INLAND CULTIVATION OF *CASUARINA EQUISETIFOLIA* L. (JHAW) IN SOUTH WEST BENGAL

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Introduction

Casuarina equisetifolia L. (locally called 'Jhaw') is a native to Australia. Its common names are 'Australian pine', 'Beef wood' and 'Horsetail-tree'. A salt-resistant tree, *Casuarina* is very hardy on limestone, seashore areas, lateritic, black and volcanic soils (Whistler, 1992). Where invasive, it forms monotypic stands under which little else grows due to the smothering effect of the fallen leaves. *Casuarina* is relatively fire-resistant and tolerant of dry sites. It can withstand inundation for a short period only. *Casuarina* species are intolerant of shade but capable of rapidly invading new sites and forming pure stands. When young, saplings are easily suppressed by various forms of competing vegetation, especially grasses and sedge. As a result, the seedlings are not nodulated and cannot fix atmospheric nitrogen. However, once *Casuarina* trees dominate a site, their heavy root mat and the deep litter layer tend to reduce, even eliminate, competitors (Wagner *et al.,* 1999).

In the coastal belt of West Bengal, in Purba Medinipur District, *Casuarina* was introduced in the mid-1940s. In 1996 Silviculture (South) Division, Forest Department of West Bengal initiated inland trial of *Casuarina* in South-West Bengal to assess its performance.

Material and Methods

Experimental area and data collection : The experimental area was located at mouza Dengakend in Bankura District within the jurisdiction of Bankura (S) Division of Central Circle of WB Forest Directorate. The area was about 23 km from the district headquarter Bankura on the Bankura-Jhilimili Road in a diversion of half km towards the East side from the said road. The study area, at an altitude of 232 m, and with mean annual rainfall of 950 mm has little or no rain during the seven months of November to May each year. Temperatures in a year vary over a wide range. While the minimum temperature (5^{o}C) occurs between December and January, the maximum (47^{0}C) is recorded in March- May. The soil is lateritic with pH value varying between 7.1 and 8.0. The available NPK was very low.

The plantation was established in July 1996. The seed source of this plantation was Maitybund Seed Stand of the same species. Before planting, seed bulking was done. The plantation was raised at 1m x 1m spacing. A population of size of 815 plants was taken up for study. As mentioned earlier, this plantation was raised with an idea to assess the efficacy of the species in inland trial. Therefore it was necessary to record the growth data.

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Considering that this crop would also be worked on the same rotation of 10-12 years as *Eucalyptus*/*A. auriculiformis*, measurement was taken in November 2002, when the crop reached an age of half the rotation. The data collection was done with the help of 2.5% systematic sampling. The sampling size was 21.

After measuring height and BHG of the standing trees, each of these 21 trees was felled and converted into logs. Starting from the butt end, logs were sectioned approximately 3.0 m of length up to a stem diameter of 5.0 cm. Then length and diameters at two ends of each section were measured. The volume was calculated as per Smalian method. Starting from the base, wood up to 8.0 cm stem dia was taken for pulpwood/pole and that less than 8.0 cm up to 5.0 cm dia was taken for producing fuelwood. Wood less than 5.0-cm dia was not considered for fuelwood production.

Formula for derivation of Volume by Smalian method is as under :

$V = 1/2 (B + b) \times L$,
where :
V = Volume of the tree
B = Cross sectional area at larger end of the log
b = Cross sectional area at smaller end of the log
L = Length of the log.

Results and Discussion

Measurements obtained are detailed in Table 1.

Table 1

Measurements obtained

Sl. No.	Tree No.	Height (m)	BHG (cm)	Volume as per Smalian method (m^3)
1	4	12.30	34	0.088868
2	44	13.30	35	0.101828
3	84	12.30	25	0.048047
4	124	11.30	31	0.067871
5	164	12.30	46	0.162668
6	204	10.8	20	0.027000
7	244	1.35	9	0.000683
8	284	9.30	17	0.016798
9	324	13.30	27	0.060598
10	364	9.30	19	0.020983
11	404	9.65	17	0.017430
12	444	4.50	22	0.013613
13	484	8.65	18	0.017516
14	524	9.65	26	0.040771
15	564	12.80	35	0.098000
16	604	13.30	30	0.074813
17	644	8.50	20	0.021250
18	684	7.00	16	0.011200
19	724	5.50	10	0.003438
20	764	5.00	13	0.005281
21	804	5.50	28	0.026950
Total vol.				0.925605

Mean volume per tree was calculated to be 0.044076 m^3 (as per Smalian method). The total volume per ha assuming 100 per cent survival came to 440.7643 m^3 (considering 10,000 trees per ha in 1 m x 1 m spacing). MAI calculated came to 67.80989 m^3 (the age of the plantation at the time of study was taken to be 6.5 years).

Individuals having BHG less than 25 cm were not considered while calculating the fuelwood and pole/pulpwood calculation

Table 2

Expected pole, pulp and fuelwood yield

Sl. No.	Tree No.	Height (m)	BHG (cm)	Base girth (m)	Top girth (m)	Volume yielding fuelwood	Volume yielding pulpwood & pole	Total volume
1	2	3	4	5	6	7	8	9
1	4	9.00	34	0.38	0.15	0.02907	0.05980	0.08887
2	44	8.50	35	0.39	0.15	0.04275	0.05908	0.10183
3	84	6.00	25	0.30	0.15	0.02118	0.02687	0.04805
4	124	7.00	31	0.35	0.15	0.02747	0.04041	0.06787
5	164	8.00	46	0.50	0.15	0.07589	0.08678	0.16267
9	324	5.50	27	0.31	0.15	0.03463	0.02597	0.06060
14	524	5.50	26	0.23	0.15	0.01614	0.02463	0.04077
15	564	8.00	35	0.39	0.15	0.04240	0.05561	0.09800
16	604	8.25	30	0.34	0.15	0.02946	0.04536	0.07481
21	804	3.00	28	0.32	0.15	0.01203	0.01492	0.02695
Total						0.3310	0.43941	0.77041

(Table 2). Mean firewood production per tree (= col 7 / 21) comes to 0.0157619 m^3 and mean pole/pulpwood production per tree (= col 8 / 21) comes to 0.020924285 m^3 (considering the sample size of 21 in 2.5% systematic sampling method). Hence the expected production per ha (considering 100% survival) for pulpwood and pole comes to 157.62 m^3 and for fuelwood it comes to 209.24 m^3.

Eucalyptus hybrid and *Acacia auriculiformis* are usually planted in South West Bengal including the area where the experimental plot is located. It has been found that growing stock of *Eucalyptus* plantation is appreciably augmented when we plant established clones of *Eucalyptus* hybrid. In an experiment conducted by Silviculture South Division, tree volume of clone 3 of *Eucalyptus* hybrid (ITC Bhadrachalam origin) has been measured in 2005 in plantations raised in various locations of South West Bengal. The plantations established in 1999 at a spacing of 2.5 m x 2.5 m are of age 6 years at the time of measurement. It has been found that MAI of the said clonal *Eucalyptus* plantations, considering cent per cent survival, ranges between 13 and 23 m^3 per ha. MAI of seed origin plantations of *Eucalyptus* hybrid comes much less and that of *A. auriculiformis* even lower. In this backdrop, MAI of *Casuarina*, as calculated above, comes to 67.80 m^3 per ha in 1m x 1m spacing. It can be argued that we may not obtain the same MAI, if we apply a spacing of 2.5m x 2.5m. However, the fact remains that at a larger spacing (2.5m x 2.5m) and consequently lesser crop

density, the figure 67.80m^3 will not suffer proportionate drop as is computable mathematically. Rather the MAI figure is likely to remain appreciably high and comparable to what has been obtained at 1m x 1m spacing. The results obtained from the trial thus show that *Casuarina*, when planted inland in similar site in South West Bengal, can produce wood at a rate higher than that of *Eucalyptus* hybrid and *A. auriculiformis*. It is advisable though to grow *Casuarina* in the same spacing (2.5m x 2.5m) as *Eucalyptus* and *Acacia* for proper physical comparison of yield. Local people who can not afford any other fuel, which is expensive, use small wood of *Eucalyptus* and *Acacia* for fuel. With a specific gravity of 0.8-1.2, *Casuarina* wood has a calorific value of 4,959 kcal/kg (8,910 Btu). The charcoal has a calorific value of 7,181 kcal/kg, one of the highest reported values (Duke, 1983). Compared to *Casuarina, Acacia* wood has specific gravity of 0.6-0.75 and calorific value of 4,800-4,900 kcal/kg (Duke, 1983). It is worth mentioning that the calorific value of *Eucalyptus* is 4,800 kcal/kg and a specific gravity of 0.8-1 (Duke, 1983). Therefore, it may be said that the close spaced plantation of *Casuarina equisetifolia* has a lot of potentiality in the dry lateritic tracts of SW Bengal.

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SUMMARY

In South-West Bengal, soil and agroclimatic conditions are not conducive for desirable growth of a wide range of species. Due to over-exploitation, the natural Sal forests were badly degraded in the past. For restoration of tree cover on blanks and degraded lands, which were unfertile, *Eucalyptus* hybrid and *Acacia auriculiformis* were introduced during 1960s. Areas which bore live root stock of Sal continued to be managed under 'Coppice with Standard' silvicultural system. While *Eucalyptus* and *A. auriculiformis* were found suitable for the region, Silviculture (S) Division of W B Forest Directorate had been trying to find some other species whose performance would be comparable to or better than those two species in terms of quality of use and production potential. With this background, experimental plantation of *Casuarina equisetifolia* was taken up to assess its performance vis–a-vis that of *Eucalyptus* and *Acacia*.

दक्षिणी पश्चिम बंगाल में *कैजुआरिना इक्विसेटिफोलिया* लि0 (झाऊ) की अन्तर्देशीय खेती

सौरभ चौधरी

सारांश

दक्षिणी पश्चिम बंगाल में मृदा और कृषि जलवायु दशाएं बहुत सारी वृक्षजातियों की वांछनीय बढ़वार के लिए अनुकूल नहीं हैं। अति–समुपयोजन किया जाने के कारण प्राकृतिक शाल वन विगत में बुरी तरह से व्याह्रासित हुए हैं। इन वनों में बीच–बीच में बन गई रिक्तियों और व्याह्रसित जमीनों को, जो अनुपजाऊ बन चुकी है, वृक्षावरण से पुनर्स्थापित करने के लिए संकर *युकेलिप्टस* और *अकेसिया औरिकुलिफार्मिस* को इस क्षेत्र में बाहर से लाकर

लगाया गया। जिन क्षेत्रों में शाल की सजीव जड़ प्रणाली विद्यमान थी उनका प्रबन्धन ध्वजक (वृक्ष) सहित स्थूणन वनसंवर्धन प्रणाली के अन्नर्गत किया जाता रहा। *युकेलिप्टस* और *अ० औरिकुलिफोर्मिस* इस क्षेत्र के लिए तो उपयुक्त पाए गए फिर भी पश्चिम बंगाल वन निदेशालय का वनसंवर्धन (एस), मण्डल ऐसी अन्य वृक्षजातियों की खोज में लगा हुआ है जिनकी क्रियाशीलता उपयोग और संभावी उत्पादन की गुणवत्ता की दृष्टि से इन दो जातियों से तुलनीय या इनसे भी ज्यादा अच्छी हो। इस पृष्ठभूमि में, *युकेलिप्टस* और *अकेसिया* के मुकाबले में क्रियाशीलता का आकलन करने के लिए कैजुआरिना इक्विसेटिफोलिया का संपरीक्षणात्मक रोपवन कार्य हाथ में लिया गया है।

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