



## Pruning of shoot branches: An efficient technique for stimulating the mangrove growth (*Rhizophora mucronata*)



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### ABSTRACT

In this paper, we analyzed the growth performance of 3 year old *Rhizophora mucronata* in response to pruning of shoot branches in the lower trunk, on 70, 117, 180 and 292 days of the experiment corresponding to four seasons (Post monsoon, summer, Pre monsoon and monsoon). The growth increased with number of shoot branch pruned, and days of growth. The pruning exercise exhibited significant promotory effect on the leaf expansion, diameter of stilt root, and buttressing of stilt root each by three fold, number and length of stilt roots each by 67%, number of leaves by 54.4%, number of lenticels in stilt root by 41%, and plant height by 16.3% in the plant pruned with 6 shoot branch than that in unpruned control. The number of shoot branch pruned exhibited significant positive correlation with the growth attributes. The present work proved the pruning of shoot branch as a simple and efficient method of stimulating the growth of *R. mucronata*.

### 1. Introduction

Pruning is a practice of selectively removing plant parts, such as branches, buds, or roots in horticultural and silvicultural sectors. The pruning is practiced to reduce risk from falling branches, to remove dead/damaged/diseased wood, to maintain plant health, to improve the quality of flowers, fruit, foliage or stems, and to control growth for shaping. Generally herbaceous plants/young trees are used rather than matured/woody plants (Wikipedia, 2018). However, pruning of shoot branch has never been practiced in the mangroves.

Mangrove conservation is a dire need for its ecological services such as fisheries enhancement, biodiversity enrichment, coastal protection, carbon sequestration, pollution abatement, and tourism development (Kathiresan and Bingham, 2001; Kathiresan and Qasim, 2005; Kathiresan, 2011). However, in many parts of the world the mangroves have been lost or degraded, along with their valuable services. Hence, mangrove planting is hugely popular, but it often experiences a serious issue of stunted growth in both natural and planted sites (Primavera and Esteban, 2008). In view of this, the present study was undertaken on the effect of pruning the shoot branches for better growth of planted mangrove species, *Rhizophora mucronata*.

### 2. Materials and methods

The mangrove species (*Rhizophora mucronata* Poir.) raised by the authors for three years along the Vellar estuary (Lat. 11° 29' 08.0" N; Long. 079° 45' 29.9" E), southeast coast of India was selected for pruning experiment. The lower shoot branches, numbering 2, 4, and 6 were pruned from individual plants with average height of 109.0 ± 0.81 cm and shoot branches of 6–8 by using a sterile knife. The unpruned plant was maintained as control. Totally 40 plants at the rate of 10 for each treatment and control were used. Pruning was done on 70, 117, 180, 292 days of plant growth corresponding to the seasons of post-monsoon, summer, pre-monsoon, and monsoon, on Feb. 17th, April 27th, June 14th, Aug.16th and, Dec. 17th of the year 2017 after collecting the data on plant height, number of leaves, number and length of stilt roots. Further, data were collected on Dec. 17th of the year 2017, on diameter of stilt root, average leaf area at third position from the shoot branch tip, number of lenticels in one sq.cm area and stilt root buttressing (% of plant height at which stilt root was formed).

A suite of statistical analysis (SPSS 11.5) was made to assess the significance for each growth variable between different pruning treatments, and or between different seasons. Correlation was made between the variables and significant ones ( $p < 0.01$ ).

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**Table 1**  
Effect of pruning the shoot branches of *Rhizophora mucronata* on growth characteristics under different seasons.

No. of shoot branch pruned/ plant	Average Plant height (cm)	No. of stilt roots/ plant	Length/ stilt root (cm)	No. of leaves/plant	No. of lenticels (No. /cm <sup>2</sup> area)	Diameter of stilt root (cm)	Buttressing of stilt root plant height	Leaf area (cm <sup>2</sup> )
0	109.0 ± 0.81	10.6 ± 0.38	28.1 ± 1.03	72.8 ± 1.16	17.20 ± 1.8	0.53 ± 0.05	40.74 ± 1.9	21.87 ± 2.5
2	110.9 ± 0.72	10.5 ± 0.52	34.5 ± 1.25	63.9 ± 1.15	35.90 ± 1.5	1.15 ± 0.06	55.59 ± 1.8	30.73 ± 2.6
4	119.3 ± 0.52	13.9 ± 0.36	37.4 ± 1.63	78.5 ± 1.12	41.00 ± 1.2	1.35 ± 0.02	55.99 ± 1.5	41.59 ± 2.8
6	126.8 ± 0.65	17.7 ± 0.35	46.8 ± 1.52	112.4 ± 1.12	49.20 ± 1.8	1.61 ± 0.05	57.40 ± 1.2	57.98 ± 1.9
No. of Days of growth/ season								
0 (initial growth)	105.1 ± 0.91	7.0 ± 0.36	24.4 ± 1.25	73.0 ± 1.25				
70 (Post monsoon)	108.7 ± 0.25 (1.5%)	10.6 ± 0.36 (21.9%)	29.2 ± 2.30 (8.4%)	78.3 ± 1.16 (3.0%)				
117 (Summer)	115.2 ± 0.68 (2.4%)	12.1 ± 0.25 (18.6%)	35.9 ± 1.23 (12.0%)	80.2 ± 1.18 (2.4%)				
180 (Pre monsoon)	121.2 ± 0.56 (2.6%)	15.8 ± 0.69 (21.0%)	41.7 ± 1.25 (11.7%)	85.8 ± 1.12 (2.7%)				
292 (Monsoon)	132.4 ± 0.23 (2.7%)	20.6 ± 0.56 (20.1%)	52.4 ± 1.02 (11.7%)	92.3 ± 1.54 (2.7%)				
Pruning No. shoot branches/ tree (A)	**	**	**	**	**	**	**	**
Interval of analysis (days) (B)	**	**	**	**	**	**	**	**
A x B	*	NS	NS	NS	NS	NS	NS	NS

Values in parentheses are percentage of initial growth per month.

Significance \*\*p < 0.01; \*p < 0.05, NS - Not significant.

### 3. Results and discussion

Data on growth performance in response to pruning are shown in Table 1 and Fig. 3. The growth performance of *R. mucronata* significantly increased with increasing in pruned shoot branches. The plant pruned with 6 shoot branches exhibited 67% higher number and length of stilt roots, 54.4% more number of leaves, 16.3% higher plant height than the unpruned control plant. Thus the pruning exhibited stimulatory effect on the stilt roots and leaf sprouting rather than plant height. There is no earlier finding to substantiate our finding, however, while transplanting of mature trees of the grey mangrove, *Avicennia marina*, it has been found that the plant with light pruning of leaves at the time of excavation has an impact on flowering in the first year, whereas the plant with heavily pruning of leaves invests more in vegetative growth (Abbot and Marohasy, 2014).

The growth performance of *R. mucronata* varied with seasons. The rate of plant height in a month was maximum in monsoon (2.7%), followed by Pre monsoon (2.6%), summer (2.4%), and minimum (1.5%) in Post monsoon. Thus the monsoon was found favourable for plant growth. The rate of leaf sprouting was maximum in Post monsoon (3.0%) followed by Pre monsoon (2.7%) and monsoon (2.7%), and minimum (2.4%) in summer. Thus the Post monsoon was found suitable for leaf sprouting.

The rate of stilt root initiation in a month was maximum in Post monsoon (21.9%), followed by Pre monsoon (21%), monsoon (20.1%), and minimum (18.6%) in summer. Thus the Post monsoon was found favourable for the number of stilt root, but this season did not encourage the linear growth of stilt root. The rate of elongation of stilt roots in a month was maximum (12%) in summer followed by Pre monsoon (11.7%) and monsoon (11.7%), and minimum (8.4%) in Post monsoon. Thus the summer was found ideal for linear growth of stilt roots. This is similar to the finding of Kathiresan et al. (2000) who have found that the growth of stilt root of *R. apiculata* is high in summer as compared to other seasons.

The pruning had significantly high stimulatory effect on the growth performance. This is evident by high positive significance between the pruning and the number of leaves, plant height, length and number of stilt roots, with correlation coefficient (‘r’) of 0.71, 0.52, 0.48 and 0.45 respectively (Fig. 1 A-D) (Fig. 2).

Plant growth was found high mostly throughout the seasons. The rate of growth ranged from 1.5% to 2.7% for plant height, 2.4–3% for number of leaves, 8.4–12% for length of stilt root, and from 18.6% to 21.9% for number of stilt root. Thus the rate of growth was higher in number and length of stilt roots than that in number of leaves and plant height. There was about 3 fold higher in average leaf area, diameter of stilt root, stilt root buttressing and 41% more lenticels in stilt root of the plant pruned with 6 shoot branches than that of the unpruned control plant. Thus the pruning of shoot branch had pronounced effect on the stilt roots and leaf area expansion (Table 1; Fig. 3). The active performance of stilt roots may be attributed to the much more supply of upward nutrients from underground roots, and downward photosynthesis from leaves to the initiation of stilt roots. This possibly helps in better anchorage of the plant in the slushy substrate and nutrient absorption, which perhaps promotes the leaf sprouting and tree height growth. In support of this, our laboratory has reported the growth of stilt roots in the early stage of mangrove establishment in the *Rhizophora apiculata* planted site of Ariyankuppam estuary of Pondicherry Union Territory, India (Kathiresan et al., 2000).

### 4. Conclusion

The present work is perhaps the first report to prove the growth stimulatory effect of pruning practice on mangroves, which is being practiced in many other plants of horticultural and silvicultural importance. Restoration projects with young plants are often experience low rates of establishments in the mangrove habitats because of

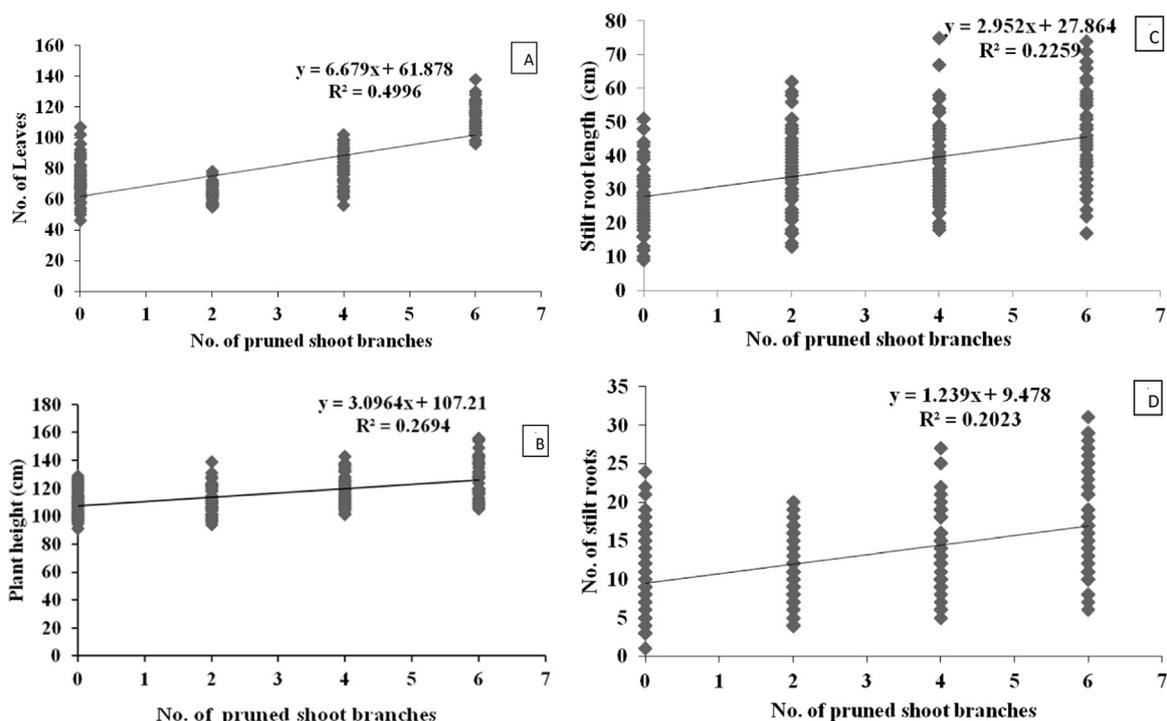


Fig. 1. Relation between shoot branch pruning and no. of leaves sprouted (A), plant height (B), length of stilt root (C), no. of stilt roots in *Rhizophora* (D) on four different seasons.

excessive wash, drowning or smothering (Abbot and Marohasy, 2014). In such situations, pruning of lower shoot branches will be promising in establishing the mangroves with fast developing stilt roots and leaf sprouting.

**Conflict of interest**

None.

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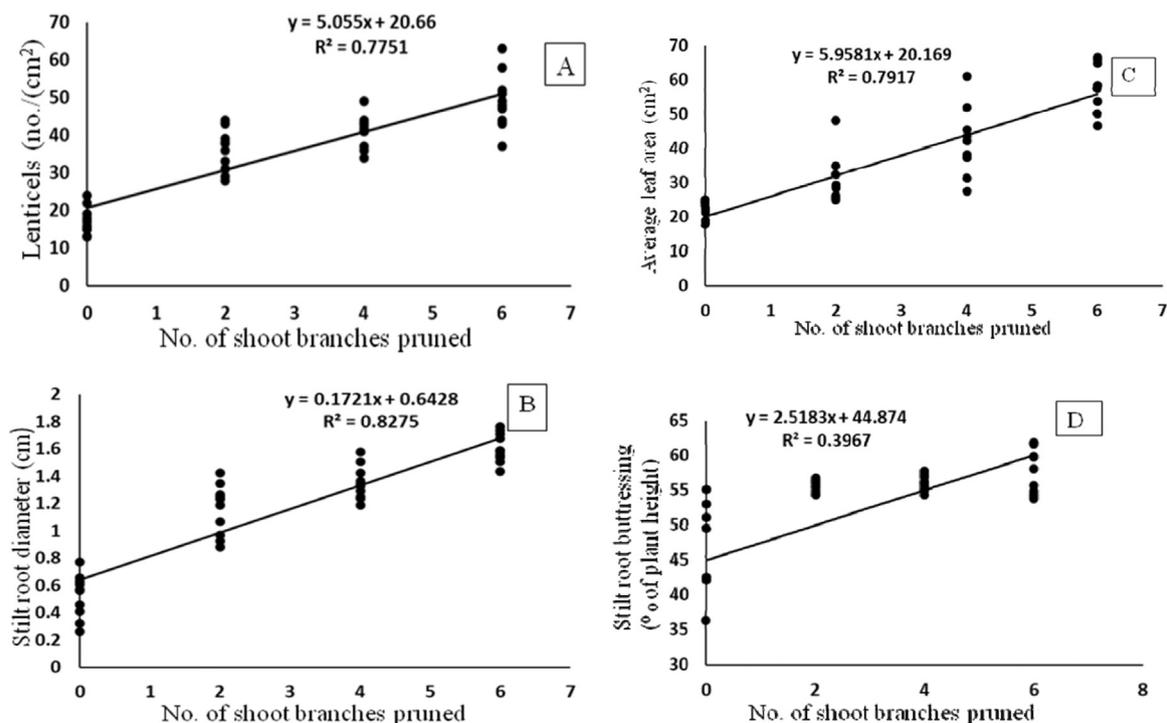


Fig. 2. Relation between shoot branch pruning and No. of lenticels (A), diameter of stilt root (B), Average leaf area (C), and buttressing in *Rhizophora* (D) on 292 days of experiment.



Unpruned control



2-shoot branch pruned



4-shoot branch pruned



6-shoot branch pruned

Fig. 3. Plant growth of *Rhizophora mucronata* in 0,2,4,6 shoot branch pruned.

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