely followed by guava shade and farmers' practice. The guava shades and farmers' practice gave similar results in terms of fresh yield in the second year's 5th harvest of 'Bilati Dhonia', whereas in mean data, the maximum fresh yield was recorded in guava shade closely followed by farmers' practice and jackfruit shade. In 6th harvest, the highest fresh yield was obtained from guava shades (7.35 and 7.41 t/ha in 2004-05, and 2005-06, respectively, with a mean of 7.38 t/ha) closely followed by jackfruit shade and farmers' practice in 2004-05 but in 2005-06, farmers' practice gave the highest fresh yield of 7.45 t/ha, which was at par with jackfruit and guava shade. In the mean data of 2004-05 and 2005-06, guava shade, jackfruit shade, and farmers' practice gave similar fresh yield and the lowest fresh yield was recorded under direct sun light. The cumulative fresh yields of all six harvests revealed that significantly higher fresh yield (27.89 t/ha in 2004-05) was obtained from jackfruit shades and 27.62 t/ha from farmers' practice in 2005-06. In both the years, there were no significant differences among guava, jackfruit shades and farmers' practice with regard to total fresh yield of 'Bilati Dhonia'. In the mean data of 2004-05 and 2005-06, farmers' practice gave the total maximum fresh yield (27.58 t/ha) that was at par with jackfruit shade (27.51 t/ha) and guava shade (27.31 t/ha). There was no significant difference between mango shade and guava shade in respect of total fresh yield. The lowest yield (14.35 t/ha in 2004-05, 13.12 t/ha in 2005-06 and 13.73 t/ha in mean data) was obtained from direct sun light. It was observed that the performances of 'Bilati Dhonia' grown under the canopies of various fruit trees and farmers' practice performed better than the crop grown under direct sun light in all parameters including fresh yield.

It could be concluded that 'Bilati Dhonia' crop could be successfully cultivated under the canopy of different fruit trees jackfruit and guava shades are more suitable for its production.

References

Ali, M. A. 1999. Performances of red amaranth and Lady's finger grown at different orientations and distances under Guava and Drumstick trees. MS. Thesis, BSMRAU, Ciazipur, Bangladesh.

Anonymous. 1999. Asian Regional Center (ARC), Training Report, 1998. The 16 th Regional Training Course on Vegetable production and Research, ARC-AVRDC, Thailand. p.170.

Haque, M. M. 2001. Effect of different light levels on the morphology, physiology, and yield of four selected vine crops. M. S. Thesis, Department of Crop Botany, BSMRAU (Bangabandhu Sheikh Mujibur Rahman Agricultural University), Gazipur, Bangladesh.

Hillman, J. R. 1984. Apical dominance, In: Wilking, M. B. (ed.) Advanced Plant Physiology. Pitman, London. pp. 127-178.

Leclerq, P.A., N.X. Dung and N. Y. Tonah. 1992. Composition of essential oil of *Eryngium foetidum* L. Department of chemical Engineering, Windhaven Univ. of Technol. *Netherlands J. Essential Oil Res.* **4** (4): 423-424.

Lugo, M-de. L. and L. R. Santiago. 1996. Herbicide screening in cilantro and spiny coriander. *J. Agric. Univ. of Puetro Rico.* **80** (1-2): 73-75.

Moniruzzaman, M. 2004. Effect of light intensity and nitrogen on the yield and quality *of* Bangladhonia *(Eryngium foetidum* L.). M.S. Thesis, Dept. of Hort., Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh. 107 p.

Moniruzzaman, M., S. Islam, M. M. Hossain, T. Hossain and M. G. Miah. 2007. Growth and yield response of Bilati Dhonia to light intensity and nitrogen levels. *Bangladesh J. Agril. Res.* **32**(1): 151-162.

Moniruzzaman, M., S. N. Alam, S. N. Mozumder and M. R. Islam. 2006. Performances of Bilatidhonia under different shade systems. *Bangladesh J. Agril. Res.* **31**(3): 401-409.

Nienga, J. 1995. Production of Eryngium. North-*Carolina Flower Growers Bulletin*. **40**(4): 9-11.

Rashid, M. M. 1999. Shabjibiggyan (In Bengali). Rashid Publishing House, 94, Old DOHS, Dhaka-1206. p.504-505.

Rubatzky, V. E., C. F. Quiros And P. W. Simon. 1999. Carrots and Vegetable Umbelliferae. Crop Production Science in Horticulture, Series 10. CAB1 Pub, Wallingford,, UK. pp.294.

Sankat, C. K. and V. Maharaj. 1996. Shelf life of the green herb 'Shadobini *(Eryngium foetidum* L.) stored under refrigerated conditions. Post harvest Bio. Tech., The University of the West Indies **79**(1-2): 109-118.

Schoch, P. G. 1972. Effects of shading on structural characteristics of the leaf and fruit yield in *Capsicum annum* L. *J. Amer. Soc. Hort. Sci.* **97**(4): 461-464.

Sheidrake, A. R. and N. P. Saxena. 1979. The growth and development of chickpea under progressive stress. In; stress physiology in crop plants H. Mussel and R. C. Staples (eds.). pp. 465-485. John willey and Sons, Chickester.

Wadud, M. A. and M. G. Miah. 2000. Studies on the perfonnance of kangkong *(Ipommea reptans)* under artificially light conditions to assess its suitability for agroforestry systems. *Bangladesh J. Agril. Sci.* **27**(2); 329-333.