Chemical Science Review and Letters ISSN 2278-6783

Research Article

Assessing the Requirement of Mineral Nutrients of Pteridophytes of Vindhyan Region (Madhya Pradesh)

Anamika Pathak[1]*, Naveen Gaurav[2]*, Anoop Singh[3], Arun Kumar[4], and A. P. Singh[5]

[1]Awadhesh Pratap Singh University, Rewa, Madhya Pradesh
[2,4]Sri Guru Ram Rai Post Graduate College, Dehradun, Uttarakhand
[3]Jaiprakash Associates Ltd. Jaypee Sidhi Cement Plant Baghwar, Rewa, Madhya Pradesh
5Govt. P.G. Science College, Rewa, Madhya Pradesh

Abstract

Nitrogen is required to develop proper green color in ferns. Nitrogen and other necessary nutrients, such as potassium can be obtained by ferns from compost mulch, peat and other organic material. A fertilizer containing 100 parts per million of nitrogen in a balanced 15:5:15 formula having equal amount of ammonia and nitrate helps in the development of leaf colour in ferns. Addition of peat to the soil especially when growing potted ferns also promotes fern growth. The primary macronutrients: nitrogen (N), phosphorus (P), potassium (K) are needed the growth of ferns. The three secondary macronutrients: calcium (Ca), sulphur (S), magnesium (Mg) are also important for growth of fern and fern allies. The micronutrients/trace minerals: which requires by pteridophytes are boron (B), chlorine (Cl), manganese (Mn), iron (Fe), zinc (Zn), copper (Cu), molybdenum (Mo), nickel (Ni).

Keywords: Necessary nutrients, Macronutrients, N, P, K, Ca, S. Mg, Micronutrients, B, Cl, Mn, Fe, Zn, Cu, Mo, Ni

***Correspondence**

Author: Anamika Pathak, Naveen Gaurav
Email: anamika5june@gmail.com, naveensri17@gmail.com

Introduction

Ferns have been cultured *in vitro* to study their growth, development or differentiation and to achieve their micropropagation due to their ornamental value. Several species of ferns have successfully been propagated by application of minerals. Application of *in vitro* culture methods could contribute to increase sporophyte production of those desirable species. At the present time, a high number of individual researches are oriented towards the propagation of pteridophytes with a view to conserve their diversity. The culture of tissue in ferns has been utilized as research instrument for the study of the developing potentialities of the leaf primordia ever since the early 1960's. The first success was seen around 1970 in the field of the intensive multiplication of plants through *in vitro* techniques. The fern Nephrolepis exaltata bostoniensis was the first plant that was micropropagated *in vitro* for commercial purpose. Growth habit of Pteridophytes thrives in a wide range of habitats from open grasslands and mountain slopes to moist shaded condition. They also have varied growth habits; many are terrestrial, a few are aquatic. A number of species grow well on trunks of trees as epiphytes and in die cracks and crevices of rocks and boulders as lithophytes. An attempt has been made to culture local pteridophytes in vitro in order to save the plant from extinction. Therefore, in vitro culture and subsequent regeneration of sporophytes from the spore culture of the ferns will be very much helpful for mass cultivation as well as screening of phytochemicals present in the plant. It was reported that supplementation of phytohormones mainly auxins (Indole-3-Acetic Acid) is favourable for sporophyte development from prothallus. Further growth and differentiation of the prothallus and sporophyte were published with various hormone concentrations and combinations [1]. After that so many research workers reported the hyperaccumulation properties of pteris and many other ferns. Several species of Salvinia such as Salvinia herzogii, Salvinia minima, Salvinia natuans, Salvinia rotundifolia have the potential of removing various contaminants including heavy metals from the waste water. Sushruta (*ca* 100AD) and Charka (ca 100 AD) described the medicinal uses of some ferns in Sanhitas in Ayurvedic systems of medicine. Pteridophytes are also used by the physicians in medicine system of Unani [2]. In medicinal treatment of China, many pteridophytes are also prescribed by physicians [3]. Later on modern pharmaceutical and biological studies were carried out on pteridophytes by several scientists [4-10]. Fern and

fern allies being fascinating group of pteridophytes are mostly distributed in Eastern Ghats, Western Ghats and Himalaya,. The present status of the pteridophytes belonging to 95 genera and 34 families having about a 272 species were reported from southern Western Ghats. Out of them most of the species are reported listed in the category of endemic and rare species. Conservation of pteridophytes are in needed in the Western Ghats region as reported by Maridass & Raju [11].

Materials and Methods

The micronutrients are provided in the pots for general growth of pteridophytes. The plants material and growth parameters were taken for measurement. The pteridophytic plants (ferns and fernallies) were collected in its fertile stage from its natural habitat. During the survey it was observed that tribal and local people of the region widely use and sell the pteridophytes in the local market. These plants grow luxuriantly in rock crevice and boulders near water stream in moist and shady places. Description of species and identification were done with the help of literature cited by Khullar [12].

Results and Discussion

Effect of mixture ratio 2:1:1 of NPK in stem growth was recorded 4.50±0.059 mm with 15 days time period while it was recorded 4.80±0.072 mm for 30 days time period. Mixture ratio 3:1:1 of NPK in stem growth was recorded 7.80±0.125 mm with 15 days time period while it was recorded 7.90±0.142 mm for 30 days time period, and mixture ratio of 4:1:1 of NPK in stem growth was recorded 8.10±0.170 mm for 15 days while it was recorded 8.32±0.200 mm for 30 days time period. Mixture ratio of 5:1:1 of NPK in stem growth was 9.20±0.239 mm for 15 days while it was recorded 9.45±0.265 mm for 30 Days. The stem growth value increases in different mixture ratio of NPK for 15 days & 30 days time period. These results that different mixture ratio of NPK is effective in stem growth. The results are tabulated in **Table 1** (**Figure 1a, 1b,** and **1c**)

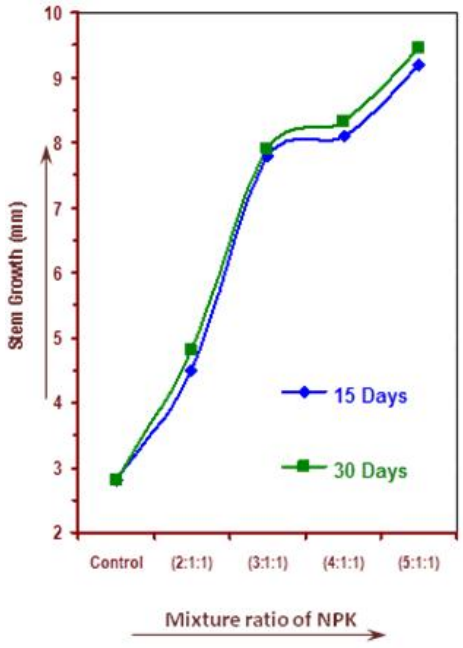
Table 1 Mineral requirements for the growth of Ophioglossum sp. of Vindhyan region

S.No.	Time period (days)	Mixture ratio of NPK	Growth Parameter		
			Stem (mm)	Leaf (mm)	Undergroung Parts (mm)
1.	2.	3.	4.	5.	6.
		Control	2.80 ±0.031	1.90 ±0.021	2.45 ±0.027
1.	15 Days	(2:1:1)	4.50 ±0.059	2.11 ±0.027	3.40 ±0.044
		(3:1:1)	7.80 ±0.125	2.80 ±0.045	4.52 ±0.081
		(4:1:1)	8.10 ±0.170	2.90 ±0.052	5.24 ±0.147
		(5:1:1)	9.20 ±0.239	2.95 ±0.062	5.20 ±0.125
2.	30 Days	(2:1:1)	4.80 ±0.072	2.25 ±0.034	3.50 ±0.053
		(3:1:1)	7.90 ±0.142	3.10 ±0.074	4.10 ±0.066
		(4:1:1)	8.32 ±0.200	3.15 ±0.082	5.20 ±0.135
		(5:1:1)	9.45 ±0.265	3.20 ±0.090	5.10 ±0.107

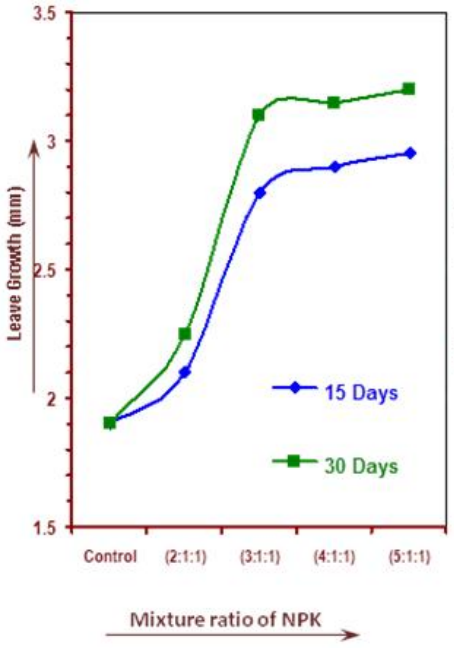
Effect of mixture ratio of NPK in leaf growth has shown promising results. Effect of mixture ratio 2:1:1 of NPK in leaf growth was recorded 2.10±0.027 mm with 15 days time period while it was recorded 2.25±0.034 mm for 30 days time period. Mixture ratio 3:1:1 of NPK in leaf growth was recorded 2.80±0.045 mm with 15 days time period while it was recorded 3.10±0.074 mm for 30 days time period, and mixture ratio of 4:1:1 of NPK in leaf growth was recorded 2.90±0.052 mm for 15 days while it was recorded 3.15±0.082 mm for 30 days time period. Mixture ratio of 5:1:1 of NPK in leaf growth was 2.95±0.062 mm for 15 days while it was recorded 3.20±0.090 mm for 30 Days. The leaf growth value increases in different mixture ratio of NPK for 15 days & 30 days time period. This result clearly shows that different mixture ratio of NPK is effective in leaf growth. The results are tabulated in Table 1.

Effect of mixture ratio of NPK in growth of underground part of plant has shown effective results. Effect of mixture ratio 2:1:1 of NPK in growth of underground part of plant was recorded 3.40±0.044 mm with 15 days time period while it was recorded 3.50±0.053 for 30 days time period. Mixture ratio 3:1:1 of NPK in growth of underground part of plant was recorded 4.52±0.081 mm with 15 days time period while it was recorded 4.10±0.066 mm for 30 days time period, and mixture ratio of 4:1:1 of NPK in growth of underground part of plant was recorded

5.24±0.147 mm for 15 days while it was recorded 5.20±0.135 mm for 30 days time period. and mixture ratio of 5:1:1 of NPK in growth of underground part of plant was 5.20±0.125 mm for 15 days while it was recorded 5.10±0.107 mm for 30 Days. The growth of underground part of plant increases in different mixture ratio of NPK for 15 days & 30 days time period. This result that different mixture ratio of NPK is effective in growth of underground part of plant. The results are presented in Table 1.



Fig–1a
Line diagram of mineral requirement for the stem growth of Ophioglossum sp. of Vindhyan region.



Fig–1b
Line diagram of mineral requirement for the leave growth of Ophioglossum sp. of Vindhyan region.

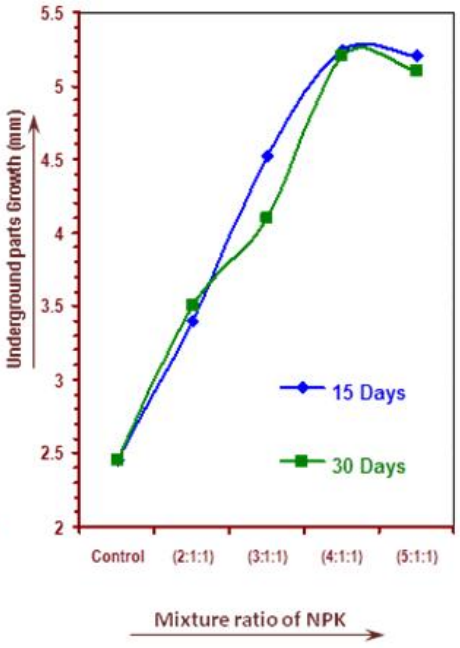


Fig-1c
Line diagram of mineral requirement for the underground parts growth of Ophioglossum sp. of Vindhyan region.

Conclusion

The results are in conformity with the finding of so many earlier workers. That micronutrients definely play important role for the growth and establishment of Ophioglossam species of pterdiophytes. Mineral requirement for the growth of specific pteridophyte plant of Vindhyan region was studied. Effect of mixture ratio of NPK in Stem growth has shown promising results.

Acknowledgement

We thank A. P. S. University Rewa, M.P. and Dr. A.P. Singh for providing technical support and guidance.

References

[1] K. B. Singha, C. M. Dutta, P. B. Mazumder. 2013, In Vitro Propagation in Pteridophytes: A Review; Int. J. Res. Ayurveda Pharm. 4 (2013) 297-303.
[2] M. G. Uddin, M. M. Mirza, M. K. Pasha. The medicinal uses of pteridophytes of Bangladesh. Bangladesh J. Plant Taxon. 5 (1998) 29-41.
[3] K. Kimura, Y. Noro. Pharmacognostical studies on Chinese drug "Gu-sui-bu". I. consideration on "gu-sui-bu" in old herbals (Pharmacognostical studies on fern drugs XI). Syoy - akugaku Zasshi. 19 (1965) 25- 31.
[4] A. K. Dhiman. Ethnomedicinal uses of some pteridophyitc species in India. Indian Fern J. 15 (1998):61-64.
[5] S. M. Vasudeva. Economic importance of Pteridophytes. Indian Fern J., 16 (1999) 2130–2152.

[6] V. L. Reddy, V. Ravikanth, T. P. Rao, P. V. Diwan, Y. Venkateswarlu. A new triterpenoid from the fern Adiantum lunulatum and evaluation of antibacterial activity. Phytochemistry. 56 (2001) 173-175.
[7] L. Singh, S. Singh, K. Singh, E. Jadu. Ethnobotanical uses of some pteridophytic species in Manipur. Indian Fern J. 18 (2001) 1214–1217.
[8] R. Gogoi. Ethnobotanical studies of some ferns used by the Garo Tribals of Meghalaya. Adv. Plant Sci. 15 (2002) 401–405.
[9] K. Chen, G. W. Plumb, R. N. Bennett, Y. Bao. Antioxidant activities of extracts from five anti-viral medicinal plants. J. Ethnopharmacol. 96 (2005) 2201-2205.
[10] M. Singh, N. Singh, P. B. Khare, A. K. S. Rawat. Antimicrobial activity of some important Adiantum species used traditionally in indigenous systems of medicine. J.Ethnopharmacol. 115 (2008) 2327-2329.
[11] M. Maridass, G. Raju. Conservation status of Pteridophytes, Western Ghats, South India; IJBT. 1(Special Issue) (2010) 42-57.
[12] S. P. Khullar. An Illustrated Fern Flora of the West Himalaya Vol.I&II (1994-2000) Dehradun.

Publication History
Received 10th Feb 2017
Revised 20th Feb 2017
Accepted 20th Feb 2017
Online 28th Feb 2017