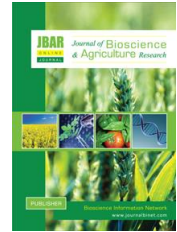


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Initial growth performance of ten woody medicinal tree species in eastern coastal belt of Bangladesh

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ABSTRACT

Two trials were conducted to assess the site-suitability and growth performance of ten woody medicinal tree species planted in the year of 2014 and 2015 at two different sites namely Bogachater of Sitakundu upazilla and Bamansunder of Mirershorai upazilla under Chittagong district (eastern coastal belt). Data on survival, height, collar diameter, dbh, stem length and number of branch were recorded from 02 years and 01 year old two trial plantations. In Bogachater site, the result revealed that the highest survival was recorded for *Terminalia catappa* (89%) followed by *Terminalia arjuna* (78%), *Azadirachta indica* (70%), *Terminalia belerica* (66%) and *Anthocephalus chinensis* (64%). The highest height was recorded for *Acacia catechu* (3.06m) followed by *A. chinensis* (2.63m), *Bombax ceiba* (1.93m), *T. arjuna* (1.89 m) and *T. catappa* (1.82m). The highest collar diameter was found in *A. chinensis* (5.93cm) followed by *A. catechu* (4.97cm), *T. arjuna* (4.27cm), *B. ceiba* (4.23cm) and *T. catappa* (3.12cm) at the age of two years. In the Bamansunder site, the highest survival was recorded for *T. arjuna* (88%) followed by *B. ceiba* (78%), *T. catappa* (74%), *T. belerica* (68%) and *A. chinensis* (60%). The highest height was recorded for *B. ceiba* (0.99m) followed by *A. catechu* (0.94m) *T. arjuna* (0.93m) and *A. chinensis* (0.92m). Considering the survival, height and diameter growth, *T. arjuna*, *A. chinensis*, *B. ceiba*, *T. catappa* and *A. catechu* were found promising and may be suitable for planting in the raised lands of the eastern coastal belt of Bangladesh.

Key Words: Medicinal tree, Plantation, Survival, Growth performance and Coastal belt

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I. Introduction

Medicinal plants are the vital components of forest products and play a significant role in the health care of rural people all over the world. They serve as important therapeutic agents as well as important raw materials for the manufacture of traditional and modern medicines (Ghani, 2003). Medicinal plants are the important wealth in Bangladesh. The rural population of the country has traditionally depended on folk medicinal healers for treatment of their ailments (Hossan et al., 2010). There has been dramatic increase in the demand for medicinal plants for use in traditional medicine in

both developing and developed countries (Lee et al., 2008). The World Health Organization (WHO) enlisted some of 21,000 medicinal plant species all over the world (Penso, 1980). Ghani (2000) reported about 500 plant species including trees, herbs and shrubs in Bangladesh as medicinal plant because of their therapeutic properties. Yusuf et al. (2009) reported 747 plant species in Bangladesh have therapeutic properties.

Bangladesh is a country of fertile deltaic land has a rich diversity of flora of medicinal plants scattered throughout the forests, crop fields, roadsides, home gardens and wastelands (Motaleb et al., 2011). Many native medicinal plants species, once found abundantly in Bangladesh have become scarce and threatened largely due to population, over extraction, habitat degradation and loss and failure of natural regeneration. Due to shifting (Jhum) cultivation, encroachment, population pressure, settlement and urbanization, wrong management practices, over exploitation of forest resources, deforestation, salinity and change in land use patterns, many medicinal plants have reached the fate of extinction or severe genetic loss (Ghani, 2003; Motaleb et al., 2011). In addition, the country will face serious consequences of biodiversity loss from the global climatic change. Medicinal plants are not only using in medicine but also in cosmetics, detergents, dyes, insecticides, foods, paints etc. There are some medicinal plants having wood values those provide a variety of forest produces, as well as a range of ecosystem services (Piotto et al., 2004; Motaleb et al., 2011). The plantations of woody medicinal species may also act as a greenbelt component in the coastal belt.

The coastal belt of Bangladesh extends over 710 kilometer long along the Bay of Bengal with numerous chars and islands. The Bangladesh Forest Department has raised 1,92,395 ha mangrove, 8690 ha non-mangrove and 12,127 km strip plantations in the coastal area till 2013 (Hasan, 2013). Among the mangrove plantations, *Sonneratia apetala* (keora) and *Avicennia officinalis* (baen) are the major planting species in the newly accreted lands (Siddiqi, 2001). Among the non-mangrove and strip plantations, *Samanea saman* (rain tree), *Acacia nilotica* (babla), *Casuarina equisetifolia* (jhao), *Swietenia macrophylla* (mehogoni) and *Acacia auriculiformis* (akashmoni) are the major planting species in the raised lands of the coastal areas. Plantation or study has not yet been carried out for introducing woody medicinal tree species in the coastal areas. Therefore, elimination trials with 10 medicinal tree species were carried out to find out suitable species for the raised coastal lands.

II. Materials and Methods

Plantation Trial Unit Division of Bangladesh Forest Research Institute (BFRI) carried out experiments on some woody medicinal tree species at two sites of the eastern costal belt of Bangladesh. Eexperimental plots were established at Bogachater of Sitakundu upazilla in June, 2014 and Bamansunder of Mirershorai upazilla in June, 2015 under Chittagong district. Chittagong lies between latitude 22°20' N and longitude 91°51' E. The amount of annual rainfall ranges 2500-3000mm and mean annual temperature is 26.24°C. Soil salinity in the monsoon and dry season was remarkable varying between 4.7-26.5 dS/m (SRDI, 2010). Soil of the site is non-calcareous alluvium.

Ten important woody medicinal tree species namely, *Azadirachta indica* (neem), *Melia azedarach* (gora neem), *Terminalia arjuna* (arjun), *Terminalia belerica* (bohera), *Bombax ceiba* (shimul), *Acacia catechu* (khoer), *Terminalia catappa* (katbadam), *Anthocephalus chinensis* (kadam), *Cassia fistula* (sonalu) and *Aphanamixis polystachya* (pitraj) were included in the trials. The seeds were collected from phenotypically superior trees. Seeds were sown in polybags of size 25cm x 15cm those were filled with powdered loamy soil and cowdung at 5:1 ratio. Seedlings were raised in the Bogachater nursery and kept for 6-10 months. The experiment was laid out in Randomized Complete Block Design with three replications. In each plot, (9 x 9) 81 seedlings were planted at 1.5m x 1.5m spacing. Six to ten months old seedlings were planted in the field. Planting was done in June by digging holes. The data in relation to survival, height, collar diameter, diameter at breast height (dbh), stem length (length to the first branch) and number of branch were collected in June 2016 from two experimental plantations (Figure 01 and Figure 02). Data were computed and analyzed using Excel spreadsheet and Minitab statistical package.



Figure 01. Two years old *Terminalia catappa* (Katbadam) trial plantation in the eastern coastal belt of Bangladesh.



Figure 02. One year old *Terminalia arjuna* (arjun) trial plantation in the eastern coastal belt of Bangladesh.

Table 01. List of woody medicinal plant species and their medicinal uses tried in the eastern coastal belt of Bangladesh

Sl. no.	Vernacular name	Scientific name	Family	Medicinal value	Plant part used
1	Neem	<i>Azadirachta indica</i>	Meliaceae	Used in skin disease, arthritis, fatigue, fever, boils, worm killer, tooth diseases, antiviral and insecticide. It is anthelmintic, antilithic and diuretic. It is used in relieving nervous headaches and skin diseases. Seeds oil is used in leprosy and scrofula.	Leaf, bark, flower
2	Gora neem	<i>Melia azedarach</i>	Meliaceae	Used in hypertension, heart disease, blood pressure, cholesterol, dysentery, piles, leucorrhoea etc.	Leaf, bark, fruit
3	Arjun	<i>Terminalia arjuna</i>	Combretaceae	Anal fissure, dysentery, hyper acidity, constipation, hypertension, jaundice, rheumatism and loss of appetite.	Fruit and Seed
4	Bohera	<i>Terminalia belerica</i>	Combretaceae	Used in skin diseases, headache, abdominal pain, indigestion, spleen fever and loss of appetite.	Bark, leaf, seed
5	Katbadam	<i>Terminalia catappa</i>	Combretaceae	Fever, smallpox, rheumatism, leprosy. bleeding gums, enlarged spleen, leucorrhoea, diarrhea, dysentery, boils, acne, pimples, cough. Roots have stimulant, tonic and aphrodisiac properties and are given in impotency.	Bark, young root.
6	Shimul	<i>Bombax ceiba</i>	Bombacaceae	Bark is anti-dysentric, anthelmintic and antipyretic. The dried extract is used in leucoderma, leprosy, eczema, itching, hemorrhages, ulcer, boils, inflammations, bronchitis, asthma, colic pain, piles, leucorrhoea and diarrhea.	Bark, wood extract
7	Koher	<i>Acacia catechu</i>	Mimosaceae	Bark is used as astringent, febrifuge and tonic, in the treatment of snakebite.	Leaf, bark
8	Kadam	<i>Anthocephalus chinensis</i>	Rubiaceae	Used in chest and heart diseases, ringworm fungal infection, rheumatism, snakebite, jaundice, diabetes and skin diseases.	Leaf, flower, fruit, root.
9	Sonalu	<i>Cassia fistula</i>	Caesalpiniaceae	Bark is used in spleen and liver diseases, tumours and abdominal complaints. Seed oil is used in rheumatism and dressing for wounds.	Stem, bark, seed
10	Pitraz	<i>Aphanamixis polystachya</i>	Meliaceae		

Sources: Ghani, 2003; Motaleb et al., 2011; Hossain, 2015.

III. Results and Discussion

The initial growth performance of 10 medicinal tree species planted in June, 2014 (02 years old) and June, 2015 (01 year old) in the eastern coastal belt of Bangladesh are shown in Table 02 and Table 03. In Bogachater site, the result showed that the significantly highest survival was recorded for *T. catappa* (89%) followed by *T. arjuna* (78%), *A. indica* (70%), *T. belerica* (66%) and *A. chinensis* (64%). The significantly highest height was recorded for *Acacia catechu* (3.06m) followed by *A. chinensis* (2.63m), *B. ceiba* (1.93m), *T. arjuna* (1.89 m) and *T. catappa* (1.82m). The lowest survival (37%) and height (1.07m) was found in *A. polystachya*. The significantly greater collar diameter was found in *A. chinensis* (5.93cm) followed by *A. catechu* (4.97cm), *T. arjuna* (4.27cm), *B. ceiba* (4.23cm) and *T. catappa* (3.12cm). The greater diameter at breast height (DBH) was also recorded for *A. chinensis* (3.72cm) followed by *A. catechu* (3.67cm), *T. arjuna* (2.17cm) and *B. ceiba* (2.16cm). The greater number of branches was found in *A. catechu* (17) followed by *A. chinensis* (12), *T. arjuna* (9) and the lowest was found in *C. fistula* (3).

Table 02. Growth performance of ten medicinal tree species planted in June, 2014 (02 years old) at Bogachater of Sitakundu upazilla, Chittagong (eastern coastal belt)

Vernacular name	Scientific name	Survival %	Height (m)	Collar dia. (cm)	DBH (cm)	Stem length (m)	No. of branch
Neem	<i>Azadirachta indica</i>	70b	1.67b	2.53b	1.62	1.33b	5a
Gora neem	<i>Melia azedarach</i>	42a	1.67b	2.19b	1.98	1.45b	4a
Arjun	<i>Terminalia arjuna</i>	78bc	1.89b	4.27c	2.17	0.93a	9ab
Bohera	<i>Terminalia belerica</i>	66b	1.12a	2.25b	-	0.95a	3a
Katbadam	<i>Terminalia catappa</i>	89c	1.82b	3.12b	2.02	1.50b	6a
Shimul	<i>Bombax ceiba</i>	54ab	1.93b	4.23c	2.16	1.44b	5a
Khoer	<i>Acacia catechu</i>	45a	3.06d	4.97c	3.67	1.49b	17c
Kadam	<i>Anthocephalus chinensis</i>	64b	2.63c	5.93d	3.72	2.21c	12b
Sonalu	<i>Cassia fistula</i>	49a	1.21a	1.76a	-	0.72a	3a
Pitraz	<i>Aphanamixis polystachya</i>	37a	1.07a	2.44b	-	0.75a	6a

Means followed by the same letter(s) in the same column do not differ significantly at 5% level

In the plantation raised in 2015 at Bamansunder site, significantly the highest survival was recorded for *T. arjuna* (88%) followed by *B. ceiba* (78%), *T. catappa* (74%), *T. belerica* (68%) and *A. chinensis* (60%). The significantly greater height was recorded for *B. ceiba* (0.99m) followed by *A. catechu* (0.94m) *T. arjuna* (0.93m) and *A. chinensis* (0.92m). The significantly greater collar diameter was found in *A. chinensis* (2.08cm) followed by *B. ceiba* (1.73cm), *T. arjuna* (1.45cm), and *T. catappa* (1.00cm).

Table 03. Growth performance of ten medicinal tree species planted in June, 2015 (01 year old) at Bamansunder of Mirershorai upazilla, Chittagong (eastern coastal belt)

Vernacular name	Scientific name	Survival %	Height (m)	Collar dia. (cm)	Stem length (m)	No. of branch
Neem	<i>Azadirachta indica</i>	36b	0.63b	0.69a	0.50a	1
Gora neem	<i>Melia azedarach</i>	17a	0.88cd	0.95ab	0.70b	1
Arjun	<i>Terminalia arjuna</i>	88d	0.93d	1.45b	0.65b	4
Bohera	<i>Terminalia belerica</i>	68c	0.52a	0.89a	0.44a	2
Katbadam	<i>Terminalia catappa</i>	74c	0.70bc	1.00ab	0.64b	2
Shimul	<i>Bombax ceiba</i>	78cd	0.99d	1.73b	0.93d	2
Khoer	<i>Acacia catechu</i>	43b	0.94d	0.67a	0.56ab	4
Kadam	<i>Anthocephalus chinensis</i>	60c	0.92d	2.08c	0.85c	3
Sonalu	<i>Cassia fistula</i>	51bc	0.64b	0.85a	0.44a	2
Pitraz	<i>Aphanamixis polystachya</i>	40b	0.78c	1.07ab	0.68	1

Means followed by the same letter(s) in the same column do not differ significantly at 5% level

Nandy et al. (2002) made a survey for the assessment of growth performance of different tree species planted on the coastal embankment. They reported that *T. arjuna* showed 4.0m in height and 8.28cm in diameter; *C. fistula* showed 3.50m in height and 1.59cm in diameter at Dauka embankment under

Bhola district of the western coastal belt at the age of three years. They also reported that *M. azedarach* showed 4.08m in height and 4.36cm in diameter; *A. catechu* showed 1.64m in height at Char Manika embankment of the western coastal belt at the age of two years. Parkash and Hocking (1986) reported 2-3m height growth of *T. arjuna* at the age of three years under favourable conditions. Stump-planted *B. ceiba* reached 12.95m height and 25.2cm dbh at the age of 7 years in Pakistan (Sheikh, 1993).

On the basis of survival and initial growth performance, the species like *T. arjuna*, *A. chinensis*, *B. ceiba*, *A. catechu*, *T. catappa* and *A. indica* were found promising at Bogachater site two years after planting. But *C. fistula* and *A. polystachya* showed poor survival and growth performance in comparison to other planting species. In Bamansunder site, *T. arjuna*, *A. chinensis*, *B. ceiba* and *T. catappa* were found promising survival and growth performance one year after planting. In both study sites, *T. arjuna*, *A. chinensis*, *B. ceiba* and *T. catappa* appeared more promising among 10 planting medicinal tree species. Among the two trials, greater height and diameter growth were found for all species in 2 years old plantation in comparison to one year old plantation.

IV. Conclusion

Medicinal plants are the important natural wealth of a country. They play a significant role in providing primary health care services to the rural people of the country. Due to over-exploitation and intensive use of these resources, the natural population is reducing drastically. Many medicinal plant species of Bangladesh are threatened and faced to risk of extinction. Bangladesh government is trying to promote cultivation of medicinal plants. But still cultivation of medicinal plants is in a very rudimentary stage. For improving the cultivation of medicinal plants, trials were initiated in the coastal areas to select the suitable species of woody medicinal plants. Some of the species from two years old trial plantation e. g. *T. arjuna*, *A. chinensis*, *B. ceiba*, *A. catechu*, *T. catappa* and *A. indica* showed promising growth performance. From one year old plantation, *T. arjuna*, *A. chinensis*, *B. ceiba* and *T. catappa* were found promising. These species can be planted in the coastal raised lands for the development of medicinal plants population in the eastern coastal belt of Bangladesh. This is however, an interim report and the comprehensive one will be available after few years.

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