STUDIES ON FRUIT SIZE, SEED PRODUCTION AND VIABILITY OF SEEDS OF KEORA *(Sonneratia apetala)*

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ABSTRACT

Data on the availability of different sizes of fruits, seed production according to size classes, germination success and viability of seeds of *Sonneratia apetala* Buch-Ham. were collected during 1984—85 from the Chittagong coastal area. The fruit dropping period extended from late July to early October. Fruit size varied and proportion of medium sized fruits was high. No significant difference in germination success was detected when seeds from different fruit size classes were collected and sown. Viability of seeds declined with passage of time in the laboratory as well as under field conditions. No seed germinated in the field when sown after 60 days of fruit collection.

চট্টগ্রাম উপকূলীয় বনাঞ্চলে কেওড়াবৃক্ষের *Sonneratia apetala* Buch-Ham) ফলের আকার, আকার অনুযায়ী বীজ উৎপাদন, অংকুরোদগম ক্ষমতা এবং বীজের সুপ্ততাকাল নির্ণয়ের জন্য ১৯৮৪-৮৫ সালে পরীক্ষা কার্য চালানো হয়। জুলাই থেকে অক্টোবর পর্যন্ত এই বৃক্ষের ফল পতন কাল বলে পরিলক্ষিত হয়। ফলের আকার বিভিন্ন। তবে মধ্যম আকারের ফলের উৎপাদন অধিক। বিভিন্ন আকারের ফল থেকে সংগৃহীত বীজের অংকুরোদগমে কোন পার্থক্য পরিলক্ষিত হয়নি। ফল সংগ্রহকালের পর সময় অতিক্রমনের সাথে পরীক্ষাগার ও মাঠ উভয় স্থানে অংকুরোদগম ক্ষমতা হ্রাস পেতে থাকে। ফল সংগ্রহের ষাট দিন পর মাঠে বীজ বপন করে কোন অংকুরোদগম পাওয়া যায়নি।

INTRODUCTION

Coastal afforestation activities were initiated in Bangladesh in 1966 with the initial objective to protect life and properties of the people living in the coastal areas against cyclone and tidal bore. Up to 1985, an area of about 90,000 ha was brought under mangrove afforestation. During the current five years (1985—1990), another

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40,000 ha will be planted with mangrove species (Anon 1986). Nowhere else in the world have mangrove plantations been raised on such a large scale (Imam 1982).

Keora (*Sonneratia apetala* Buch.-Ham.) constitutes 80% of the plantation and the remaining 20% consists of *Avicennia officinalis* and other mangrove species (Nuruzzaman 1982). Recently, *S. apetala* is gaining further priority over other species because of its better performance with respect to survival and growth. In the natural state, *S. apetala* is the pioneer tree species in the successional stages for the coastal belt of Bangladesh (Das 1971).

Nursery techniques for *S. apetala* have been developed by practical experience of the field officers and staff. There is, however, scope for improvement. Studies by Islam and Siddiqi (1987) revealed that a much higher quantity of seeds than required were sown in the nursery beds which, in turn, affected the seedling quality. The present studies were made during 1984 and 1985 to obtain information on phenology, seed quantity and germination performance of seeds of *S. apetala* in the laboratory as well as under field conditions.

MATERIAL AND METHODS

The phenology of the species was studied in the Sundarbans forest which was the initial source of seed supply for the coastal afforestation.

To determine the number of seeds per fruit, fruits of *S. apetala* were collected at random from an eight year old plantation in the Chittagong coastal area. The fruits were measured, weighed and graded into various size groups—A (very large, diameter> 26 mm), B (large, 23–26 mm), C (medium, 20–23 mm) and D (small, <20 mm). Seeds from various groups were collected, sun-dried and placed into germination tests to determine the germination performance from different size groups of fruits.

Unpredictable heavy showers are one of the main causes for repeated nursery failure because seeds are washed away from the beds. So, it was necessary to see if nursery raising was possible after monsoon. In addition, nursery raising in the post-monsoon period would ensure a year-round supply of seedlings for planting out. The fruits were kept in a heap and it took about 15 days for the decay of the fleshy portion of the fruits. Fruits were collected from the same stock/heap at 15 day intervals and washed in water to separate the seeds. On the next day, the seeds were sown in the petridishes as well as in the field near Patenga, Chittagong, where the experiment was laid out in RCDB with 3 replications and 5 treatments (interval of sowing). The size of the plots was 1.2 m x 1.2 m and each plot was sown with 80 *g* (2300 nos) of seeds. First sowing was made on 2nd September, 1985.

RESULTS AND DISCUSSION

Phenology of the trees

Flowering of *S. apetala* starts in late March and continues up to mid April. The fruiting period extends from April to mid May. Matured fruits are available

in June and July. Dropping of fruits takes place during July and August. However, variation in flowering, fruiting and dropping period was observed between natural Sundarbans forest and plantations at Chittagong. This process occurred with some delay : fruit dropping at Chittagong was found to extend up to early October. *S. apetala* starts flowering from a very early stage. Even three year-old trees were found to produce fruits. No periodicity was noticed or so far reported for the species.

Fruit size and seed production

Proportion of various sizes of fruits differed significantly (x^2-63.62 ; $p<0.001$). Out of 339 fruits examined, 15.63% were very large, 30.38% large, 40.13% medium

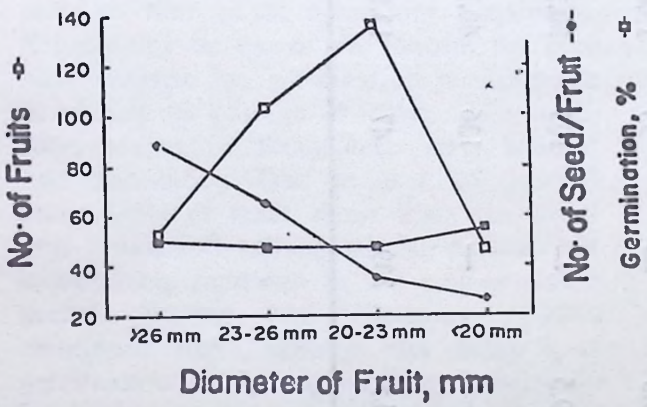

Fig. 1. Fruit availability, seed production and germination success in relation to size of fruits

and 13.86% small (Fig. 1). Seed production per fruit also varied significantly with the size of fruit (x^2-44.18 ; $p<0.001$). Average number of seed for group A, B, C and D was 88.5, 65.1, 35.6 and 26.9 respectively (Table 1 and Fig. 1). One kilogram of green fruits produced 7,700 seeds and one kilogram of dry seed at 13% moisture content contained 43,000 number of seeds. One kilogram of wet seeds immediately after separation from the decayed fruits produced 22,000 seeds.

When dry seeds obtained from various groups of fruits were placed in germination test one and half months after fruits collection, no significant difference in respect of germination success was noticed ($x^2=0.75$) among the groups (Fig. 1).

Germination performance

The seeds were sown in petridishes in laboratory conditions at every 15 days interval up to 80 days from the day of fruit collection, and germination percentage was recorded up to three weeks following sowing. First sowing was done 20 days after collection of fruits from the trees. Germination percentage were 93, 80, 81, 69 and 67 for sowing the seeds at 20, 35, 50, 65 and 80 days respectively. A significant decline (Fig. 2) in germination success was noticed ($r= 0.949$; $p<0.05$.)

In the field, a significant decrease in germination performance for sowing the wet seeds at 20 (T_1), 35 (T_2), 50 (T_3), 65

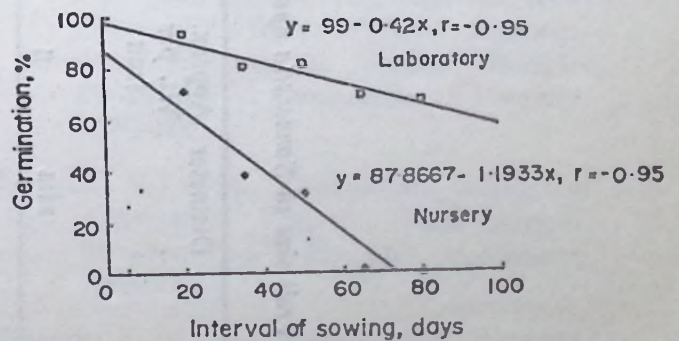

Fig. 2. Viability of Keora (*Sonneratia apetala*) seeds in relation to time.

(T_4) and 80 (T_5) days was observed (Fig. 2). Germination percentage was 71, 38,

Table 1. Fruit size of *Sonneratia apetala* in relation to seed production and germination

Group	Diameter	Approx. Wt. per fruit	Fruits examined	Fruits of different sizes	Proportion of fruits of different sizes	Average seed/fruit of different sizes	Average seed/fruit	Average seed/kg	Germination of dried seeds sown one month after collection
	mm	g	No	No	%	%	No	No	%
A	>26	9.5	—	53	15.63	88.5	—	—	50.0
B	23–26	7–9.5	—	103	30.38	65.1	—	—	47.5
C	20–23	4.5–7	—	136	40.13	35.6	—	—	47.5
D	<20	4.5	339	47	13.86	26.9	51.627	7,706	55.0

31, 1 and 0 for sowing the seeds at 20, 35, 50, 65 and 80 days respectively following collection of fruits. The decline was highly significant ($r=0.961$; $p<(0.01)$. The difference was also significant for germination success among various treatments when F-test was done ($F=2866>3.84$, the tabulated value of F at 5% level ; L. S. D.= 7.774) T_1 showed highest germination success. There was no significant difference between T_2 and T_3. The worst treatments were T and T_5.

A significant difference in respect of germination performance was found between laboratory and field conditions (tratio = 5.83> 4.06, the tabulated value of t at 1% level with 4 d. f.). Germination percentage in the nursery beds was much lower compared to that of the laboratory conditions. Salinity may be one of the causes for gradual decrease in germination performance in relation to passage of time. The monsoon season in Bangladesh ends around mid September. Due to lack of rainfall and supply of fresh water from the adjacent areas, soil salinity in the coastal belt considerably increases in the post-monsoon period. Weaver and Clements (1938) mentioned that "salinity may delay seed germination either temporarily or indefinitely by hindering water absorption". Saenger (1986) also mentioned that some mangrove species were tolerant of wide range of soil salinity while most showed a fairly narrow tolerance range. In view of the apparant decline in germination success with increasing soil salinity, raising of *S. apetala* seedlings needs to be undertaken during periods of reduced salinity. Consequently, establishment of nurseries during the post-monsoon dry season is not feasible.

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