



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating: 5.20
www.agronomyjournals.com
2025; 8(3): 334-338
Received: 06-12-2024
Accepted: 14-01-2025

Prashanti Rai
Department of Horticulture,
Sam Higginbottom University
of Agriculture, Technology
and Sciences, Prayagraj,
Uttar Pradesh, India

Vijay Bahadur
Department of Horticulture,
Sam Higginbottom University
of Agriculture, Technology
and Sciences, Prayagraj,
Uttar Pradesh, India

Urfi Fatmi
Department of Horticulture,
Sam Higginbottom University
of Agriculture, Technology
and Sciences, Prayagraj,
Uttar Pradesh, India

Ram Bharose
Department of Soil Science
and Agricultural Chemistry,
Sam Higginbottom University
of Agriculture, Technology
and Sciences, Prayagraj,
Uttar Pradesh, India

Corresponding Author:

Prashanti Rai
Department of Horticulture,
Sam Higginbottom University
of Agriculture, Technology
and Sciences, Prayagraj,
Uttar Pradesh, India

Effect of nitrogen management through urea and vermicompost on growth and leaf yield of Brahmi (*Bacopa monnieri* L.) var. CIM-Jagriti

Prashanti Rai, Vijay Bahadur, Urfi Fatmi and Ram Bharose

DOI: <https://www.doi.org/10.33545/2618060X.2025.v8.i3e.2652>

Abstract

A field experiment was conducted on 2024 in the Crop Research Farm, Department of Horticulture, SHUATS, Naini, Prayagraj to assess the “Effect of Nitrogen Management through Urea and Vermicompost on growth and leaf length of Brahmi (*Bacopa monnieri* L.) var. CIM-Jagriti”. The trial was conducted using a Randomized Block Design (RBD) with 15 treatments and three replications. Nitrogen was applied through urea in (50%,100% dose) along with a full dose of phosphorus (P) and potassium (K), supplemented with vermicompost. The variety selected for the research was CIM Jagriti released from CIMAP, Lucknow. Growth parameters such as plant height, leaf length, leaf width, number of internodes, length of internodes, root length, fresh weight, dry weight and dry weight recovery % were recorded and analyzed statistically. Recommended dose of NPK is 100:60:50 kg/ha⁻¹, and of Vermicompost is 2-5 t/ha⁻¹ respectively. The growth and yield parameters was recorded maximum in T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK]. It revealed from the trial that T₁₄ is considered the best treatment for the growth and yield followed by T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK]. The present study reported that the Nitrogen (50%,100% dose), Phosphorus (P) and Potassium (K) along with Vermicompost promoted a positive outcome on growth & yield parameters of Brahmi (*Bacopa monnieri* L.) var. CIM-Jagriti and it also gave positive test values arching desired yield targets of brahmi situations for Prayagraj region.

Keywords: Brahmi, nitrogen management, vermicompost, CIMAP Lucknow, yield improvement

Introduction

Brahmi (*Bacopa monnieri*) is a well-known medicinal plant widely used in traditional Ayurvedic medicine for its adaptogenic, and therapeutic properties. It is a creeping herb that thrives in wet, tropical regions, and is characterized by small, succulent leaves and white or light purple flowers. Brahmi has been studied for its potential to improve memory, learning, and mental clarity, making it a popular nootropic. The active compounds, primarily bacosides, are believed to support neurotransmitter function, reduce oxidative stress, and promote neuroprotection. In addition to its cognitive benefits. Brahmi has been used to treat anxiety, stress, epilepsy, and various skin conditions due to its anti-inflammatory, antioxidant, and antimicrobial effects. Modern scientific research has corroborated many of Brahmi's traditional uses, demonstrating its potential to improve memory, enhance learning, reduce anxiety, and alleviate symptoms of neurological disorders. It is also valued for its adaptogenic properties, helping the body manage stress and maintain overall mental clarity. Recent pharmacological studies also suggest its role in supporting cardiovascular health and improving overall well-being. Despite promising therapeutic effects, further clinical trials are needed to fully establish the safety, efficacy, and mechanisms of action of Brahmi in modern medicine. This plant represents a promising candidate for further research in both traditional and integrative health systems.

Over centuries, Brahmi has been used to treat a variety of ailments, ranging from cognitive disorders like dementia and Alzheimer's to stress, anxiety, and epilepsy. This versatile plant is believed to work as a powerful adaptogen, balancing the body's stress response and helping to restore mental and physical equilibrium. The active compounds responsible for Brahmi's

therapeutic effects are primarily bacosides—saponin glycosides that support brain function by promoting the regeneration of neurons and improving neurotransmission. Modern research has increasingly focused on these bioactive compounds, which exhibit antioxidant, anti-inflammatory, and neuroprotective properties. In addition, it was also reported to possess anti-inflammatory, analgesic, antipyretic, sedative, free radical scavenging and anti-lipid peroxidative activities.

Nitrogen is an essential macronutrient for plants, playing a crucial role in their growth and development and it appears to have the most rapid and apparent effect on plants. One of its primary roles is promoting vegetative growth, giving plants their lush green color. Plants absorb nitrogen mainly in the form of nitrates (NO_3^-) and ammonium (NH_4^+) from the soil, which is often supplemented through fertilizers like urea and ammonium sulfate.

Vermicompost a rich organic amendment also helps to improve soil structure, microbial activity, and slow-release nutrient availability, leading to sustainable growth and yield improvement. Benefits of Integrated Nutrient Management (Urea + Vermicompost + P-K) enhances nutrient-use efficiency by reducing nitrogen loss and improving soil retention of phosphorus and potassium, promotes sustained plant growth, balancing fast-acting inorganic fertilizers with the slow-release benefits of vermicompost, improves soil structure and microbial diversity, leading to better nutrient availability and long-term fertility, increases leaf yield and quality, ensuring higher biomass production and better value.

Treatment Combination

T₀: Control, T₁: Vermicompost @ 2.5t/ha, T₂: Vermicompost @ 5.0t/ha, T₃: Vermicompost @ 7.5t/ha, T₄: Vermicompost @ 10t/ha, T₅: 50% N through Urea + Full PK, T₆: 50% N through Urea + Vermicompost @ 2.5t/ha + Full PK, T₇: 50% N through Urea + Vermicompost @ 5.0t/ha + Full PK, T₈: 50% N through Urea + Vermicompost @ 7.5t/ha + Full PK, T₉: 50% N through Urea + Vermicompost @ 10t/ha + Full PK, T₁₀: 100% N through Urea + Full PK, T₁₁: 100% N through Urea + Vermicompost @ 2.5t/ha + Full PK, T₁₂: 100% N through Urea + Vermicompost @ 5.0t/ha + Full PK, T₁₃: 100% N through Urea + Vermicompost @ 7.5t/ha + Full PK, T₁₄: 100% N through Urea + Vermicompost @ 10t/ha + Full PK.

Materials and Methods

The experiment “Effect of Nitrogen management through Urea and Vermicompost on growth and leaf of Brahmi (*Bacopa*

monnieri L.) Var. CIM- Jagriti” was conducted in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The area of Prayagraj district comes under agro climatic zone V (Upper Gangetic Plain region) and sub-zone of Central Plains. The climate ranges from dry sub-humid to semi-arid and the soil is alluvium calcareous sandy loam. The district experiences average maximum temperature ranges between 43°- 47 °C which may go as high as 48 °C during peak summers (May-June). The minimum average temperature is 2-4 °C, which may fall as low as 1 °C during peak winter months (December-January). The average rainfall of the district is 960 mm and the monsoon season is spread between July-September. As per experimental recommendations, the fertilizers nitrogen, potassium, phosphorous, and vermicompost were weighed and applied in the field by mixing thoroughly with soil. The experimental soil was sandy loam in texture. Brahmi cuttings of 5-6 cm were planted at 4-5 cm deep with a spacing of 20 cm between rows and 10 cm within plants. The experimental field was well prepared by ploughing with a tractor. The field was leveled, and stubbles and weeds were picked up from the field manually. In order to keep the field free from weeds and to ensure soil moisture, several hand weeding was done at intervals to maintain the optimum population of the plant.

A. Soil Sampling: The soil sample was collected from different places of the experimental field from the surface to 12-15 cm depth. These soil samples were mixed together, air dried, powdered and thoroughly mixed. A representative soil sample of five gram for each and every analysis was drawn and subjected to mechanical and chemical analysis.

B. Physio-Chemical properties of the soil: The experimental site was a fairly levelled land with sandy loam soils of uniform fertility status with low clay and high sand percentage. The soil sample were collected at random spots from depth of 0-30 cm. and the soil was analysed for pH, electrical conductivity (EC), organic carbon, available nitrogen, available phosphorus, and available potassium at Allahabad and are presented in Table 1 and 2.

Table 1: Physical properties of soil

S. No.	Particulars	Value (0-30 cm depth)
1.	Sand	60.60
2.	Silt	22.41
3.	Clay	21.30
4.	Bulk Density	1.64
5.	Textural Class	Sandy Loam

Table 2: Chemical properties of soil

S. No.	Particulars	Value (0-30cm depth)	Method Adopted
1.	Soil pH	7.2	Digital pH meter (M.L. Jackson)
2.	Organic Carbon (%)	0.4	Wet method (Walkely and Black, 1934)
3.	Available Nitrogen (N)	250 kg/ha	Alkaline permanganate method (Subaiah & Asija, 1956)
4.	Available Phosphorus (P)	135 kg/ha	Calorimetric method (Olson <i>et al.</i> , 1954)
5.	Available Potash (K)	344 kg/ha	Flame Photometric method (Jackson, 1967)

C. Statistical Analysis: The data recorded during the course of the investigation was subjected to statistical analysis by RBD (Randomized Block Design), an experimental design where the experimental units are in groups called blocks. This kind of design is used to minimize the effects of systematic error. The data recorded during the course of the investigation will be subjected to statistical analysis by the analysis of variance (ANOVA) technique. The significance and non-significance of treatment effect were judged with the help of the ‘F’ (variance ratio) (Fisher 1960). The

significant difference between the means was tested against the critical difference at the 5% level for testing the hypothesis.

Results and Discussion

All the growth attributing characters were studied viz., Plant Height (cm), Leaf length (cm), No. of leaves, Leaf Width (cm), Root length (cm), No. of nodes and Length of Internode, Fresh Weight of shoots, Dry Weight of shoots and Dry weight recovery (%) were recorded at 90 days after planting (DAP).

The results obtained are discussed in light of previous researchers and the results obtained of the various above mentioned characters are as given in Table 3 and 4.

Plant height (cm): A significant difference was observed in the plant height as affected by different treatments among which T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK] remained significantly highest (35.50 cm) and was *at par* with T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] while all the other treatments were significantly lower. The lowest plant height (21.10 cm) was observed in T₀ [Control] which was 40.56% lower than treatment T₁₄ which had the highest Urea and vermicompost. Urea and vermicompost manure showed better results over the lower doses of Urea and vermicompost as it enhanced the water holding capacity of the soil which is a major requirement for brahmi as it is an aquatic herb. Vermicompost manure also acts as chelating agent hence ensuring nutrient availability throughout the crop growing period. Supportive evidence was given by a research of G.R Smitha *et al.* (2021)^[15].

Leaf Length (cm): The leaf length (cm) were significantly higher in treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK] (2.40 cm) which is *at par* with treatment T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] (2.34 cm) and the rest of the treatment while the minimum leaf length was found in T₀ [Control] (1.90 cm). Application of cow dung compost helped brahmi to produce better branching and faster elongation of prostrate branches, confirming the findings of Shirole *et al.* (2005)^[26] and Baruah *et al.* (2014)^[6].

Number of leaves: It is evident that treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK] 371.91 showed the highest results at all the crop growth stages followed by T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] 348.11. It was also observed that T₁₂ and T₁₁ were *at par* during most of the crop stages for different growth attributes while the minimum number of leaves was found in T₁ [Control] 227.71. The low dose of Urea and vermicompost showed less growth attributes in all the growth stages. Increased dose of Urea and vermicompost resulted in more crop growth including the enhanced leaf length, No. of leaflets and leaves per m². It can be attributed to the fact that Urea and vermicompost when applied in the soil helps to accelerate the microbial population that in turn helps to mineralize the organic stock of nitrogen in the soil. The mineralized nutrient gains mobility in the soil system and enters the plant to build the framework of plant system. Increasing parameters like length of leaflets, No. of leaflets and no. of leaves due to enhanced nutrient uptake have a direct effect on the crop yield. The same has been corroborated by Mathur *et al.* (2000)^[17] and Tiwari *et al.* (2000)^[19].

Leaf width (cm): The treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK + Full PK] gave the highest leaf width (cm) (1.01 cm) which was significantly higher than the rest of the treatments. The second highest fresh leaf width (cm) was recorded in T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] (0.99 cm) which was *at par* with T₁₂ [100% N through Urea + Vermicompost @ 5.0t/ha +Full PK] (0.97 cm) and T₁₁ [100% N through Urea + Vermicompost @ 2.5t/ha +Full PK] (0.94 cm). Treatment T₀ i.e., control also showed low results of leaf width (cm) (0.51 cm) as compared to the lower doses of Urea and vermicompost and they were *at par* with other treatments viz, T₁ [Vermicompost @ 2.5t/ha] (0.53 cm) and T₂ [Vermicompost @

5.0t/ha] (0.55 cm). The variation in leaf length may be due to the effect of urea and vermicompost combined. The similar results were also reported by Maneeply *et al.* (2018)^[18] in *Bacopa monnieri* and Aliniaiefard *et al.* (2010)^[3] in lemon verbena.

Root length (cm): The treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK + Full PK] produced highest Root length (cm) (3.55 cm) in all the crop growth stages followed by T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] (3.47 cm) which was *at par* with treatment T₁₂ [100% N through Urea + Vermicompost @ 5.0t/ha +Full PK] 3.39 (cm). Treatment comprising of control T₀ [Control] was *at par* with T₁ [Vermicompost @ 2.5t/ha] (1.76 cm), T₂ [Vermicompost @ 5.0 t/ha] (1.84 cm) and T₃ (2 cm) had the lowest root length. Hence, an increased Urea and vermicompost application rate was positively correlated with the recorded increase in root length (cm) of the crop. Urea and vermicompost prepared from cow dung has the ability to direct the cosmic flow of energy that can revitalize the growth process Sundararaman *et al.*, (2001)^[27] and Nirnanjan (2002)^[22]. Similar findings were reported by Anjana Devkota *et al.* (2018)^[4].

Number of nodes: It showed that treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK + Full PK] gave the highest number of nodes (27.82) which was significantly higher than the rest of the treatments. The second highest number of nodes was recorded in T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] (27.81) which was *at par* with T₁₂ [100% N through Urea + Vermicompost @ 5.0t/ha +Full PK] (26.84) and T₁₁ [100% N through Urea + Vermicompost @ 2.5t/ha +Full PK] (26.56). Treatment T₀ i.e., control also showed low results of number of nodes (21.33) as compared to the lower doses of Urea and vermicompost and they were *at par* with other treatments viz, T₁ [Vermicompost @ 2.5t/ha] (23.02) and T₂ [Vermicompost @ 5.0 t/ha] (23.12). Heller and Weibel (1997) explained that when the crop is supplied with organic manure, plant is fed indirectly, as the manure builds up clay humus complexes, developing a porous and stable soil structure and promoting microbial growth and activity resulting in enhanced growth parameters. Nutrients especially nitrogen supplied to the plants by means of organic sources lead to the luxuriant plant growth by converting the synthesised photosynthates metabolically into proteins which ultimately leads to more vegetative growth and biomass production. The similar results were also reported by Anjana Devkota *et al.* (2018)^[4] in *Centella asiatica*.

Length of internodes (cm): It showed that treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha +Full PK + Full PK] gave the highest length of internodes (cm) (1.83 cm) which was significantly higher than the rest of the treatments. The second highest length of internode was recorded in T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] (1.74 cm) which was *at par* with T₁₂ [100% N through Urea + Vermicompost @ 5.0t/ha +Full PK] (1.67 cm) and T₁₁ [100% N through Urea + Vermicompost @ 2.5t/ha +Full PK] (1.63 cm). Treatment T₀ i.e., control also showed low results of length of internodes (0.59 cm) as compared to the lower doses of Urea and vermicompost and they were *at par* with other treatments viz, T₁ [Vermicompost @ 2.5t/ha] (0.99 cm) and T₂ [Vermicompost @ 5.0 t/ha] (1.01 cm). Nitrogen which is an important cell constituent and a metabolically active compound helps in enzyme activation and energy transformation. It also enhances dark green colour, quality, quantity and succulency of the crop.

Fresh weight (g/plant): Fresh weight taken at observations recorded at harvest showed significant yield advantage of treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha + Full PK + Full PK] (69.70 g) over lower doses of Urea and vermicompost (T₁₃ to T₀). Control treatment was found lowest value found (66.30) with other treatment which showed inorganic and organic treatment showed the same results as natural treatment but the economics involved in the former is higher hence making the later advantageous. Application of N and Vermicompost plays a positive role in mineralization and maintains soil health which leads to vigorous growth of Brahmi. Similar results were also reported by Bandyopadhyay *et al.* (2010)^[8] in soy bean.

Dry weight (g/plant): Dry weight taken at observations recorded at harvest showed significant yield advantage of treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha + Full PK + Full PK] (15.41 g) over other doses of Urea and vermicompost (T₁₃ to T₀). Control treatment was found lowest value of (9.31g) with other treatment which showed inorganic and organic treatment showed the same results as natural treatment but the economics involved in the former is higher

hence making the later advantageous. Similar findings were also reported by Kumawat *et al.* (2010) and Sharma *et al.* (2010). Similarly, Kumar *et al.* (2016)^[16] obtained the highest dry herbage yield (5.73 t/ha) and oil yield (36.82 kg/ha) of patchouli under shade with application of vermicompost (24 kg/plot) compared to that in open condition under teak (*Tectona grandis*) based agroforestry system.

Dry weight Recovery (%): Dry weight recovery (%) taken at harvest showed that treatment T₁₄ [100% N through Urea + Vermicompost @ 10t/ha + Full PK + Full PK] gave the highest dry weight recovery (%) (25.44) which was significantly higher than the rest of the treatments. The second was recorded in T₁₃ (24.16) which was *at par* with T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha + Full PK] (24.85) and T₁₂ [100% N through Urea + Vermicompost @ 5.0t/ha + Full PK] (24.42). Treatment T₀ i.e., control also showed low results of dry weight recovery (%) (15.29) as compared to the lower doses of Urea and vermicompost and they were *at par* with other treatments viz, T₁ [Vermicompost @ 2.5t/ha] (18.92) and T₂ [Vermicompost @ 5.0 t/ha] (19.22).

Table 3: Growth parameters as affected by various treatments

Treatments	Plant height (cm) 90 DAP	Leaf length (cm) 90 DAP	No. of Leaves 90 DAP	Leaf width (cm) 90 DAP	Root length (cm) 90 DAP	No. of nodes 90 DAP	Length of internodes (cm) 90 DAP
Control	21.10	1.90	227.71	0.51	1.7	21.33	0.59
Vermicompost @ 2.5t/ha	25.20	1.90	257.21	0.55	1.76	23.02	0.99
Vermicompost @ 5.0t/ha	25.40	1.92	276.51	0.59	1.84	23.12	1.01
Vermicompost @ 7.5t/ha	27.10	2.00	317.41	0.68	2	23.89	1.15
Vermicompost @ 10t/ha	29.20	2.06	339.01	0.75	2.27	24.89	1.33
50% N through Urea + Full PK	30.50	2.16	254.91	0.53	2.53	25.47	1.42
50% N through Urea + Vermicompost @ 2.5t/ha + Full PK	30.70	2.17	300.31	0.75	2.53	25.6	1.42
50% N through Urea + Vermicompost @ 5.0t/ha + Full PK	31.20	2.17	329.91	0.77	2.61	25.82	1.44
50% N through Urea + Vermicompost @ 7.5t/ha + Full PK	31.80	2.20	341.21	0.94	2.73	25.96	1.49
50% N through Urea + Vermicompost @ 10t/ha + Full PK	32.00	2.24	360.51	0.97	3.01	26.19	1.56
100% N through Urea + Full PK	32.60	2.25	315.11	0.8	3.09	26.47	1.6
100% N through Urea + Vermicompost @ 2.5t/ha + Full PK	32.80	2.26	323.11	0.87	3.27	26.57	1.63
100% N through Urea + Vermicompost @ 5.0t/ha + Full PK	33.40	2.28	332.11	0.89	3.39	26.84	1.67
100% N through Urea + Vermicompost @ 7.5t/ha + Full PK	34.50	2.34	348.11	0.99	3.47	27.31	1.74
100% N through Urea + Vermicompost @ 10t/ha + Full PK	35.50	2.40	371.91	1.01	3.55	27.82	1.83
F- test	S	S	S	S	S	S	S
S. Ed. (±)	0.93	0.47	2.01	0.13	0.47	1.24	0.16
C. D. (P = 0.05)	1.85	0.93	4.02	0.26	0.95	2.49	0.32

Table 4: Fresh weight of Shoots, Dry weight of Shoots and Dry weight recovery (%)

Treatments	Fresh weight of shoots	Dry weight of shoots	Dry weight recovery (%)
Control	66.3	9.31	15.29
Vermicompost @ 2.5t/ha	67.36	11.43	18.92
Vermicompost @ 5.0t/ha	67.44	11.61	19.22
Vermicompost @ 7.5t/ha	67.6	11.98	19.85
Vermicompost @ 10t/ha	67.87	12.53	20.76
50% N through Urea + Full PK	68.13	13.1	21.7
50% N through Urea + Vermicompost @ 2.5t/ha + Full PK	68.13	13.1	21.7
50% N through Urea + Vermicompost @ 5.0t/ha + Full PK	68.21	13.28	22
50% N through Urea + Vermicompost @ 7.5t/ha + Full PK	68.33	13.56	22.46
50% N through Urea + Vermicompost @ 10t/ha + Full PK	68.61	14.2	23.5
100% N through Urea + Full PK	68.69	14.38	23.79
100% N through Urea + Vermicompost @ 2.5t/ha + Full PK	68.87	14.77	24.42
100% N through Urea + Vermicompost @ 5.0t/ha + Full PK	68.99	15.04	24.85
100% N through Urea + Vermicompost @ 7.5t/ha + Full PK	69.07	15.23	25.16
100% N through Urea + Vermicompost @ 10t/ha + Full PK	69.15	15.41	25.44
F- test	S	S	S
S. Ed. (±)	0.66	0.37	0.33
C. D. (P = 0.05)	1.33	0.75	0.67

Conclusion

Brahmi is considered as one of the oldest traditional medicinal crop and is also referred to as brain tonic. It contains several vitamins, minerals and essential amino acids and useful to treat various cardiovascular diseases and cognitive function as well as enhancing memory. In this research it is concluded that the maximum plant height, leaf length, number of leaves, leaf width, root length, number of nodes, length of internodes, fresh weight, dry weight, and dry recovery % was found significantly highest in T₁₄ [100% N through urea + vermicompost @ 10 t/ha + full PK] and was *at par* with T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK]. The treatment combination T₁₄ [100% N through urea + vermicompost @ 10 t/h + full PK] and T₁₃ [100% N through Urea + Vermicompost @ 7.5t/ha +Full PK] can be taken for cultivating Brahmi as it aids a better income of the farmers of the Prayagraj region (U.P.) to increase production and sustainable agriculture by boosting the productivity of medicinal herb.

Acknowledgements

Mere words cannot express the sense of my indebtedness to my respected advisor, Dr. Vijay Bahadur, for his guidance, support, and expertise. His valuable suggestions, innovative ideas, and meticulous nature helped me in the execution of my investigation and degree. I am grateful for the support of Dr. V.P Sahi, Dr. Urfi Fatmi and Dr. Ram Bharose including all the faculty members and friends of Department of Horticulture, Naini, Prayagraj, 211007, Uttar Pradesh, India, for providing all the necessary facilities to undertake my research programme.

References

- Balkrishna A, *et al.* Ayurvedic plants in brain disorders: the herbal hope. J Tradit Med Clin Natur. 2017.
- Aguiar S, Borowski T. Neuropharmacological review of the nootropic herb *Bacopa monnieri*. Rejuvenation Res. 2013;16:313-326.
- Aliniaiefard S, *et al.* Use of chlorophyll meter for nitrogen management and recommendation of optimum nitrogen concentration in soil-less culture of lily. Floricult Ornamental Biotechnol. 2010;4(Special Issue 1):63-67.
- Devkota A, Jha PK. Effect of integrated manuring on growth and yield of *Centella asiatica* L. Urb. 2013.
- Anwar M, Patra DD, *et al.* Effect of organic manures and inorganic fertilizer on growth, herb and oil yield, nutrient accumulation, and oil quality of French basil. J Commun Sci Plant Anal. 2005;36(13-14):1737-1746.
- Baruah A, Gogoi PK, Barua IC, Baruah D. Agronomic manipulation in Brahmi (*Bacopa monnieri*) cultivation for higher productivity in Assam plains. J Krishi Vigyan. 2014;2(2):11-13.
- Ardeep, Chauhan D, Chauhan A. Yield and economics of Brahmi crop under natural farming. J Krishi Vigyan. 2024;12(3):722-725.
- Bandyopadhyay KK, Misra AK, Hati KM. Effect of integrated use of farmyard manure and chemical fertilizers on soil physical properties and productivity of soybean. Soil Tillage Res. 2010;110:115-125.
- Kumar ME. Studies on the effect of organic manures and bio-fertilizers on growth, yield and quality of stevia (*Stevia rebaudiana* Bert.). M.Sc. (Hort.) Thesis, University of Agricultural Sciences, GKVK, Bengaluru, India. 2009.
- Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants. Council of Scientific and Industrial Research; 1956.
- Geetha A, Rao PV, Mohammad S. Effect of organic and inorganic fertilizers on macro and micro nutrient uptake, oil content, quality and herbage yield in sweet basil (*Ocimum basilicum*). Res Crops. 2009;10:740-742.
- Goraya GS, Ved DK. Medicinal plants in India: An assessment of their demand and supply. National Medicinal Plants Board, Ministry of AYUSH, Government of India, New Delhi; 2017.
- Goswami S, Sajoi A, Kumar N, Thawani V, Tiwari M, Thawani M. Effect of *Bacopa monnieri* on cognitive functions in Alzheimer's disease patients. Int J Collab Res Intern Med Public Health. 2011;3(4):285-293.
- Gohil KJ, Patel JA, Gajjar AK. Pharmacological review on *Bacopa monnieri*: potential for cognitive improvement. Int J Pharm Sci Rev Res. 2010;5(1):29-33.
- Smitha GR, Kalaivanan D, Sujatha S. Influence of shade and organic nutrition on growth, yield and quality of memory enhancing herb, Brahmi (*Bacopa monnieri* L.). ICAR-Indian Institute of Horticultural Research, Bengaluru. 2021.
- Kumar D, Bijalwan A, Kalra A, Dobriya M. Effect of shade and organic manure on growth and yield of patchouli (*Pogostemon cablin* (Blanco) Benth) under Teak (*Tectona grandis* L. F.) based agroforestry system. Indian Forester. 2016;142:1121-1129.
- Mathur BK, Patel AK, Kaushish SK. Utilization of tumba (*Citrullus colocynthis*) seed-cake of desert for goat production. Indian J Anim Sci. 2000;70(4):431-433.
- Maneeply C, Sujipuli K, Kunpratun N. Growth of Brahmi (*Bacopa monnieri* (L.) Wettst.) by NFT and DFT hydroponic systems and their accumulation of saponin bacosides. NU Int J Sci. 2018;15(2):114-124.
- Tiwari M, Pant CC, Tewari VC. Neoproterozoic sponge spicules and organic-walled microfossils from the Gangolihat Dolomite, Lesser Himalaya, India. 2000.
- Nilsen E, Orcutt DM. The physiology of plants under stress - Abiotic Factors. 2nd ed. John Wiley and Sons, New York; 1996.
- Rao R, Rajput BR, Kothari DK, Sastry KP, Singh CP. Cultivation of medicinal and aromatic plants. Current Scenario. National exhibition and seminar on medicinal plants and herbal products. Souvenir. 2006;1-16.
- Niranjan. 2002.
- Russo A, Borrelli F. *Bacopa monnieri*, a reputed nootropic plant: an overview. Phytomedicine. 2005;12(4):305-317.
- Sendur KS, Natarajan S, Thamburaj S. Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. South Indian Hort. 1998;46(3-4):203-205.
- Seneviratne KGS, Kirthisinghe JP, Senenayake YDA. Influence of shade on rooting and growth of black pepper (*Piper nigrum* L.) propagules. J Plantation Crops. 1985;13:41-43.
- Shirole MS, Jadhav AS, Mahatale PV, Shinde RH, Mahatale YV. Effect of organic manure and spacing on growth and yield of Brahmi. Annals Plant Physiol. 2005;19(2):264-265.
- Sundaraman *et al.* Harmony of Organic farming, natural way of farming movement-communication prajetha NGO network, Kongal Nangram Tamil Nadu. 2001.
- Surendran U, Sushanth CM, George Mammen Joseph EJ. FAO-CROPWAT model-based estimation of crop water need and appraisal of water resources for sustainable water resource management: pilot study for Kollam district - humid tropical region of Kerala, India. Curr Sci. 2017;112:76-86.