Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 830-832
Received: 17-11-2019
Accepted: 19-12-2019

Kumar BS
College of Forestry, SHUATS, Prayagraj, Uttar Pradesh, India

Abdul Nasir
Assistant Professor, Nangarhar University Agriculture Faculty, Department of Horticulture, Afghanistan

Gyanaranjan Sahoo
College of Forestry, SHUATS, Prayagraj, Uttar Pradesh, India

Afaq Majid Wani
Head & Associate Professor, Dept. of Forest Biology & Tree Improvement, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Afaq Majid Wani
Head & Associate Professor, Dept. of Forest Biology & Tree Improvement, SHUATS, Prayagraj, Uttar Pradesh, India

Integrated nutrient management for production of quality seedling production in *Dendrocalamus strictus* (Roxb.) Ness

Kumar BS, Abdul Nasir, Gyanaranjan Sahoo and Afaq Majid Wani

Abstract
An experiment was carried out for quality seedling production in nursery experiment at three levels of INM combinations viz., N, P_2O_5 and K_2O (2.0, 1.25, 1.25; 1.5, 0.938, 0.938; 1.0, 0.625, 0.625 g kg^{-2} of soil) applied as urea, Single Super Phosphate and Muriate of Potash along with FYM (500 g) and biofertilizers viz., VAM, *Azospirillum* each @ 40, 20 g kg^{-2} of soil respectively were evaluated with unfertilized control. The results revealed that integration of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil supplemented with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) significantly enhanced the growth parameters *viz.*, shoot length and number of leaves, root length and collar diameter, dry matter, volume index and quality index of *D. strictus* seedlings over control.

Keywords: Bio-Fertilizers, VAM, FYM, *Azospirillum, Dendrocalamus strictus*

Introduction
Bamboo is a wonderful gift of nature. Bamboo species are giant, woody tree like grasses and have a long history and widely used renewable bioresource. Modern scientific research on bamboo has a history of more than 150 years. The comprehensive utilization of bamboo was extensively observed in China, Japan and Korea, where the industries related to bamboo carbon and bamboo distillate has reached large scale levels. In India the main focus of utilization of the abundant bamboo resource especially in natural forests has been for pulp. Both American and African continents have substantially lower bamboo species richness compared to Asia. The range of uses of bamboo for humans is remarkable, with an estimated annual use of 12 kg of bamboo produce per capita in Asia (Recht and Wetterwald, 1994) [7]. Besides some minor uses such as leaves for medical purposes (Zhang, 1997) [10], fresh edible shoots, and culms for timber or a raw material for pulping are the major products from bamboo. While supplying products of immediate use of humans, bamboo also serves multiple ecological functions such as soil and water conservation and erosion control (Fu and Banik, 1995) [2]. Due to its great potential for rapid biomass production (Pearson *et al*., 1994) [6], bamboo is a significant net sink of global CO_2 (Jones *et al*., 1992) [4]. Although wasteland tracts in south and southern Asia are covered with bamboo and area planted to bamboo is increasing in China by 51,000 ha/year (Li and Xu, 1997) [5], there is rising concern about acute scarcity of bamboo products in the future (Hsiung, 1988) [3]. In India it is projected that at the current level of bamboo productivity for paper industry and with the growing demand for paper, an additional 30-60 million ha of land would be required by 2015 (Adkoli, 1991) [1].
The plethora of its uses in the human economy has led to the coinage of a variety of names for this superb species. The Vietnamese call it *'my brother'*, the Chinese *'Friend of the people'* and in India it is widely known as *'Green gold"* or *'Poorman's timber'*. Bamboo is a tall arborescent grass belonging to the family Bambusae, a tribe of Poaceae (Gramineae) is indigenously found in all the continents except Europe. It is reported that over 75 genera and 1250 species of bamboos occur in the world whereas, 43 species belonging to 14 genera are found in Africa.
Dendrocalamus strictus it is middle sized, densely tufted bamboo, often gregarious, sub-deciduous, culms attaining 8-16m height 2.5-8 cm diameter according to the locality. Young culms are pale blue-green, dull green or yellowish when old, nodes somewhat swollen, basal nodes often rooting, lower nodes often with branches; internodes 30-45 cm long, thick walled. Culms are almost solid in dry areas and hollow with thick walls in moist areas.

Materials and Methods
Nursery studies were carried out to for production of quality seedling through integrated nutrient management of *Dendrocalamus strictus.* The experiment was laid out in completely

Randomized Design (CRD) Snedecor and Cochran (1967) [8], with five treatments and five replications at College of Forestry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. In the present experiment seed management techniques and INM were taken. The polythene bags of size 25 x 20 cm were filled with two kg of soil. The bags were arranged in a Completely Randomized Design with five replications @ 100 polythene bags treatment^{-1} replication^{-1}. The seeds of *D. strictus* were sown in mother bed size of 10 x 1 m. Healthy seedlings were transplanted uniformly @ one seedling bag^{-1} on 30th DAS. The irrigation and plant protection measures were given as per recommendations. The soil mixture was 2:1:1 (Soil: Sand: FYM) used for poly bags (Wani *et al*., 2018) [9]. The calculated quantity of bio fertilizers (VAM and *Azospirillum*) were added to the respective poly bags as per the treatment schedule at transplanting. The inorganic fertilizers were added as aqueous solution to each poly bag seven days after transplanting. The experiment and treatment details are furnished in Table 1. The biometric observations *viz.,* shoot length (cm), root length (cm), collar diameter (cm), number of leaves, were recorded at 60, 90 and 120 days after transplanting (DAT) @ three seedlings/ treatment/replication.

Results and discussion

Effect of Integrated Nutrient Management (INM) On Seedling Quality

The shoot length of *D. strictus* seedlings significantly varied at all the three stages and the highest shoot length of 65.67 cm was recorded with the application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil along with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) at 120 DAT followed by the application of 2 g of N, 1.25 g of P_2O_5 and 1.25 g of K_2O kg^{-2} soil supplemented with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_3) (54.41cm). The lowest shoot length of 28.83 cm was observed in control at 120 DAT. All the treatments followed the same trend at 60 and 90 DAT as well the different levels of treatments registered a significant effect on root length of *D. strictus*. Application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil along with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) rated to be the best by recording the highest root length of 29.55, 51.33 and 64.61 cm at 60, 90 and 120 DAT, respectively. The lowest root length of 32.25 cm was observed in control at 120 DAT. Collar diameter exhibited a significant variation among the stages and treatments. Application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil along with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) recorded the highest collar diameter of 2.97 cm followed by 2 g of N, 1.25 g of P_2O_5 and 1.25 g of K_2O kg^{-2} soil along with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_5) with the value of 2.08 cm. The lowest collar diameter of 1.21 cm was observed in control at 120 DAT. The Number of leaves ranged from 13.20 to 29.00, 17.2 to 36.0 and 24.6 to 45 at 60, 90 and 120 DAT, respectively. Application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil combined with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) ranked first at 60, 90 and 120 DAT, recording 29.1, 36.1 and 45.1 number of leaves, respectively. Control recorded the lowest number of leaves at all the stages 13.3, 17.3 and 24.7 (Table 2).

Effect of INM on dry matter production at various stages of seedling growth

Shoot dry weight all the treatments had a profound influence in enhancing the shoot dry matter, while control recorded the least value of 0.977, 1.472 and 1.939 g seedling^{-1} respectively at 60, 90 and 120 DAT, all other treatments proved to be better than control. The shoot dry matter was higher with the application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} soil supplemented with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4), recording 3.165, 3.917 and 4.660 g seedling^{-1} respectively at 60, 90 and 120 DAT (Table 3). Root dry weight Among the treatments, the performance of the integrated application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil combined with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) was the best at all the stages by recording the highest root dry matter value of 2.731, 3.286 and 3.955 g seedling^{-1} for 60, 90 and 120 DAT, respectively, 2 g of N, 1.25 g of P_2O_5 and 1.25 g of K_2O kg^{-2} soil associated with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_3) with the value of 3.352 g seedling^{-1} at 120 DAT. The control recorded the lowest root dry matter of 1.866 g seedling^{-1} at 120 DAT (Table 3).

There was a significant difference in total dry matter production of *D. strictus* seedlings as affected by the treatments at all stages of observation. Application of 1.5 g N, 0.938 g of P_2O_5 and 0.938 g of K_2O kg^{-2} of soil along with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_4) recorded higher value of 8.617 g seedling^{-1} at 120 DAT, which was followed by the application of 2 g of N, 1.25 g of P_2O_5 and 1.25 g of K_2O kg^{-2} of soil supplemented with FYM (500 g), VAM (40 g) and *Azospirillum* (20 g) (T_3) recorded 7.132 g seedling^{-1} g. The control remained to be inferior to all other treatments by recording 1.927, 2.884 and 3.807 g seedling^{-1} at 60, 90 and 120 DAT, respectively. The individual application of inorganic fertilizers proved its superiority over control, but could not stand before any of the integrated nutrient management treatments (Table 3).

Conclusion

Considering the above findings regarding nutrient management studies, T4 - (1.5 g N, 0.938 P_2O_5 and 0.938 K2O + FYM (500 g) + VAM (40 g) + *Azospirillum* (20 g) has given maximum growth and biomass production and uptake of nutrients under nursery condition for production of quality seedling production in *Dendrocalamus strictus* (Roxb.) Ness.

Table 1: Pass port details INM Treatment

S. No.	Treatments	Particulars (kg^{-2} soil of pot mixture)
1.	T_1	Control
2.	T_2	2 g N, 1.25 g P_2O_5 and 1.25 g K_2O alone
3.	T_3	2 g N, 1.25 g P_2O_5 and 1.25 g K_2O + FYM (500 g) + VAM (40 g) + *Azospirillum* (20 g)
4.	T_4	1.5 g N, 0.938 P_2O_5 and 0.938 K_2O + FYM (500 g) + VAM (40 g) + *Azospirillum* (20 g)
5.	T_5	1 g N, 0.625 P_2O_5 and 0.625 K_2O + FYM (500 g) + VAM (40 g) + *Azospirillum* (20 g)

Table 2: Effect of INM on shoot length (cm) and root length (cm) of *D. strictus* seedlings

Treatment	Shoot length (cm)			Root length (cm)		
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT
T_1	16.15	21.66	28.83	19.41	25.47	32.25
T_2	19.45	26.13	37.07	22.77	33.53	36.01
T_3	20.72	28.81	54.41	26.37	40.69	53.25
T_4	25.81	31.73	65.67	29.55	51.33	64.61
T_5	18.93	28.23	45.73	13.25	36.65	46.15
SEd	0.68	0.71	0.65	0.82	1.26	1.24
CD (P=0.05)	1.41	1.53	1.33	1.71	2.63	2.58

Table 3: Effect of INM treatments on collar diameter (cm) and number of leaves of *D. strictus* seedlings

Treatment	Collar diameter (cm)			Number of leaves		
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT
T_1	0.84	1.05	1.21	13.3	17.3	24.7
T_2	1.16	1.46	1.93	18.1	27.3	32.1
T_3	1.55	1.81	2.21	24.3	28.5	36.7
T_4	2.06	2.26	2.97	29.1	36.1	45.1
T_5	1.39	1.61	2.08	20.3	23.9	33.5
SEd	0.04	0.05	0.06	1.08	1.05	1.17
CD (P=0.05)	0.09	0.09	0.12	2.27	2.16	2.36

References

1. Adkoli NS. Bamboo in the Indian pulp industry. In: Proceedings of the 4th International Bamboo Workshop on Bamboo in Asia and the pacific, Chiangmai, Thailand. 27-30 No. 1991. Forest, Research Support Programme for Asia and the pacific, Bangkok, Thailand, 1991.
2. Fu MY, Banik RL. Bamboo production systems and their management. In; Bamboo, people and the environment. Proceedings of the Vth International Bamboo Congress, Ubod, Bali, Indonesia, 19-22 Propagation and management International Network for bamboo and Rattan, New Delhi, India. 1995; 1:18-33.
3. Hsiung WY. Prospects for Bamboo development in the world. J Am. Bamboo Soc. 1988; 8:168-178.
4. Jones MB, Long SP, Roberts MJ. Synthesis and conclusions. In: primary productivity of grass ecosystems of the tropical and sub tropics. Chapman and Hall, London, U.K., 1992, 212-225.
5. Li SD, Xu CD. The history of Chinese bamboo industry and the challenge for development in 21st century. In: Bamboo towards 21st century, 7-11 Sept. 1997, Research institute of subtropical forestry, Chinese Academy of Forestry, Anji, Zhejiang, P.R. China, 1997, 4.
6. Pearson AK, Pearson OP, Gomez IA. Biology of Bamboo chusquea culeou (Poaceae: Bambusoideae) In Southern Argentina. 1994; 3:93-126.
7. Recht C, Wetterwald MF. Bamboos. Timber Press, Portland, Oregon, 1994.
8. Snedecor GW, Cochran WG. Statistical methods. 6th Edn. Oxford and IBH Publishing Co., Ets. Press. Kolkota, 1967.
9. Wani Afaq Majid, Lipoksanen Jamir L, Prakash Rai. Effects of IBA, NAA and GA3 on rooting and morphological features of *Ginkgo biloba* Linn. Stem cuttings Journal of Pharmacognosy and Phytochemistry. 2018; 7(3):1894-1896.
10. Zhang Y. Bio-antioxidative activity of functional factors in bamboo leaf In "Paper Summaries, International Bamboo Towards 21st Century, 7-11 September 1997" (M.-Y.Fu, and Y.-P. Lou, Eds.), p.26. Research institute of subtropical Forestry Chinese Academy of Forestry, Anji Zhejilang, P.R. China, 1997.