PRICE-SIZE RELATIONSHIP AND RATE OF RETURN FROM TEAK PLANTATIONS IN BANGLADESH

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Teak (*Tectona grandis* Linn. f.) has occupied a dominant position in the plantation programme of the Forest Department in Bangladesh. It is important to know the social rate of return from Teak plantation in order to evaluate the economic suitability of plantation programme and compare Teak with other promising species.

The paper contains discussions on regression of size variation of Teak logs on price changes. Government revenue is calculated assuming that the lot purchasers and the consumers have similar size preferences. Internal rate of return from Teak plantations belonging to site index 15, 20, 25, 30 and 40 is estimated.

INTRODUCTION

Teak has occupied a dominant position in the plantation programme of Bangladesh. As much as 70–80 percent of the total plantations established in the hill forests is composed of Teak (Douglas 1981, White 1979). In the future plantation programmes also it is likely to remain to be the principal species.

The rate of return from Teak plantation is not known in Bangladesh. Because of lack of this information it is not possible to compare Teak with other promising species and without doing so forestry management cannot be developed to maximise social welfare which is the basic aim of the National Forest Policy.

OBJECTIVES

i. To find out a suitable price-size regression equation in order to calculate the stream of gross revenue from Teak plantations established in different sites in Bangladesh

ii. To give an estimate of the internal rate of return for all site qualities, and

iii. To open a discussion on social rate of return generating from Teak plantations

PRICE-SIZE REGRESSION EQUATIONS TESTED

In this study the following two regression equations have been tested to explain price changes in response to size variation of Teak logs.

i. $Y=a+bX$
ii. $\log Y=a+b \log X$

where,

Y= Price/m^3 of Teak logs in taka ;

X= Mid girth of logs in per metre ;

a= Regression constant ; and

b= Regression coefficient

The above two equations are selected on the basis of plotting of average price data (Y) over log sizes (X) of Teak expressed in terms of mid girth (Table 1).

THE DATA

Data were collected from ten A-class randomly selected Teak merchants of Chittagong. They supplied data for 3.6 m long medium quality logs on the basis of transactions made during October, 1980. Information was collected for all available sizes of Teak logs which varied from 30 cm to 305 cm by mid-girth.

An attempt was made to study the relationship on the basis of auction values as available at Kalurghat and Feringi Bazar Government Timber Depots. But the records give information for average logs upto only 1.07 m by mid-girth. The lots do not, therefore, represent the average logs produced in a plantation older than 20 years. Moreover, in some cases it was found that bigger logs were sold at lower prices than the smaller logs. For these difficulties data were collected from open market. But it did not represent government transaction. The equations were tested on the basis of the assumption that the preference of lot purchasers for log sizes would be quite similar to consumer's size preferences. The price-size relationship operating in Teak transactions at the depots was derived from consumer's behaviour as revealed by market prices. For calculating prices received by the Government from spot sales, 15 percent of the estimated market price/m^3 (for merchants' cost of transport and marketing plus profit) was not taken into account.

RESULTS

The regression co-efficients were estimated to be the following for equation 1 and equation 2 :

Equation. i. $Y=27.31+149.24$ X m
$R^2=0{\cdot}91$ $(r=95)$

Equation. ii. Y=Antilog of $(-0.08+1.13 \log X)$
$R^2=0.95$ $(r=97)$

The first equation explains 91% of variations, while the second one explains 95% of variations. Regression was highly significant in both the cases. The Furnival Indices for equation i and equation ii. stood at 41.18 and 17.52 respectively. Equation ii was thus found better fit.

Table 1. Teak prices as supplied by sample merchants

Sl. No.	Log size in mid girth (X) (m)	Mean prices of log (Y) (Tk. 0.028/m^3)	log X	log Y
1.	0.30	34.30	1.47	1.5352
2.	0.46	53.00	1.66	1.7252
3.	0.61	73.50	1.79	1.8662
4.	0.76	106.50	1.88	2.0273
5.	0.91	151.00	1.96	2.1789
6.	1.07	185.50	2.03	2.2683
7.	1.22	245.50	2.09	2.3900
8.	1.37	282.50	2.14	2.4510
9.	1.52	307.00	2.18	2.4871
10.	1.68	324.00	2.23	2.5105
11.	1.83	342.00	2.26	2.5340
12.	1.98	361.00	2.30	2.5575
13.	2.13	375.50	2.33	2.5746
14.	2.29	381.00	2.36	2.5809
15.	2.44	400.00	2.39	2.6020
16.	2.59	402.00	2.41	2.6042
17.	2.74	410.00	2.44	2·6127
18.	2.90	410.00	2.46	2.6127
19.	3.05	410.00	2.48	2.6127

THE INTERNAL RATE OF RETURN

The internal rate of return (IRR) is the compound rate of money yield which makes stream of costs equal to stream of revenue. Using average cost/acre figures of plantation operations (Rahman 1982), the yield table (Kingstone 1979) and proper price-size regression equation (equation ii), the following IRRs were calculated for Teak plantations belonging to different site indices under 30% and 50% yield reductions. (Table 2).

Table 2. Rate of return from Teak plantations raised at different sites in Bangladesh (Rotation : 60 years)

Site Index	Return percent per acre (1 acre=0.4047 hectare)	
	30% yield reduction	50% yield reduction
15	10	4
20	16	8
25	21	12
30	26	16
35	30	22
40	35	26

THE SOCIAL RATE OF RETURN

The IRR as estimated above does not take into account the opportunity costs, other related social costs and linkge effects over the economy. A large area of Teak plantation is not established in favourable sites (Douglas 1981). As a result, the opportunity cost of Teak plantation would be much higher than the nominal costs. A poor Teak site giving an IRR of three percent might generate a rate of return of six percent with fuelwood plantation. Again, it will also have to be considered that after first rotation a Teak site greatly loses reproductive capacity and in order to regain soil quality a long-term programme involving high social cost may be needed. Another form of social cost of Teak plantation originates from overlooking bamboo and pulpwood plantation. Teak plantation, to be economically feasible, should pay the society a rate of return which is not less than the alternative rate generated by other plantations feeding paper mills, plywood factories and particleboard plants.

The average site quality of Teak is SI 25 (Slavicky 1978). If the practical condition of plantation is considered, the IRR from these sites would not be more than six percent. But some of these sites have an opportunity cost of more than 10%. In these cases, Teak plantation has a negative rate of return. In Bangladesh, the social rate of return of Teak plantation is much lower than the estimated IRR.

CONCLUSION

The IRR from average site would be about six percent/acre and the social rate of return is much lower than the IRR. In many sites social rate of return may even be negative. Therefore, to continue Teak plantation according to schedule, emphasis has to be put on development of an efficient forest management system. Poor Teak sites might be released for plantation of alternative promising species.

REFERENCES

Douglas, J. J. 1981. Consumption & Supply of Wood and Bamboo in Bangladesh. Field document No. 2 UNDP/FAO Planning Commission Project BGD/ 78/010 : 87+71 pp

Kingstone, B. 1979. A compendium of mensuration statistics. Field document No. 7, UNDP/FAO Project BGD/ 72/005 : 136+67+72 pp

Rahman, Afzalur. 1982. Economic prospects and management problems of Teak Plantations in Bangladesh. Paper presented in the Second National Forestry Conference, Dhaka. 13 pp

Slavicky, J. S. 1978. Forest Inventory & Aerial Photogrammetry, Field document No.5, UNDP/FAO Project BGD/72/005.Forest Research Institute, Chittagong 173 pp

White K. J. 1979. Fast growing tree species in industrial plantation—Eucalyptus, Pinus and others. Field document No. 18, UNDP/FAO, Project BGD/72/005., Forest Research Institute, Chittagong : 90 pp

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