Effects of Integrated Nutrient Management of Nutrients on Morphological Characters in *Eclipta alba l.*

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Abstract

Eclipta alba is an important medicinal herb found as a weed throughout India. Almost all of its parts are used in traditional system of medicine including seeds, roots and shoots and leaves. Integrated nutrient management refers to maintenance of the soil fertility and plant nutrient supply to an optimum level for sustaining the desired medicinal plant productivity through optimization of the benefits from all possible sources of plant nutrient in an integrated manner. We planned to study the effect of integrated nutrient management of nutrients in *Eclipta alba* with respect to seed germination, morphological characters and reproductive characters in randomized block design with three replications. There were eight treatments, P1: Control (500 : 300 : 300 g NPK per plant through fertilizers), P2: Vermicompost, P3: Biofertilizers, P4: Chemical fertilizers, P5: Biofertilizer+Vermicompost, P6: Biofertilizer+Chemical fertilizer, P7: Chemical fertilizer+Vermicompost and P8: Biofertilizer+Chemical fertilizer+Vermicompost. The observation on plant height, days to flower initiation, days to 50 per cent flowering, percentage seed germination, shoot length and root length were documented to study the effect of treatments and their interpretation. The findings exhibited that the P8 performed best among all treatments. The maximum plant height (39.18 cm), days to flower initiation (30.69 DAS), days to 50 per cent flowering (33.47 DAS), percentage seed germination (97.48%), shoot length (26.47 cm) and root length (28.26 cm) under P8 treatment.

Key words: Integrated nutrient management, Biofertilizer, Chemical fertilizer, Vermicompost plant height

Introduction

When medicinal plants are grown continuously in a piece of land, nutrient supplying capacity of the soil becomes exhausted. So, the nutrient removal by medicinal plants must be replenished through external addition of nutrient elements. But if only chemical fertilizer is applied there may be loss of biological properties of the soil. Nutrient imbalance created by single or combined application of NPK through chemical fertilizers is stated to be the main reason for non sustainable yield. Under good management conditions and adequate supply of biofertilizers and organic manures, the nutrient removal can be replenished and soil physical, chemical and biological properties can be improved. Nutrients added through combined inorganic and organic sources are reported to be better utilized than inorganics alone besides reducing cost of production and maintaining soil health. It is indicated that fertilizers induced drop in pH

could be neutralized and further improvement in soil physical condition can be achieved by supplementing part of the inorganic fertilizers with organic manures and biofertilizers and that it could also be possible to defer the onset of deficiency of some of the essential elements[1-3].

For optimum plant growth, nutrients must be available in sufficient and balanced quantities. Soils contain natural reserves of plant nutrients, but these reserves are largely in forms unavailable to plants, and only a minor portion is released each year through biological activity or chemical processes. This release is too slow to compensate for the removal of nutrients by agricultural production and to meet crop requirements. Therefore, fertilizers are designed to supplement the nutrients already present in the soil. The use of chemical fertilizer, organic fertilizer or biofertilizer has its advantages and disadvantages in the context of nutrient supply, crop growth and environmental quality. The advantages need to be integrated in order to make optimum use of each type of fertilizer and achieve balanced nutrient management for medicinal plants growth[4].

Integrated Nutrient management (INM) involves conjugative use of inorganic fertilizers, organic manures and biological source of nutrients. Considering the environmental and ecological problems and present energy crisis, integrated nutrient management has been gaining popularity all over the world.

Eclipta alba (L.) Hassk. (syn. *Eclipta prostrata* L.), commonly known as False Daisy, yerba de tago, and Bhringraj, is a plant belonging to the family Asteraceae. It grows commonly in moist places as a weed all over the world. It is also known as Bhringaraj and Karisilakanni, which is found a common weed throughout India ascending up to 6000 ft. The genus name comes from the Greek word meaning "Deficient," with reference to the absence of the bristles and awns on the fruits. The specific *Eclipta alba* means white which refers to the color of the flowers. The chief active principles consist of coumestans like wedelolactone, desmethylwedelolactone[5], furanocoumarins, oleanane & taraxastane glycosides[6]. In Ayurvedic medicine, the leaf extract is considered a powerful liver tonic, rejuvenative, and especially good for the hair. It has been used in various cultures to prevent ageing, maintain and rejuvenate hair, teeth, bones, memory, sight, and hearing, rejuvenate the kidneys, remove graying, cure balding, make hair darker, promote sleep, improve complexion, treat hepatitis, treat skin disorders, relieve burning urine, relieve headache, alleviate excess mucus, remove worms, treat earaches, treat uterine hemorrhaging, and to remove gray hair and balding. *Eclipta alba* also has traditional external uses, like athlete foot, eczema and dermatitis, on the scalp to address hair loss and the leaves have been used in the treatment of scorpion stings. It is used as anti-venom against snakebite in China and Brazil[7,8].

Eclipta alba occupies an important place in the pharmaceutical industry, but yield levels of *Eclipta alba* are still very low. Out of many factors, poor nutrient status of the soil as well as malnutrition is considered to be the major factors responsible for citrus decline and low yield. Chemical fertilizers are mostly in use for their cultivation, which have some deleterious effects on plant quality besides adverse effect on soil, water and

environmental pollution. An integrated use of organic manures, biofertilizers and chemical fertilizers could help in achieving the goal of obtaining safer food and environment for the people[9].

Organic fertilizers are a very important method of providing plant with their nutritional requirements without having the best undesirable impact on the environment. Organic manure and biofertilizers are important for medicinal and aromatic plants to product best product in both quantity and quality and it is also safe for human, animal and the environment. Therefore, integrated nutrient management is the most appropriate approach for managing the nutrient input. Integrated nutrient management refers to maintenance of the soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrient in an integrated manner. The aim of this study was an attempt of assessing the effect of integrated nutrients management on *Eclipta alba*.

Material and Methods

Experimental details

Eclipta alba was propagated in garden of Columbia Institute of Pharmacy, Raipur. It was propagated by seeds, and observed for 60 days.

Eclipta alba were planted at a spacing of 6 m × 6 m. The water was applied to the plants through ring system of surface irrigation method. An experiment was laid out in a randomized block design with three replications. There were eight treatments, P1: Control (500 : 300 : 300 g NPK per plant through fertilizers), P2: Vermicompost, P3: Biofertilizers, P4: Chemical fertilizers, P5: Biofertilizer+Vermicompost, P6: Biofertilizer+Chemical fertilizer, P7: Chemical fertilizer+Vermicompost and P8: Biofertilizer+Chemical fertilizer+Vermicompost.

Soil properties of experimental site

The experimental site consisted of black clay soil with neutral pH. The physico-chemical properties of the soil are presented in table 1.

Table 1: Analysis of physico-chemical properties of the experimental site

Particulars	**Values**
Physical Properties	
Course sand (%)	5.23
Fine sand (%)	10.38
Silt (%)	22.17
Clay (%)	63.29

Chemical Properties	
Organic carbon (%)	0.61
pH	7.8
Available nitrogen (kg ha^{-1})	201.34
Available P_2O_5 (kg ha^{-1})	32.56
Available K_2O (kg ha^{-1})	324.21

Method of application of nutrients

The required quantity of Vermicompost, Biofertilizers and Chemical fertilizers were weighed by weighing balance separately and applied by broadcasting in the plant basin area, then mixed in the soil properly. The seed germination, morphological characters and reproductive characters were observed for 60 days[10-12].

Plant height (cm)

The plant height was measured from the base of the plant to the tip of fully opened leaf on the main shoot at 30 and 45 days after sowing (DAS) and also at harvest. Measurements were taken from five plants in each treatment tagged earlier and the average height was calculated and expressed in cm.

Days to flower initiation

The number of days required for the plants in each plot to show initiation of flowering were observed and recorded.

Days to 50 per cent flowering

The number of days required for 50 per cent flowering of the plants in each plot to show 50 per cent flowering were observed and recorded.

Germination (%)

Seed germination was determined by the standard germination test using between paper towel. Hundred seeds of four replications each were tested. The germination counts on the fifth day and eighth day for first and final count. respectively were made on normal seedlings and total germination percentage was calculated.

Shoot length (cm)

Ten normal seedlings in each treatment were randomly selected from the germination test for the measurement of shoot length. It was measured from the collar region to the tip of apical bud and the mean of shoot length was computed and expressed in centimeters.

Root length (cm)

The same ten seedlings used for the measurement of shoot length were also used for the measurement of root length. It was measured from the collar region to the tip of the root and the mean of root length was computed and expressed in centimeters[13-15].

Statistical analysis

An ANOVA was used to determine significant effects and where differences were found, separations were investigated using Tukey's test. In all the cases, values of $P < 0.05$ were considered significant.

Results and Discussions

Plant height (cm)

The data on plant height of *Eclipta alba* at different growth stages as influenced by integrated nutrient management is presented in the table 2.The plant height was differed significantly at 30, 45 DAS and harvest stage of plants.

On 30 days after sowing significantly higher plant height (23.85 cm) was recorded in P8. The lowest plant growth (18.83 cm) was found in P4. On 45 days after sowing significantly higher plant height (31.23 cm) was documented in P8. The lowest plant growth (23.28 cm) was found in P4. During harvest the plant height was significantly differed due to different treatments.

Integrated nutrient management involving Biofertilizer+Chemical fertilizer+Vermicompost seed treatment has significantly influenced on plant growth parameters like plant height at 30 and 45 DAS. The combined application of nutrients sources from Biofertilizer+Chemical fertilizer+Vermicompost sources enhanced the growth of plant, because of Biofertilizer released the nutrients slowly as compared to the inorganic. Hence, the integration of nutrients have showed better results.

Table 2: Effect of integrated nutrient management on *Eclipta alba* height at different growth stages

Treatment	Plant height (cm)		
	30 (DAS)	45 (DAS)	At harvest
P1	20.35	24.36	30.12
P2	22.62	27.58	32.52
P3	22.47	28.45	33.63
P4	18.83	23.28	31.43
P5	23.14	29.67	35.74
P6	22.35	28.19	34.41

P7	21.92	26.37	33.24
P8	23.85	31.23	39.18

Days to flower initiation

The data on days to flower initiation as influenced by integrated nutrient management is presented in the Table 3. The plant treated with Biofertilizer+Chemical fertilizer+Vermicompost produces flower initiation at lesser days compared to other treatment.

Days to 50% flowering

The data on days to 50% flowering as influenced by Biofertilizer, Chemical fertilizer and Vermicompost as seed treatment is presented in Table 3. The data clearly indicated that there was significant difference in 50% flowering. More number of days (36.92) recorded in case of P7 compared to other treatments.

The flowering parameters like days to flower initiation and 50% flowering were also found to differ significantly due to integrated nutrient management. All these flowering parameters were significantly longer in P8 and whereas, shorter in P5. Significantly longer flowering parameters noticed in P8 may be attributed to the combined application of Biofertilizer, Chemical fertilizer and Vermicompost, and it has resulted more of vegetative growth. Inversely, the P5 recorded shorter duration of flowering parameters due to the inadequate availability of plant nutrients during plant growth.

Table 3: Effect of integrated nutrient management on days to flower initiation and days to 50% flowering of *Eclipta alba*

Treatment	Days to Flower initiations	Days to 50% Flowering
P1	33.28	35.26
P2	31.16	34.14
P3	30.84	33.53
P4	35.59	37.63
P5	32.72	34.47
P6	33.35	36.61
P7	34.42	36.92
P8	30.69	33.47

Germination (%)

The data on seed germination percentage of *Eclipta alba* as influenced by Biofertilizer, Chemical fertilizer and Vermicompost as seed treatment is presented in Table 4. The germination percentage differ significantly, higher germination percentage (97.48%) recorded in P8. Whereas, the lowest germination percentage (90.72 %) in P5.

Table 4: Effect of integrated nutrient management on seed germination percentage in *Eclipta alba*

Treatment	Germination percentage
P1	92.23
P2	94.58
P3	93.16
P4	95.34
P5	90.72
P6	93.42
P7	95.95
P8	97.48

Shoot length (cm)

It is evident from the data presented in Table 5 the shoot length of seedling increased with application of Biofertilizer, Chemical fertilizer and Vermicompost as seed treatment. The results indicated significant difference for shoot length among the treatments. The plant applied with integration of Biofertilizer+Chemical fertilizer+Vermicompost seed treatment recorded progressive increase in shoot length as compared to the supply of other nutrient. Significantly maximum shoot length (26.47 cm) was obtained in P8.

Root length (cm)

It is evident from the data that, the root length of seedling increased with the application of Biofertilizer, Chemical fertilizer and Vermicompost as seed treatment is presented in Table 5. The results indicated significant difference for root length among the treatments. The plant applied with integration of Biofertilizer+Chemical fertilizer+Vermicompost seed treatment recorded progressive increase in root length as compared to the supply of other nutrient. Significantly maximum root length (28.26 cm) was obtained in P8.

The root length differed significantly due to different treatments of integration of Biofertilizer+Chemical fertilizer+Vermicompost seed treatment. The shoot length was differed significantly due to integration of Biofertilizer+Chemical fertilizer+Vermicompost seed treatment. Among the treatments significantly higher shoot length (26.47 cm) was observed in P8, whereas, significantly lowest shoot length (20.13 cm) was observed in P5.

Table 5: Effect of integrated nutrient management on shoot length and root length in *Eclipta alba*

Treatment	Shoot length (cm)	Root length (cm)
P1	20.35	22.42
P2	21.42	26.62
P3	22.82	25.14
P4	20.13	23.85
P5	24.18	25.29
P6	25.24	26.74
P7	24.39	26.53
P8	26.47	28.26

Conclusion

The findings indicates that the application of Biofertilizer+Chemical fertilizer+Vermicompost produces significantly increase in plant height, root and shoot length. The rate of percentage germination was increased by applying Biofertilizer+Chemical fertilizer+Vermicompost on plants compared to other nutrients. The current work has substantially improved the understanding of nutrient accumulation and its potential roles during *Eclipta alba* production.

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