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Studies on effect of different fertilizers on the morphological properties of *Vigna radiata* L.

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Abstract

Biofertilizers are living microbial inoculants, environment friendly, and the best alternatives for today's agronomy. Chemical fertilizers containing nitrogen, potassium, and phosphorous are though vital micronutrients for plants growth, they causes severe health hazards. The use of bio fertilizers in agriculture improves the quality and fertility of the soil. Present study deals with the comparative applications of chemical fertilizers with biofertilizers on the morphological properties of *Vigna radiata* (L.). The seeds of *Vigna radiata* (L.) treated with *Azotobacter* and *Rhizobium* biofertilizers separately and in combination with both organisms along with chemical fertilizer urea (T_1-T_7) were studied and data obtained revealed that seeds coated with biofertilizers showed a significant increase in the morphological properties of plants as compared to seeds coated with chemical fertilizer and control seeds.

Biofertilizer are defined as preparations containing living microorganisms that when applied to the soil or seeds, it forms the association with roots or the inner part of the plant and stimulate growth by increasing the supply of essential nutrients to the host plant[4]. The microbes in biofertilizers form a symbiotic or non-symbiotic association with the roots of plants. These microbes easily convert complex organic matter into simpler ones to easily utilizable by plants. By improving soil fertility biofertilizers improves crop yield by 20-30%, replace chemical nitrogen and phosphorus by 25% in addition to stimulating plant growth. Besides this, these microbes provide protection to plants against some soil-borne diseases. Biofertilizers in comparison with chemical fertilizers have enormous economic and environmental advantages[3].

Mungbean contains high graded vegetable proteins and satisfactory level of minerals and vitamins. Mungbean may be the first choice of farmers due to its good taste, easy digestibility, better palatability and acceptable market price. Among the pulses area, only 8.10% lands are used for the cultivation of mungbean[2]. There are numerous factors

responsible for low seed yield in mungbean that are mostly related with the selection of varieties and poor crop management including improper fertilizer management.

Hence, the present research work was conducted for investigation of the effect of biofertilizers *Azotobacter* and *Rhizobium* separately and in combination along with chemical fertilizer on the growth and yield of mungbean in pot assay.

The healthy seeds of *Vigna radiata* (L.) and chemical fertilizer urea were purchased from the local market of Shahada, Dist- Nandurbar, and used in the present research study. Two organisms *Azotobacter* and *Rhizobium* were isolated from rhizospheric soil samples and used for biofetilillizer production.

Isolation of Azotobacter :

Isolation and identification of *Azotobacter* was carried out as method described by Dubey and Maheshwari. *Azotobacter* was isolated on the sterile nitrogen-free Ashby's mannitol salt agar plate after incubation at RT for more than 3 days. Mucoid, transparent colony of *Azotobacter* on Ashby's mannitol salt agar plate was selected, purified further, and confirmed by morphological and biochemical tests.

Isolation of Rhizobium- The culture of *Rhizobium* was isolated from freshly collected healthy nodules of the nodulated plant as method described by Dubey and Maheshwari. Sample was inoculated on congo red yeast extract mannitol salt agar plate. Plates were incubated for 48-72 h. Pink-colored, large, gummy isolated colonies were purified further and confirmed by morphological and biochemical tests.

Preparation of liquid biofertilizer and slurry :

For the preparation of liquid biofertilizers slant cultures were inoculated in the respective selected liquid medium and cell biomass was used as a thick paste for coating the seeds and the remaining medium with organism was stored in refrigerator for use as liquid biofertilizer preparation.

Seeds treatment :

Direct seed coating method with sugary syrup was applied in seed treatment. 20 healthy seeds of Mungbean seeds (approx. 50 g) were coated with the thick paste of *Azotobacter* and *Rhizobium* biofertilizers separately, and 5gm paste of each with the combination. All the seeds were thoroughly mixed with the paste and dried under the shade in the laboratory and sown on the next day. Seed treatments were carried out in the manner like T_1 Control, T_2 *Rhizobium,* T_3 *Azotobacter* T_4 *Rhizobium* + *Azotobacter,* T_5 *Rhizobium* + Urea(0.5g), T_6 *Azotobacter* + Urea(0.5g), T_7 Only Urea(0.5g). Control was maintained by one set of seeds in sterile distilled water. All the experimental pots were allowed to grow up to 20 days at Room temperature. After incubation, the number of seeds germinated in each fertilizer treated and control pots were observed. Morphological properties like shoot length, root length, the number of leaves per plant, and plant height along with chlorophyll content were measured

Table-1. Effect of different fertilizers on the morphological proprerties of mungbean

Treatment	Root length (cm)	Shoot length (cm)	Number of leaves	Plant height(cm)	Chlorophyll
T_1 (Control)	1.2 ± 0.2	0.4 ± 0.4	05	4.2 ± 0.2	0.30 ± 0.2
T_2 (*Rhizobium*)	15.5 ± 0.3	3.4 ± 0.2	15	9.3± 0.4	0.85 ± 2.2
T_3 (*Azotobacter*)	4.3 ± 0.1	0.7±0.3	09	7.5 ± 0.5	0.63 ±2.3
T_4 (*Rhizobium* + *Azotobacter*)	12 ± 1.2	2.2 ± 0.14	20	12.3 ± 2.1	0.101 ± 0.2
T_5 (*Rhizobium* + Urea)	10.6 ± 0.5	1.1 ± 0.2	12	8.5 ± 0.23	0.63 ± 0.31
T_6 (*Azotobacter* + Urea)	3.4 ± 0.2	0.48 ± 1.1	10	7.3 ± 0.5	0.61 ± 0.4
T_7 Urea	4.8 ± 0.1	0.4 ± 0.2	0	7.5 ± 0.2	0.53 ± 0.3

Values are the means of triplicate ± SD

in seeds treated with bio-fertilizer, chemical fertilizer, and in control.

Biofertilizers *Azotobacter* and *Rhizobium* were prepared in the present investigation and applied separately and in combination with chemical fertilizer to healthy seeds for investigation of their effect on morphological properties and yield of mungbean plant. Experimental data (Table-1) revealed that the coating of seeds with *Azotobacter* and *Rhizobium* biofertilizers in combination had a great influence on the yield of mungbean including shoot length, root length, number of leaves, plant height, and chlorophyll content of plants. All characters observed were differed significantly under the treatments of biofertilizers and chemical fertilizer as compared to control. Biofertilizer plants absorbed more nutrients from the soil, the increase in the growth prarmeters may be due to the favourable actions of biofertilizers which resulted in more availability of nitrogen, certain growth-promoting hormones like auxins, gibberellins, vitamins and organic acid secreted by bio-inoculants.

Root length and shoot length :

When root length and shoot lengths were measured in centimetres results (Table-1) revealed that elongated roots and shoots were observed in seeds treated with Treatment T2, *i. e.* with treatment of *Rhizobium* separately. Maximum root length 15.5± 0.3 cm and shoot length 3.4 ± 0.3 cm were observed in seeds treated with treatment T2 as compared to control or treatment T5. While minimum root length, as well as shoot length, was observed in control and in seeds treated with only chemical fertilizers.

Plant height :

Large variations was observed in the height of the plants due to the treatment of biofertilizers separately and in combination. The maximum height was recorded in seeds treated with rhizobium biofertilizer and seeds treated with combined treatment of *Azo-Rhizo*

biofertilizer. Similarly, a maximum number of leaves 20 and chlorophyll content 101 were observed in plants treated with treatment T4, *Azo-Rhizo* biofertilizers as compared to control. Results in Table-1 revealed that significant variation in the number of leaves as well as all other morphological parameters of plants were observed due to the treatment of biofertilizers. Microbial cells present in biofertilizers through their metabolic activities supply essential nutrients as well as growth substances for enhanced growth and morphological properties of plants.

Data obtained in the present study revealed that biofertilizers have significant importance in the growth of the plants. Seeds coated with biofertiliizers *Azotobacter* and R*hizobium* showed enhanced increase in the shoot length, root length, plant height as well as chlorophyll content of the plant as compared to chemical fertilizer.

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