RESEARCH ARTICLE

INFLUENCE OF ORGANIC, INORGANIC AND INTEGRATED NUTRIENT MANAGEMENT ON BIOMASS YIELD AND QUALITY OF BRAHMI

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Abstract: *Bacopa monnieri* (L.) Pennel, commonly known as Brahmi is an important medicinal crop which is in high popularity because of its high market value. Brahmi belongs to the family Plantaginaceae and is extensively being used in Indian system of medicine as a memmory booster. Brahmi is used to treat insomnia, insanity, depression, psychosis, stress, cardiac, respiratory problems etc. The therapeutic effect is mainly based on bacosides (saponins). Bacoside A (a saponin glycoside) is the major active ingredient. Nowadays organic farming or integrated nutrient farming in crop production is gaining much boom because of our increasing health consciousness. In this context an experiment was conducted to study the effect of organic and inorganic sources of nutrients on the quality of brahmi at All India Coordinated Research Project on Medicinal, Aromatic Plants & Betelvine, College of Horticulture, Kerala Agricultural University, Thrissur during 2018 - 2019. The experimental design was RBD with six different treatments .The results of the study revealed that plants which received integrated nutrient management (NPK @ 100:60:60 kg/ha along with Farm yard manure @ 10 t/ha) recorded higher biomass yield (6672 kg/ha)and Bacoside A content (0.94%). Integrated Nutrient Management was thus found more effective to boost up the production of the active constituent Bacoside A compared to purely organic or purely inorganic management practices in Brahmi cultivation. Calcium, Magnesium and iron content were also found higher in INM.

Keywords: *Bacopa monnieri* , Bacoside A, Integrated nutrient management (INM)

INTRODUCTION

Bacopa monnieri (L.) Pennell is a perennial trailing herb which belongs to the family Plantaginaceae. This medicinal plant famous as brahmi in Hindi and Malayalam is a very effective memory booster and brain tonic used in Ayurveda. It is effective in the treatment of epilepsy, asthma, ulcers, tumors, enlarged spleen, inflammations, leprosy, anemia and gastroenteritis. The whole plant is medicinal containing saponin bacosides as major active ingredients. This bacoside saponin can be taken as marker compound for authentication of true brahmi samples. Brahmi is the major essential ingredient in many ayurvedic formulations like Brahmeegritham, Brahmi oil and Saraswatharishtam (Nair and Sashtri, 1990; Nambiar *et al*.,2000;Ved and G.S.,2007). Since the nutrient management can greatly influence the yield as well as quality parameters of plants, an experiment was conducted to study the effect of organic, inorganic and integrated nutrient management on the biomass yield and quality of Brahmi (*Bacopa monnieri* L.)

MATERIALS AND METHODS

Field experiment was conducted at AICRP on MAP&B, College of Horticulture, Kerala Agricultural University, Vellanikkara during 2018. The site lied between 13^0 32'N latitude and 76^0 26'E longitude at an elevation of about 40 m from MSL and had typical humid tropical climate. The soil was latterite sandy loam of oxisol group. The experimental design was RBD with six treatments in four replications. (T_1 - control,T_2 -NPK (100:60:60 kg/ha) **,** T_3- FYM (10 t/ha), T_4- FYM (5 t/ha) ,T_5- FYM (10 t/ha)+ NPK (100:60:60 kg/ha) ,T_6- FYM (5 t/ha)+ NPK (100:60:60 kg/ha)).

The experimental area was ploughed and leveled thoroughly. Plot size taken was 6 m^2. Fresh noded cuttings of about 10 cm were planted at a spacing of 20cm X 20cm. Harvest was done at the 5 th month after planting. The fresh biomass yield was observed at the time of harvest. Fresh leaves were subjected to bacoside A analysis by HPTLC (High performance thin layer chromatography) method using bacoside standard purchased from Reddys Lab ,Mumbai (Powar and Jadav, 2015). For HPTLC the solid phase used was Silica gel 60 $F_{254,}$ mobile phase as Toluene: Ethyl acetate: methanol: Acetic acid (3:4:3:1). Methanol extract of Brahmi was used. The spray reagent used was anisaldehyde followed by heating of the plate at 100^0C for 2 minutes.

Heavy metal and mineral content analysis were also carried out in the Brahmi samples by ICP -OES (Inductively coupled plasma - optical emission spectrometry) method (Powar and Jadav, 2015) . The data was subjected to statistical analysis using MSTAT – C package (Freed, 2006).

RESULTS AND DISCUSSION

It was observed that the plants in T_5 which received integrated nutrient management FYM (@10 t/ha) + NPK (@100:60:60 kg/ha) significantly recorded higher biomass /fresh herbage yield (667 kg/ha)

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followed by the plants (T6) treated with FYM @ 5 t/ha+ NPK @100:60:60 kg/ha with a yield of 6216 kg/ha. Lowest yield (3335 kg/ha) was recorded for absolute control plots.

The same trend was observed for Bacoside A content also. It was significantly higher for INM treatments T5 with 0.94% bacoside A content .Treatment T6 was on par with a bacoside content 0.93 %. Lowest bacoside content was observed in absolute control (T_1, 0.66%) as detailed in Table.1 and Figure 1. Calcium, Magnesium and iron content were also found higher in INM treated plants (Table 2). Effect of nutrients on the heavy metal load of the plant material when tested revealed absence of arsenic, cadmium, led and chromium. Similar results are reported from other scientific studies also. Agronomic manipulation studies carried out in Brahmi in Assam plains by Aparna *et al* in 2014 showed that 2t/ha enriched compost application gave a hike in the yield (144 g/m^2). Singh *et al* from Pantnagar (2007) revealed that INM application with 75 kg N + 5 t/ha FYM/ha gave maximum yield compared to all other treatments and control in their soils for Brahmi.

Table 1. Effect of nutrients on herbage yield and Bacoside A content of Brahmi

Nutrient Management	**Treatment code**	**Treatment details**	**Bacoside AA (%)**	**Herbage yield kg/ha kg/ha**
Absolute	T1	No manures and fertilizers	0.655[e]	3335[f]
Inorganic	T2	NPK (100:60:60 kg/ha)	0.845[c]	5189[c]
Organic	T3	FYM (10 t/ha)	0.870[b]	4169[d]
	T4	FYM (5 t/ha)	0.733[d]	3629[e]
Integrated	T5	**FYM (10 t/ha) + NPK (100:60:60**	**0.940[a]**	**6672[a]**
	T6	**FYM (5 t/ha) + NPK (100:60:60**	**0.928[a]**	**6216[b]**
	CD(0.05)		0.021	47.323

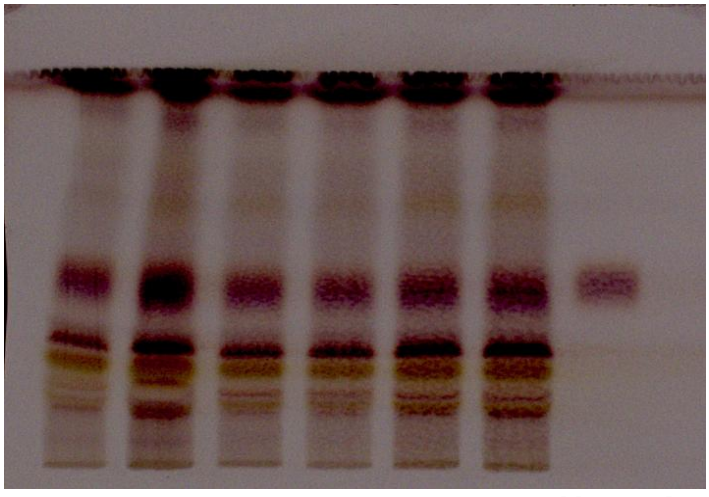


Figure 1. HPTLC of Brahmi – Bacoside A estimation

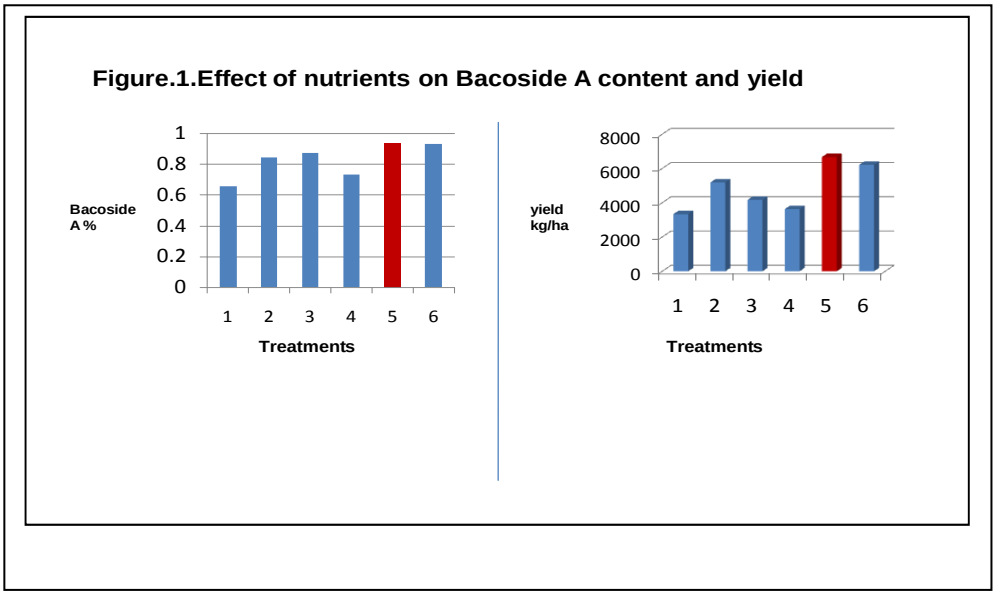
Table 2. Effect of nutrients on mineral content in brahmi

Treatments	Mn %	Zn%	Ca %	Mg%	Fe **%**
T1	0.050	0.013	0.93	1.16	0.046
T2	0.062	0.015	0.94	1.20	0.069
T3	0.068	0.021	1.18	1.35	0.077
T4	0.063	0.018	1.05	1.35	0.066
T5	**0.069**	**0.210**	**1.20**	**1.38**	**0.118**
T6	0.067	0.200	1.18	1.35	0.111

Table 3. Effect of nutrients on heavy metal content in brahmi

Treatments	As **%**	Cr **%**	Cd **%**	Pb **%**
T1	BDL	BDL	BDL	BDL
T2	BDL	BDL	BDL	BDL
T3	BDL	BDL	BDL	BDL
T4	BDL	BDL	BDL	BDL
T5	BDL	BDL	BDL	BDL
T6	BDL	BDL	BDL	BDL

BDL= below detectable level



CONCLUSION

Based on the present investigation it was concluded that INM is better compared to pure organic or pure inorganic nutrient management in Brahmi (*Bacopa monnieri*) cultivation with respect to Bacoside A content as well as herbage yield.

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