THE INFLUENCE OF SOME GROWTH REGULATORS ON THE SEED GERMINATION OF *DENDROCALAMUS STRICTUS* NEES.

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Introduction

India is one of the leading bamboo producers in the world, second only to China, producing 32,30,000 tonnes of bamboos annually. There are about 124 indigenous and exotic species of bamboos, belonging to 23 genera (Sharma, 1987). It covers an area of about 10.03 million ha that constitutes about 12.8% of the total area of forest cover in India. *Dendrocalamus strictus* is an important species, covering about 53% of the total bamboo area in India largely in Uttar Pradesh, Madhya Pradesh, Uttarakhand, Orissa, Himachal Pradesh and the Western Ghats.

Dendrocalamus strictus is widely distributed in semi-dry and dry zone along plains and hilly tracts to an altitude of 1,000 m amsl in India. *D. strictus* has a high adaptability; it can tolerate temperature as low as –5°C and as high 45°C (Anon., 2001). In natural conditions, this species is found in drier open deciduous forests. *Dendrocalamus strictus* is extensively used as raw material in paper mills, construction, agricultural implements, musical instruments and furniture etc. Young shoots are generally used as food and a decoction of leaves, nodes and silicaceous matter is used in traditional medicines.

Propagation through seed in *Dendrocalamus strictus* is difficult due to unreliable flowering habit at an interval of 30 to 100 years and quick loss of viability. But it is not uncommon to find reports of bamboo propagation by using seeds and macro-proliferation of seedlings to increase numbers in *Bambusa tulda* (Banik, 1987); *D. strictus* (Kumar, 1991; *D. hamiltonii* (Kumar *et al*., 1991). Details of the studies on *in-vitro* seed germination of *D. strictus* are provided in recent publications by Reddy (2006), Saxena and Dhawan (1991), Rao *et al.* (1985, 1990), Raut and Das (1994) and Ravikumar *et al*. (1998), where a large number of plantlets are produced either through micro-proliferation or somatic embryogenesis. However, this is an expensive technique and requires skills. As availability of seeds across the country for this species is common, therefore, the present studies were carried out to enhance seed germination by subjecting seeds to different Plant Growth Regulators (PGR) treatments. Accelerated ageing was developed as a test to estimate the longevity of seeds under a range of storage conditions (Helmer, 1962). Therefore, in the present studies in order to enhance seed germination, some plant growth regulators have been used at different concentrations.

Material and Methods

The field work was carried out for a period of one year at the experimental farm area of Biodiversity, Institute of Himalayan Bioresource Technology (CSIR) Palampur (H.P.), located at 1,350m amsl at 32° 06' 05"N lat. and 76° 34' 10" E long. situated in the mid-hills of Himachal Pradesh, India. Fresh seeds of *Dendrocalamus strictus* Nees were procured from the H.P. State Forest Department, Solan.

The experiments were laid out on 16 June 2005, using 3 plant growth regulators viz. Indole-3 Acetic Acid (IAA), Indole-3 Butyric Acid (IBA) and Nephthalene Acetic Acid (NAA) at three concentrations i.e. 100, 200 and 500 mg /l. One hundred seeds were taken for each treatment and it was replicated thrice in each case. The seeds were carefully dehusked manually and immersed in water for 5 minutes. All floating seeds were discarded and the sinkers were selected for use in the experiment. These seeds were then dipped upto 15 minutes in each concentration and sown in the polysleeves containing a mixture of garden soil: sand and well rotten FYM in the ratio of 1 : 1 : 1. The polysleeves were kept in a polyhouse under controlled conditions having an average temperature of 25° 2°C and RH (65%). Seed germination was started within 5 days of sowing in each treatment. The data on parameters like germination percentage stem height, root length, number roots and leaves per plant were recorded at weekly intervals up to one month of seed germination. The plants were then transferred to open field conditions. These plants were maintained for one year and data recorded for various parameters. Regular weeding and hoeing operations were also carried out.

Observations

The maximum seed germination (68.89%) was recorded in IBA (Table 1a) while IAA and NAA recorded 60% germination. Control showed only 52.33% seed germination. In the case of stem height (Table 1a), although maximum height was recorded in IAA (23.92 cm) treated seedlings, all growth regulators were found to be statistically significant. Parameters related to the number of leaves were also statistically significant. The seed germination was found to be statistically significant (Table 1b) and generally in an increasing order with increase in auxin concentrations. However, after one year, the results were statistically non-significant (Table 1b) at all concentrations of growth regulators for parameters related to plant height and number of tillers each plants produces.

Discussion

Seeds have always been a preferred mode of propagation for many forest species and bamboos are no exception. Long and irratic flowering behaviour, low viability and being a preferred food for rodents, are some of the reasons why studies on enhancing seed germination are important for restoration and rejuvenation of bamboo forests which already have shown a decline in the recent years. The newly launched National Mission on Bamboo application (TIFAC, DST) has a focus on this method of propagation as it can be adopted by farmers/ foresters easily.

Even in the past, many workers have made attempts to study *in-vitro* seed germination in different types of bamboos for large-scale propagation (White, 1963; Mascarenhas *et al*., 1975; Mehta *et al*.,

Table 1(a)

Influence of growth regulators on the seed germination, plant height, number of leaves per plant and number of tillers per plant in Dendrocalamus strictus Nees.

PGRs	After one month of germination					After one Year	
	Germination (%)	Shoot ht. (cm)	No. of leaves/ plant	Root length (cm)	No. of Roots/ plant	Plant ht. (cm)	No. of tillers/ plant
IAA	59.56	23.92	5.67	4.98	3.81	63.96	4.0
IBA	68.89	20.87	6.26	6.40	5.63	53.81	3.8
NAA	60.33	21.85	6.11	5.00	4.67	50.22	3.3
Control	52.33	20.41	6.00	4.47	4.67	38.56	2.3
LSD (P=0.05)	2.090	0.250	0.093	0.10	0.16	2.279	0.3

Table 1(b)

Influence of concentrations on the seed germination, plant height, number of leaves and number of tillers per plant in Dendrocalamus strictus Nees. (after one year)

Concen-trations (IAA, IBA, NAA)	After one month of germination					After one Year	
	Germination (%)	Shoot ht. (cm)	No. of leaves/ plant	Root length (cm)	No. of Roots/ plant	Plant ht. (cm)	No. of tillers/ plant
100 mg/l	56.667	21.955	6.250	5.04	4.33	48.528	3.4
200 mg/l	58.250	20.848	5.916	5.21	4.61	51.028	3.4
500 mg/l	65.917	22.480	5.860	5.38	5.14	55.362	3.2
LSD (P=0.05)	1.810	0.216	0.081	NS*	0.14	NS	NS

* NS = Non-significant

1982; Nadgir *et al.,* 1984; Banik, 1987; Saxena, 1990; Chang, 1991; Chaturvedi and Bhatia 1993; Bag *et al*., 2000; Sood *et al*., 2002). Muthukumar and Udaiyan (2006) have reported the importance of fungal association with nursery-grown bamboos.

It is a well known fact that auxins play an important role in seed germination and later induction of roots in many bamboo species (Nadgir *et al*., 1984 and Saxena 1990). In the present studies, IAA induced 59.56% seed germination and maximum shoot height (Table 1a), whereas IBA showed best results in terms of seed germination. Further, Singh *et al.* (2004), have reported a simple method for large scale propagation in *Dendrocalamus asper* and have shown

the effectiveness of growth regulator (IAA, IBA and NAA) treatments which corroborate our results.

The seed viability of *Dendrocalamus strictus* is reported to be six months only and continuously deteriorated up to one year. Roberts (1972) concluded that depletion of essential metabolites, including loss of food reserves, is one of the important factors responsible for loss in seed viability. Prolonged moist storage leading to fungal infection might be responsible for further loss of viability (King and Roberts, 1979). Ravikumar *et al*. (2002) have shown the initial germination percentage of 73% in *Dendrocalamus strictus* seed using White's basal medium with IBA supplementation but declined during further ageing. Appasamy (1993) tried seed germination of *Dendrocalamus strictus* in normal conditions. He has reported 25 to 30 % as germination without using any controlled condition, the seed germination in *Dendrocalamus strictus*. Further, Appasamy (1993) has reported that by using 200 mg/l IBA in *ex-vitro* conditions has resulted 85 to 90 % rooting in *Dendrocalamus strictus*.

Conclusion

The present study has shown that the treatment of seeds with growth regulators increased seed germination and better growth performance in all selected parameters in *D. strictus*.

SUMMARY

The influence of growth regulators IAA, IBA and NAA on the seed germination of *Dendrocalamus strictus* Nees at three different concentrations i.e., 100, 200 and 500 mg/l has been studied. The germination percentage, stem height, root length, number of roots and leaves per plant were recorded after one month of germination and after one year. The maximum germination (about 69%) was recorded in IBA while in control, it was 52%. On the basis of statistically analysed parameters, it was found that all the growth regulators IAA, IBA and NAA were statistically significant in terms of germination percentage; stem height, root length, number of roots and leaves per plant. As the parameters were recorded after one year, the plant height and number of tillers per plant were also found to be statistically significant. In terms of concentrations, all the concentrations were also statistically significant along with stem height and root length. While these parameters i.e., plant height and number of tillers per plant were statistically non-significant after one year. The experiments were conducted in polysleeves with single seed in each sleeve.

***Key words* : *Dendrocalamus strictus*, Seedling germination, Growth regulators.**

डैण्ड्रोकैलेमस स्ट्रिक्टस नीज़ की बीजों के अंकुरण पर कुछ वृद्धिविनियामकों से पड़ता प्रभाव

गोपी चन्द व अनिल सूद

सारांश

तीन विभिन्न संकेन्द्रणों अर्थात 100, 200 और 500 मिग्रा/लि में इण्डोल एसेटिक अम्ल, इण्डोल ब्युटिरिक अम्ल और न्यूक्लिइक एसेटिक अम्ल वृद्धिविनियामकों से *डैण्ड्रोकैलेमस स्ट्रिक्टस* के बीजों के अंकुरण पर पड़ते प्रभाव का अध्ययन किया गया। अंकुरण होने के एक महीने और एक वर्ष के उपरान्त अंकुरण प्रतिशत, तने की ऊँचाई, जड़ की लम्बाई प्रति पौधे, जड़ों और पत्तियों की संख्या आलेखित की गई। अधिकतम अंकुरण (लगभग 69%), इण्डोल ब्यूटिरिक अम्ल प्रयोग से मिला जबकि नियामक (कण्ट्रोल) में यह 52% पाया गया। सांख्यिकीय दृष्टि से परिमापों के किए विश्लेषण के आधार पर यह पाया गया कि सभी वृद्धिविनियामक, इण्डोल एसेटिक अम्ल,

इण्डोल ब्यूटिरिक अम्ल और न्यूक्लिइक एसेटिक अम्ल, जहां तक अंकुरण प्रतिशत, तने की ऊंचाई, जड़ की लम्बाई, प्रति पौधे जड़ों और पत्तियों की संख्या का प्रश्न है, सांख्यिकीय दृष्टि से सार्थक पाए गए। जब इन परिमापों को एक वर्ष के बाद आलेखित किया गया तो पौधों की ऊंचाई और प्रति पौधे प्ररोहों की संख्या भी सांख्यिकीय दृष्टि से सार्थक निकली। जहां तक संकेन्द्रणों का प्रश्न है, सभी संकेन्द्रण तने की ऊंचाई और जड़ की लम्बाई की दृष्टि से सांख्यिकीतः सार्थक निकले। पौधे की ऊंचाई और प्रति पौधे प्ररोहों की संख्या परिमाप एक वर्ष उपरान्त सांख्यिकीय दृष्टि से कुछ ज्यादा खास अच्छे या सार्थक नहीं पाए गए। ये संपरीक्षण पोलिथीन थैलियों में प्रत्येक थैली में एक–एक बीज डालकर कराए गए थे।

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