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Influence of Pre - Sowing Treatments on Seed Germination and Seedling Quality in Canes

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ABSTRACT

A comprehensive laboratory study entitled "Influence of pre- sowing treatments on seed germination and seedling quality in Canes." was undertaken at Department of Forest Biology and Tree Improvement, College of Forestry, Sirsi, University of Agriculture Sciences, Dharwad during 2014-15. Different chemical and non-chemical, physical and other pre-sowing seed treatments were tried to study the effect of presowing treatments on seed germination and seedling qualities. Fresh seeds of Calamus thwaitesii and Calamus nagabettai were used separately for each treatment with three replications using CRD design. The pre-sowing treatments exhibited significant differences in seed germination percentage in both the species. The maximum germination of 91.33 per cent and 61.00 per cent was recorded in removal of sarcotesta treatment in Calamus thwaitesii and Calamus nagabettai respectively. The increase in germination percentage due to removal of sarcotesta was 30.67 and 40.00 per cent over the control in both the species respectively. The higher mean daily germination values of 1.78 and 1.22 and peak values of 1.87 and 1.24 were observed in removal of sarcotesta in Calamus thwaitesii and Calamus nagabettai respectively. Similarly speed of germination was significantly higher in all the pre sowing treatments compared to control. The pre-sowing treatments had significant influence on seedling length and root length during experimentation. Maximum shoot length at the end of germination period was found to be 12.95 cm and 9.53 cm which were recorded in sarcotesta removal treatment in Calamus thwaitesii and Calamus nagabettai respectively. The same treatment has showed significantly higher seedling vigour index of 3159 in Calamus thwaitesii and 1214 in Calamus nagabettai.

Key words: *Canes, sarcotesta, germination. peak value and vigour*

INTRODUCTION

In recent years biodiversity degradation is affecting the global vegetation with raising levels. Lack of ecological consideration and internalisation of ecological costs have resulted in habitat disturbance and extinction of many species of flora and fauna. Due to increasing awareness of these problems and concerns on climate modifications, efforts should be made to conserve existing biodiversity not only in restricted areas reserves but also in modified local ecosystems.

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In this perspective forest products extraction should be considered on more ecological level through the reduction of the logging impacts or the empowerment of alternative resources[9].

Rattans are climbing palms belonging to the family *Arecaceae* (*Palmae*). Although rattans are still found in the natural forests in Karnataka, they are restricted to less accessible areas. One of the major reasons for the depletion of resources appears to be the indiscriminate extraction of rattans due to heavy demand for raw material. Even immature rattans are extracted before they could bear flowers or fruits, which drastically affect the production of seeds. On the other hand this is partially due to the non-adherence to the prescribed cutting cycles, and also due to inadequate information available on silviculture aspects of species for purposes of developing sound management practices. Another factor which has substantially affected the status of the cane resource is the large scale conversion of natural forests into plantations and agricultural purposes, thus destroying the original habitat of canes. As a result of such continuous pressures on the natural habitat of rattans, the broad genetic base of rattan is being reduced rapidly[4].

The severe depletion in the rattan resources resulted in an urgent need for effective conservation and propagation measures to be taken. The available resources in India are scarce to meet the demands of the cane industry creating a wide gap between demand and supply. But this can be reduced by augmenting the existing resources by large scale cultivation of canes. The increasing global demand for rattans necessitated the research on the seed production and quality seedling production, propagation aspects of rattans species.

The major difficulty in establishing forest plantation of this species is poor germination capacity of seeds. It also shows a poor recruitment in the wild. A uniform germination with good vigour is necessary for the production of uniform production stock which is prerequisite for any successful domestication and large scale afforestation programme. Seeds are produced in large number and are readily available each year or at a definite interval and it can be stored for future use[3]. Foresters are facing a major problem in the propagation of rattan species due to dormancy condition which prevents the easy germination of the rattan seeds. This can be altered by seed treatments, subjecting the seeds to favorable condition of moisture and temperature. Hence, a study of the pre-sowing treatments and nutrient response holds major scope in the propagation of rattan seedlings which usually could not germinate well under ordinary conditions due to dormancy. With this background information, the present study was carried out to standardize pre-sowing treatments for early germination and better seedling establishment in canes.

MATERIAL AND METHODS

A natural population of *Calamus thwatesii* was identified in a semi- evergreen forest of Katagal forest range, Honnavar division, Uttara Kannada in the month of April and *Calamus nagabettai* was identified in evergreen forest of Kukke Subramanya, Sulllia taluk in Dakshina Kannada in the month of July (Plate -1). The fruits were randomly collected from ten mature mother trees, when the fruit colour turns to yellow. Soon after collection, the fruits were brought to the laboratory in gunny bags, processed to get clean, pure seeds of high physiological quality. The outer coat of the fruit is extracted by manual pressing; the fruits are macerated and thoroughly washed under running water to remove all pulp that is adhered to the fruit. Finally the seed is allowed to air dry in laboratory condition. Since the difference in the seed collection period, the experiments were conducted separately. Immediately after collection fruits outer coat removed in the laboratory. After seed processing, seeds were dried under shade in a well-ventilated place. Three hundred randomly collected fresh seeds of both species were used for each treatment which was replicated thrice. In control, seeds were sown without any treatment. For treatment T_2 the outer sarcotesta part of the

fruit was removed. In T_3 the hilum part of the fruit was removed. In treatment T_4, T_5 seeds were soaked in ratio of 1:2 proportions seed to chemical solution (Gibberllic acid with 500 ppm and 1000 ppm) respectively for 8 hours. In treatment T_6 seeds were rubbed in hard surface with sand for reducing the hardness of the seed. In treatment T_7 seed were soaked in chemical solution KNO_3 for 8 hours. In treatment T_8 seeds were soaked in Cow dung slurry for 5 days. In treatment T_9 seeds were dipped in boiling water for 5 min. For Mini sachet method the seeds were sown in open bed by providing airtight polythene covering after giving a mulch of dried grass to retain moisture. Then seeds were exposed to direct sunlight in same condition for five days. All the treatments were timed in such a way that all of them would end at the same time. After imposing all the treatments, seeds were sown in nursery bed. Aftercare like watering and weeding was done regularly as and when required throughout the experimental period[1].

RESULTS AND DISCUSSION

High quality seeds are key factor for successful forest plantations. A rattan produce seed in bulk, but their germination per cent is very low if sown as such. Several species of the family *Arecaceae* have mysterious physical numbness in varying degrees, demanding pre-treatment in water or growth regulatory chemicals, chemical or mechanical stratification or even degrees of exposure to brightness[7].

The different pre-sowing treatments exhibited significant difference in seed germination percentage in both the species. The maximum germination percentage 91.33 per cent and 61.00 per cent was recorded in removal of sarcotesta treatment in *Calamus thwaitesii* and *Calamus nagabettai* respectively (table 1 and fig-1). The increase in germination percentage due to removal of sarcotesta was 30.67 and 40 per cent over the control in both the species respectively. Increased germination might be due to the removing the all fleshy part of the seed and moderate soil temperature which triggers the germination process in the seed. The positive effect of sarcotesta removal was established in the investigations of Renuka and Rao[10]. These results were in line with investigations of Maithani *et al*[5]., and Barylnikova[2].

Seeds treat with GA_3 1000 ppm for 8 hrs (T_5) also has high germination percent 89.33 and 54.33 in *Calamus thwaitesii* and *Calamus nagabettai* respectively. Number of investigators has reported hastening effect on germination by soaking seed in 10 to 2000 ppm concentration of GA_3 for 1 to 3 days[6,7] and 10-25 ppm GA_3 worked well for a wide variety of species.

Apart from sarcotesta removal treatment, GA_3, 1000 ppm, GA_3 500 ppm 8 hrs (T_4), T_9 (boiling water treatment 5 min) and T_6 (sand scarification) also recoded higher seed germination in *Calamus thwaitesii*. Similar trend was noticed in case of *Calamus nagabettai* this may be because of the canes seeds exhibiting the both seed coat and embryo dormancy. Hence, the physical and chemical treatments help in clearing the double dormancy in canes. Better adaptability of the seeds to the nursery conditions may also have played a significant role for their successful germination results.

All the pre-sowing treatments significantly improved the seed germination over control, except the seeds treated with mini sachat method for 5 days in *Calamus thwaitesii* and removal of hilum in *Calamus nagabettai*. This poor performance in these treatments may be due to the loss of moisture and size of the seed respectively. Compared to *Calamus thwaitesii*, *Calamus nagabettai* was very slow in germination perhaps for this reason the distribution is limited. In both the species germination was early in T_2 (Removal of Sarcotesta) and GA_3 1000 ppm (T_5) but the time taken to germination was different.

The mean daily germination and peak values differed significantly over control. The higher mean daily germination (1.78) and (1.22) and Peak value (1.87) and (1.24), and (1.10) and Peak value (1.85) and (1.15) was observed in removal of sarcotesta in *Calamus thwaitesii* and *Calamus nagabettai*

respectively (table 2). The pre-sowing treatments initiated early germination and reduced period of germination by facilitating enhanced imbibitions of water into cotyledons and hastened the biochemical reactions; intern increased the mean daily germination and peak value. Thus the liberation of enzyme rapidly increases the whole system that is already in motion, so that when the seeds are sown, developmental processes go on rapidly. It leads to higher germination with reduced germination period.

In general, the rate of germination was significantly higher in all the pre sowing treatments compared to control. This difference in treated seeds might be due to altered physiology of embryos and liberating enzymes. It may mobilize storage reserves for seed germination, which helped to enhance the germination. These results are in line with the results of Renuka[9], who found high mean daily germination, speed of germination and peak values in removal the outer part sarcotesta in *Calamus thwaitesii*.

The mean seedling height in both species was significant among different pre-sowing treatments. Maximum seedling height at the end of germination period was found to be 12.95 cm and 9.53 cm which were recorded in sarcotesta removal treatment in *Calamus thwaitesii and Calamus nagabettai* respectively. Again the same treatment has significantly higher seedling vigour index of 3159 in *Calamus thwaitesii* and 1214 in *Calamus nagabettai* (table 3 and fig-2). A fruit at maturity level also produces seedlings characterized by maximum size, dry matter production and vigour index[8].

Table 1: Effect of various pre-sowing treatments on seed germination%, Mean daily germination and Peak value in *C. thwaitesii* and *C. nagabettai*

Treatments	Germination %		Mean daily germination		Peak value	
	C. thwaitesii	***C. nagabettai***	***C. thwaitesii***	***C. nagabettai***	***C. thwaitesii***	***C. nagabettai***
T_1 Control	60.66 (51.15)*	21.00 (21.27)	1.10	0.49	1.30	0.51
T_2 Removal of Sarcotesta	91.33 (72.87)	61.00 (51.35)	1.78	1.22	1.87	1.24
T_3 Removal of Hilum	69.66 (56.57)	17.33 (24.60)	1.27	0.42	1.47	0.45
T_4 GA_3 500 ppm (8 h)	88.35 (70.04)	38.33 (38.25)	1.72	0.86	1.82	0.89
T_5 GA_3 1000 ppm (8 h)	89.33 (70.93)	54.33 (47.48)	1.76	1.10	1.85	1.15
T_6 Sand scarification	74.66 (59.77)	49.33 (44.61)	1.45	1.02	1.52	1.09
T_7 KNO_3 2 % (8 h)	71.33 (57.62)	28.66 (32.36)	1.45	0.62	1.50	0.66
T_8 Cow dung slurry (5 days)	69.00 (56.16)	25.33 (30.21)	1.26	0.51	1.30	0.52
T_9 Boiling water (5 m)	85.66 (67.75)	33.33 (35.26)	1.23	0.76	1.33	0.78
T_{10} Mini sachet method (5 days)	40.33 (39.42)	31.00 (33.83)	0.88	0.68	0.90	0.71
SEm±	**14.88**	**4.01**	**0.34**	**0.09**	**0.34**	**0.1**
CD @ 5%	**43.9**	**11.82**	**0.99**	**0.25**	**1.01**	**0.28**

* - Figures in parenthesis are arc sign transformed values

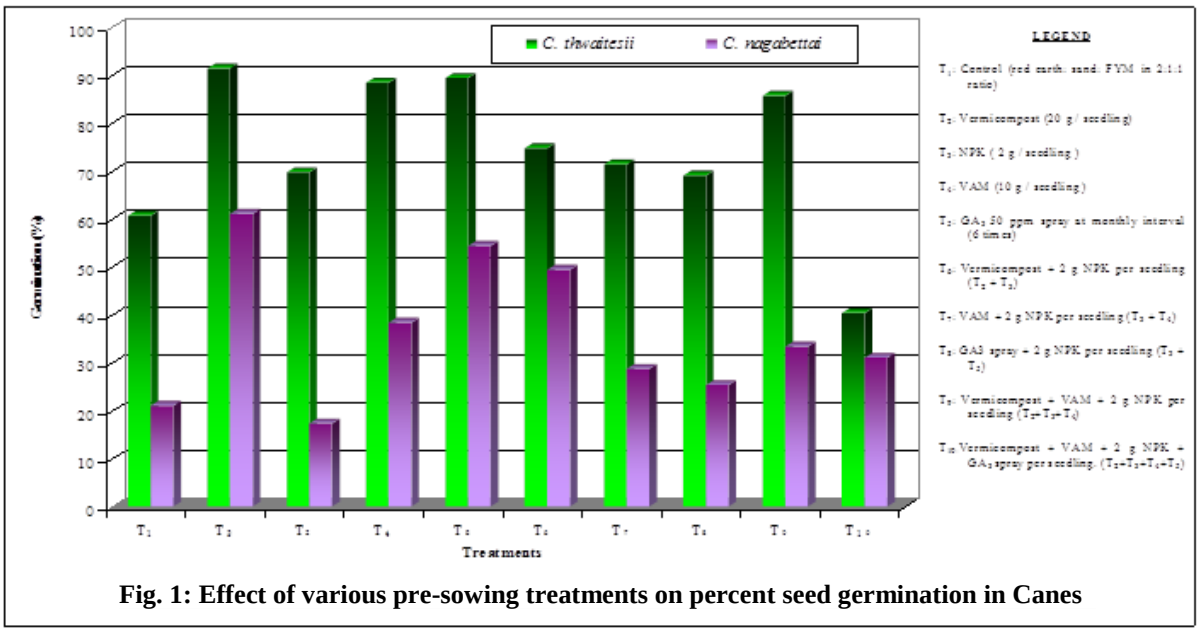

Fig. 1: Effect of various pre-sowing treatments on percent seed germination in Canes

Table 2: Effect of various pre-sowing treatments on germination value, rate of germination and root length attributes in *C. thwaitesii* and *C. nagabettai*

Treatments	Germination value		Rate of germination		Seedling dry weight (g)	
	C. thwaitesii	***C. nagabettai***	***C. thwaitesii***	***C. nagabettai***	***C. thwaitesii***	***C. nagabettai***
T_1 Control	1.43	0.24	1.12	0.50	0.18	0.32
T_2 Removal of Sarcotesta	3.32	1.51	1.68	1.93	0.93	0.50
T_3 Removal of Hilum	1.86	0.18	1.25	0.40	0.70	0.39
T_4 GA_3 500 ppm (8 h)	3.13	0.76	1.56	0.87	0.78	0.44
T_5 GA_3 1000 ppm (8 h)	3.25	1.26	1.57	1.23	0.79	0.47
T_6 Sand scarification	2.17	1.11	1.29	0.93	0.50	0.43
T_7 KNO_3 2 % (8 h)	2.17	0.40	1.30	0.53	0.64	0.40
T_8 Cow dung slurry (5 days)	1.63	0.26	1.25	0.55	0.72	0.35
T_9 Boiling water (5 m)	1.63	0.59	1.49	0.63	0.74	0.38
T_{10} Mini sachet method (5 days)	0.79	0.48	0.82	0.64	0.12	0.41
SEm±	**0.25**	**0.08**	**0.07**	**0.07**	**0.07**	**0.05**
CD @ 5%	**0.74**	**0.23**	**0.21**	**0.21**	**0.21**	**0.14**

Table 3: Effect of various pre-sowing treatments on shoot length, seedling vigour index and seedling dry weight in *C. thwaitesii* and *C. nagabettai*

Treatments	Shoot length (cm)		Root length (cm)		Seedling vigor index	
	C. thwaitesii	*C. nagabettai*	*C. thwaitesii*	*C. nagabettai*	*C. thwaitesii*	*C. nagabettai*
T_1 Control	7.96	7.60	17.07	8.20	1518	331
T_2 Removal of Sarcotesta	12.95	9.53	21.64	10.60	3159	1214
T_3 Removal of Hilum	8.44	7.90	19.02	8.60	1912	279
T_4 GA_3 500 ppm (8 h)	10.32	8.80	20.96	10.00	2762	720
T_5 GA_3 1000 ppm (8 h)	11.69	9.00	21.36	10.80	2952	1075
T_6 Sand scarification	9.97	8.70	20.00	10.20	2237	938
T_7 KNO_3 2 % (8 h)	8.72	8.50	17.71	10.00	1885	530
T_8 Cow dung slurry (5 days)	8.50	8.20	19.33	8.70	1905	428
T_9 Boiling water (5 m)	10.47	8.50	20.33	9.60	2640	603
T_{10} Mini sachet method (5 days)	6.52	8.70	16.87	9.50	944	564
SEm±	**1.06**	**0.49**	**1.46**	**0.56**	**247**	**74**
CD @ 5%	**3.14**	**1.45**	**4.29**	**1.66**	**731**	**218**

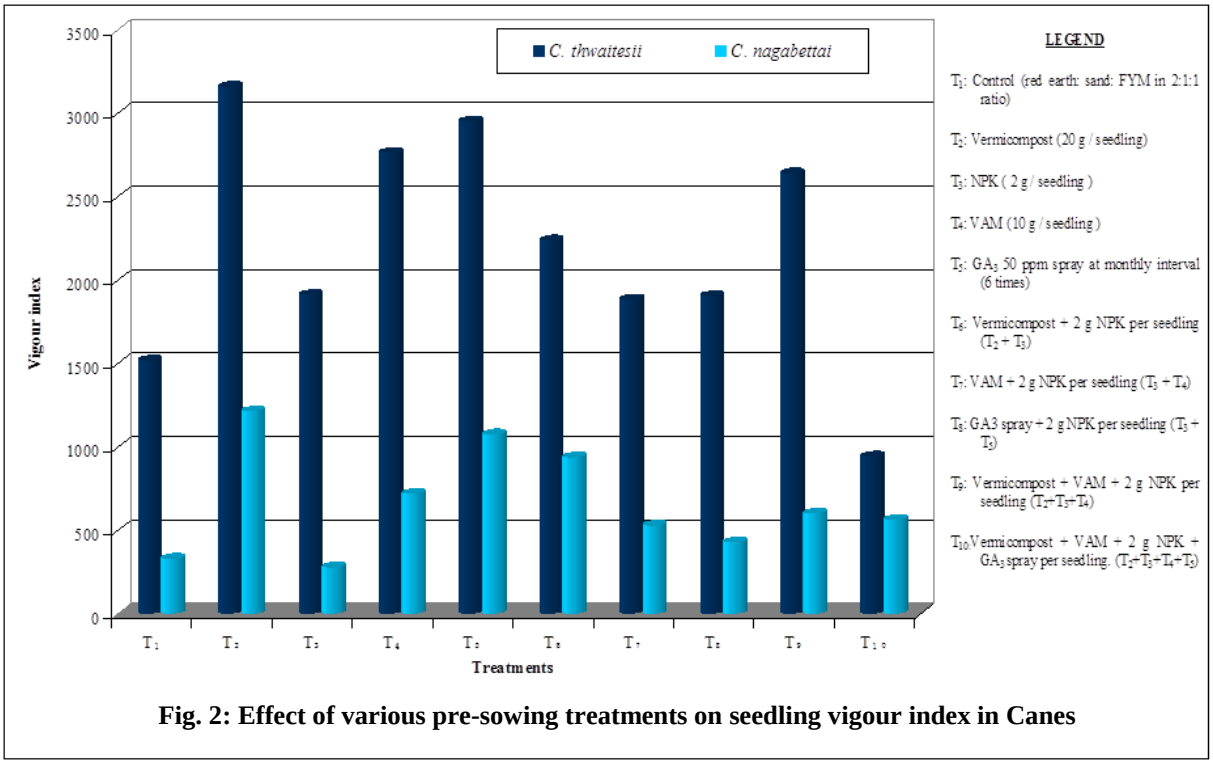

Fig. 2: Effect of various pre-sowing treatments on seedling vigour index in Canes

Plate 1: A view of (A) *Calamus thwaitesii* (B) fruits of *Calamus thwaitesii* (C) *Calamus nagabettai* tree in natural habitat (D) fruits of *Calamus nagabettai*

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