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Role of biofertilizers in combination with organic and inorganic nutrient sources in enhancement of growth in Kalmegh (*Andrographis paniculata*)

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Abstract

Kalmegh (*Andrographis paniculata*) is an important medicinal plant being used in liver ailments, snake bite, diabetes, fever and stomach disorders. In order to study the response of kalmegh to various manure combinations, an experiment was conducted at department of Botany, P.P.N. College, Kanpur. As a result, application of 25 kg/ha N as vermicompost, + 12.5 kg / ha P + 25 kg/ha K +*Azotobacter*+ *Azospirillum*+ PSB recorded the highest growth parameters.

Keywords: Biofertilizers, Kalmegh, vermicompost, growth parameters.

Introduction

Kalmegh [*Andrographis paniculata* (Burm.f.) Wall. ex Nees], a member of family Acanthaceae, is a well-known multifaceted plant employed in ayurveda and homeopathy.

Panchang (root, stem, leaf, flowers and seeds) of the plant is used in various formulations of Indian systems of medicine. The whole plant has astringent, anodyne, anti-inflammatory, antifungal, antibiotic, anti- snake venom, alexipharmic properties and is useful in cholera, dysentery, diabetes, malaria, typhoid, influenza, bronchitis, tonsillitis, hypertension and gonorrhea. A decoction of the plant is a blood purifier and is used as a cure for torpid liver, jaundice, dermatological diseases, dyspepsia and stomach ailments in infants (Anonymous, 1985).

Till recent years, medicinal plants like Kalmegh were being collected from the wild but due to increasing anthropogenic stress in forests, these plants are being encouraged to be cultivated outside the forest ecosystem.

Plant growth is a process where the plant utilizes solar energy, CO_2 from the atmosphere and water and nutrients from the soil. Plants continuously extract nutrients from the soil. When insufficient, these nutrients are responsible for limiting crop growth. N, P, K are the primary nutrients. In addition, less intensively used secondary nutrients are necessary as well. A shortage of one or more nutrients can inhibit or stunt plant growth (Gruhn *et al*., 2000).

The way these nutrients are managed is crucial for plant growth.

Various studies show that medicinal plants respond best to organic source of nutrients which are also environment friendly (Menon and Potty, 1998 and Kurian et al, 2000).Vermicompost and FYM may

fulfill the nutritional requirements if used appropriately. Inoculation with biofertilizers like *Azotobacter/Rhizobium* may increase the productivity by 10-20 %.(Gill and Sarlach, 2006).

Apart from NPK, the plant also requires other nutrients, particularly micronutrients, which may become a limiting factor with chemical fertilizers (Chauhan *et al*., 2005).

Integrated nutrient management studies on various crops have proved to be beneficial and a measure to maintain soil health and productivity. Integrated supply of nutrients to plants is incredibly important aspect of environmentally sound sustainable agriculture (Meelu et al, 1995).

Agricultural practices continuously undergo some modifications, improvements or change.

Therefore, the present study was undertaken to investigate the best combination of fertilizer(s) for Kalmegh.

Materials and Methods

Kalmegh seeds obtained from FRI, Jabalpur were sown in sandy loam soil in earthen containers of size 30 X 30 cm. The soil of the experiment had a pH of 7.42, organic carbon 0.44%, available N 170 kg/ha, P 19.8 kg/ha and K 230 kg/ha. There were 5 treatments with three replicates. The treatment details are given in table 1.

Table 1: Treatment details

S.No	Treatment	Abbreviation
1	Control(no fertilizers)	T_1
2	50 kg/ha N through vermicompost	T_2
3	25 kg/ha N through vermicompost + 25 kg/ha N through urea+ 12.5 kg/ha P	T_3
4	25 kg/ha N through vermicompost + 25 kg/ha N through urea+ 12.5 kg/ha P + 25 kg/ha K + micronutrient spray	T_4
5	25 kg/ha N through vermicompost + 12.5 kg/ha P+ 25 kg/ha K +*Azotobacter* + *Azospirillum* + PSB	T_5

N was given through vermicompost and urea, P through Single super phosphate and K through Muriate of Potash. Micronutrients were given through Micnelf 19:19:19 foliar spray. The cfu for *Azotobacter* and *Azospirillum* were 2 X 10^9 /gm of culture.

The plants were watered when required. One plant per container was maintained in a completely randomized design for 120 days. The plants were uprooted and yield attributes like plant height, number of branches, number of leaves, leaf area, fresh biomass were recorded. Plants were shade dried and dry biomass was recorded. The results were subjected to ANOVA suitable for CRD for the test of significance (Little and Hills, 1978).

Results and Discussion

The data on growth attributes at 120 days after sowing are presented in the table 2.

The results are presented in table 2.

Table 2: Effect of various treatments on growth parameters of Kalmegh

Treatment	Plant height (cm)	Branches / plant	No of leaves per plant	Leaf area (cm^2)	Fresh weight per plant(g)	Dry weight per plant(g)
T_1	63.00	13.80	78.50	9.00	48.80	35.00
T_2	66.00	14.80	92.00	9.80	69.00	47.60
T_3	72.50	15.50	96.00	10.40	75.80	48.90
T_4	80.40	18.00	108.40	10.45	80.50	52.90
T_5	82.50	15.00	160.20	14.60	84.20	59.45
CD at 5%	9.58	1.69	12.17	1.12	7.11	6.14

The results showed that integration of biofertilizers significantly improved the yield attributing characters.

The conjunctive use of vermicompost along with inorganic P, K and *Azotobacter***,** *Azospirillum* and PSB produced taller plants with more fresh weight, leaf area and dry weight followed by T_4 .

However highest no. of branches was recorded with T_4.

These results are in close consonance with the findings of Jeybal *et al.* (2000) where the integrated application of organic fertilizer combined with *Azospirillum* and phosphobacteria gave 29 % higher yield than recommended NPK in sunflower.

Sanjutha *et al*. (2008) also recorded the highest yield in kalmegh with FYM + NPK integrated with a bioregulator slurry containing azospirillum.

In the present study, half of the recommended N was adjusted with biofertilizers which are N fixers. Highest growth in this treatment support the findings in *Phyllanthus amarus* that inoculation of biofertilizers have a synergistic effect on the plant and supports the vegetative growth (Balakumbahan *et al*., 2005)

This is due to the fact that organic fertilizers improve the physical and chemical health of soil and also contribute to the nutrient pool (Tiessen *et al*., 1994)

The biofertizers have high potential of supplementing the required nitrogen and also make available P as well as S from their unavailable forms as in Ashwagandha (Ramesh Babu,1996), Agaricus (Ahlawat and Verma,2002) and henna (Vyas and Purbey, 2005).

All these studies and the present results indicate that the application of biofertilzers with 50% of Recommended N can be at par with 100% Recommended N or even better. The use of organic sources enhances the absorption and release of macro as well as micro nutrients and thus ensure their availability to the plant throughout its growing season. Through biofertizers, fertilizer application can be reduced by 50 per cent.

Conclusion

The study established the positive role of organic sources integrated with biofertilzers and inorganic fertilizers in enhancing the growth of kalmegh.

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