Educational Administration: Theory and Practice
2024, 30(1), 6958-6962
ISSN: 2148-2403
https://kuey.net/
Research Article

Response Of Fertilizer And Bio Fertilizer (Rhizobium) Application On Plant Growth And Yield Traits In Mung Bean (Vigna Radiata L.) Wilczek

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Citation: Lovishpreet Kaur, et.al (2024). Response Of Fertilizer And Bio Fertilizer (Rhizobium) Application On Plant Growth And Yield Traits In Mung Bean (Vigna Radiata L.) Wilczek, *Educational Administration: Theory and Practice*, 30(1) 6958-6962
Doi: 10.53555/kuey.v30i1.10194

ARTICLE INFO

ABSTRACT

Fertilizer is very important in Mung bean. Using fertilizer not only increases revenue and revenue attributes, but also improves seed quality. Therefore, this experiment was carried out to determine the effects of fertilizers along with organic fertilizers (Rhizobium). The nutrients (N, P) can be supplied through Urea, P 2 O 5 fertilizers, Nano fertilizer, with the combination of Rhizobium. The production of mung bean is influencedss by the genotype of varieties and agronomic management. The seed yield is influenced by the nutrient levels both applied and present in soil, the nutrient source and the method of application including basal foliar and nano based fertilizers. Therefore, To determine the combination response of fertilizer and bio fertilizer (rhizobium) application on plant growth and yield traits in mung bean is warranted to identify the effect on growth patterns, yield attributes and quality parameters. the grain yield and biomass in mung bean under different fertilizer and bio fertilizer level conditions. This review examines response of mung bean varieties to nutrient management practices on different levels of fertilizer with combination of bio fertilizer (rhizobium) in different varieties of mung bean crop sown under normal conditions. This study is conduct to optimize the fertilization strategies for high yield and to improve growth and yield components of mung bean.

Keywords: *Yield attributes, bio fertilizer, Genotype, Urea, fertilizers, Varieties.*

1. Introduction

Among the various pulses, mungbean has a major role in fulfilling the pulses requirement in India and is evident from the fact that during 2021-22 out of the total pulses production 27.3mt (DPD) the mungbean contributed to extent of 20.4%. Mungbean (*Vigna radiata*. L) a member of Fabaceae family is known by various names. in different languages *viz*. green gram, moong, golden gram etc. Cultivated mungbean is a self-pollinated annual pulse crop (IIPR, 2022). Mungbean is consumed for its easy digestion as dhal or split seeds, while the green pods are utilized as vegetables.Mungbean husk and split beans can be used as livestock feed.Mung bean is an excellent green manure since it decomposes easily when absorbed (the biomass includes 1.5% nitrogen). The seed comprises 25% protein, 1.15% fat, and 62.6% carbohydrate. Seeds are boiled and used in soups or cereal with rice or wheat, while sprouted seeds, which are high in vitamins, are eaten as salad.

Mung Bean (Vigna Radiata (L) Wilckzeck) is an important source of easy-to-digest high-quality proteins for vegetarians and diseases. The seeds are said to be a traditional source of cures for paralysis, rheumatism, coughs, fevers and liver ailments (Muchira *et al* 2018).

In 2021, the global mung bean market generated roughly USD 3,787.83 million in sales, and it is expected to grow at a Compound Annual Growth Rate (CAGR) of more than 3.31% from 2021 to 2028, reaching approximately USD 4,757.59 million by 2028. Furthermore, the worldwide mung bean market is expected to expand by around USD 30.25 billion between 2022 and 2028 (IIPR, 2022). Mungbean has numerous applications in various places, and particular cultivars may be required.

The pulsesin general and the mungbean crop in particular has low nitrogen fertilizer requirement due to their ability to fix the atmospheric nitrogen. Even this low amount of required fertilizer is applied as a starter dose at the time of sowing. Afterwards, the nodules develop on the roots and take care of nitrogen requirement of the crop (Oljirra D *et al.*2019).

2. Effect of Fertilizer

A field experiment was conducted by Yomso *et al.* (2023) to determine the best fertilizer combination and cropping system for mung bean production. The experiment consisted of eight treatments and three replicates arranged in a split plot design. For various fertilizer levels, treatment with a combination of nano fertilizer and NPK fertilizers produced higher yield attributes compared to all other treatments. In contrast, we observed low numbers for revenue and revenue attributes in therapeutic treatments (no fertilizer). This study concluded that the combination of 50% recommended doses of fertilizer + 50% nano NPK fertilizer + single mental bean produced the highest yield. This study showed that the growth of manganese beans was affected by leaf spraying with nano NPK fertilizer, resulting in positive changes in revenue attributes and yield. Therefore, in this experiment, the best fertilizer combination and the best cultivation system for increasing the yield of the gun is the combination of 50% RDF + 50% Nano NPK fertilizer + Sole mung bean, which can be carried over to produce at higher munjin. Similarly, a field trial by Singh et al. (2020) During the rabbi in 2017-2018, at the Agricultural Research Farm of Lovely Professional University Faculty of Agriculture, Phagwara, Punjab. The performance of Munger beans was evaluated in the study by expanding them with a variety of nutrients and seeding methods. SML 668 varieties were used in the experiment. Two factors random block designs were used. Three seeding patterns (flat sowing, layer sowing, increased comb seeding) and six treatments: T0 (control), T1 (compost), T2 (NPK), T3 (micron nutrients), T4 (NPK + micronutrients), and T5 (NPK + lush substances). It was found that Ridge Seed had the best results. Better growth and revenue parameters were observed in T5 (NPK + micronutrient + compost). Furthermore, the interaction between comb seeds and T5 resulted in higher plant height, resulting in number of leaves, number of branches, and particle yield, whereas the interaction between flat sowing and T5 showed better results with podding, number of grains per pod, pods per plant, and weight of 1000 grains.

Field tests were conducted by Abdul et al. (2020) During the 2018 season in the central Kut Nursery des Kut district of Iraq's Wasco province, they assess the response of Munger Bean yield to different nitrogen fertilizer and irrigation management under pelvic irrigation conditions in central Iraq. This study was conducted using a complete block design randomized in three replicates. The treatment contained 40 kg of N.HA-1 as the base with irrigation in the first flower stage (N1), and 60 kg of N.HA-1 as the base with irrigation in the first stage of the flow (N2), 80 kg N.ha-1 as basal with one irrigation at first flowering stage (N3), and 100 kg N.ha-1 as a basal with one irrigation during the first flowering stage (N4). Significant impacts on pod length, 100-seed weight, grain yield, and biological yield were found, with the highest values at treatment N3 (10.72 cm, 8.55 gm, 1.604 t. ha-1, and 2.231 t. ha-1, respectively). Treatment N2 produced the most pods per plant (34.28), however the number of seeds per pod and harvest index were not significantly influenced.

Fim is considered to be an ideal but crap for growing impulses. Field tests were conducted by Muchira et al. (2018) to determine the effect of distance and application speed of fim on the growth and grain yield of mungu beans of locally termed variety-K22. A randomized complete block design (RCBD) with three replicates was used. Individual figures measured 2.1 x 2 m and separated by a 0.5 m route. Phosphorus was used at a speed of 46 kg P_2O_5/ha using DAP (18:46:0) at a speed of 100 kg/ha. The Farm of Farm (FYM) was used along with control diagrams of 5 tons and 10 tons per HA. Mungbean was sown at three distance levels: 40 x 15 cm, 45 x 15 cm, and 50 x 15 cm. Data were recorded as plant height, number of leaves for flowering, number of pods per plant, number of seeds per pod, weight of 100 seeds, dry matter, horn yield, and harvest index. Due to different distances and fertilizer usage rates, significant differences were observed in terms of mung bean growth and grain yield. Mung bean economic yield was optimal at a distance of 45 x 15 cm, as this distance provides the best plant population. It was found that the most effective fertilizer coverage rate is 100 kg/ha DAP. Despite the low nutritional freedom, Fim showed the potential to increase productivity at 10 tons/ha. This study recommended the use of DAP at a distance of 45 x 15 cm and 100 kg/ha to improve the growth of mung bean and grain yields in Munguia County, Nakuru County. Additionally, a 45 x 15 cm distance combined with a 10 ton/ha fim was proposed as an alternative that is a limited factor in the cost of inorganic phosphorus.

Field tests were conducted by Achaakza et al. (2012) at the Agricultural Research Institute (ARI) in Quetta. The soil in the testing area was salt free, with a central texture with low organic matter and total nitrogen content. During Khalif season, four types of mung beans, NM-92, NM-98, M-1, and NCM-209, were cultivated for the second consecutive year (2007 and 2008). Six different nitrogen fertilizer values were applied at rates of 0, 20, 40, 60, 80, and 100 kg/ha, while constant doses P_2O_5 and K_2O were applied to any N levels (except controls). The Urry material was used as a nitrogen source, while the TSP and SOP were used as phosphorus or potassium sources. The size of the figure was kept at 2.40 m^2 and placed in a randomized complete block design (RCBD). Due to different fertilizer levels, a significant effect ($p < 0.05$) on most growth characteristics of Munger beans was observed. The maximum number of days to flower (48.25) and the maximum number of branches per plant (3.83) were recorded for plants exposed to the highest nitrogen dose of 100 kg/ha. Similar responses were found for different types of mung bean. The maximum days to flower (47.72) and the number of leaves per plant (5.86) were recorded in NCM-209, but the maximum plant height (38.52 cm) and the number of branches per plant (3.72) (3.72) of Mung Beanser M-1 were obtained. The correlation coefficient studies showed a positive correlation with a significant ($p < 0.05$) between plant height (0.593), number of leaves per plant (r = 0.325), number of branches per plant (r = 0.187) and leaf area (r = 0.342) and particle yield (kg/ha). However, days of up to 50% flowers (r = -0.265) showed a significant but negative correlation with grain yield. A field experiment was conducted by Singh et al. (2014) to study the effect of Sulphur (S) and cobalt (Co) fertilization in combination with Rhizobium inoculant (RI) and recommended NPK fertilization (RDF) on mung bean growth, yield, and nutrient uptake in an acidic soil of northeast India. The application of RI alone or in combination with S or Co (without NPK) did not significantly increase grain yield. However, the combined application of RI+S+Co increased yield up to 450 kg/ha from 240 kg/ha in the control. The application of recommended NPK alone resulted in a higher grain yield of 530 kg/ha, which was more than double the yield in the control. Further addition of RI+S+Co along with RDF nearly tripled the yield (730 kg/ha) compared to the control.

Effect of bio fertilizer

Biofertilizers are living creatures that have various microbial cells which play crucial role in agriculture. These are preparation entities, which have microbial strains of living and latent cells that may be helpful in uptake of nutrients from root rhizosphere zone and majorly fix N from atmosphere where nutrients are in the gaseous form (Kumawat *et al.* 2022). A lot of microorganism species that are beneficial by stimulating plant growth through plethora of mechanism (Vessey *et al.* 2003).
The rhizobium culture inoculates the seed of the pulse crop during sowing to ensure proper nodulation. Nitrogen promotes plant and root growth (Kumawat al., 2021). Nitrogen (N) and phosphorus (P) are vital and abundant in mung bean, playing important roles in its growth, development, and high production. They also have a substantial impact on numerous mung bean features. In low-nitrogen soils (total N content <0.05%), applying a small amount of N fertilizer increases rhizobia development and vigorous mung bean seedling growth (Hosamaneet al. 2017). Mung bean cannot efficiently fix atmospheric nitrogen during the early growth phases before the branches emerge due to a lack of rhizobia. Increasing N fertilizer treatment during the early growing period stimulates vegetative growth and generates conditions conducive to high production (Mekonnen et al. 2018).As the plant grows, so does its rhizobia, and its ability to fix atmospheric N improves; however, high N fertilizer inhibits rhizobia activity during the late growth period. In this scenario, floral bud differentiation and yield production are hampered. P fertilizer improves root growth, disease resistance, drought tolerance, and improved nutrition and water absorption in seedlings that have depleted their endosperm reserves.

Bhuvan *et al.* (2023) Field tests were conducted at the Crop Research Farm Agricultural Farm Training Institute in Dehradun, Uttarakhand, India. This experiment followed a factorial randomized block design (RBD) with 12 treatments with three replicates at a figure size of 2 m x 2 m. The treatments included Rhizobium inculcation (inoculated and uninoculated) phosphorous (50,60,70 kg/ha) and sulphur (5,10 kg/ha) dose. The results demonstrated the significant role of these nutrients in enhancing green gram productivity offering valuable insights into sustainable crop management practices. The result showed that highest plant height was observed in treatment Rhizobium + phosphorous @ 60 kg/ha + Sulphur @ 5 kg/ha. Maximum dry weight was observed with treatment with rhizobic bacteria inoculation at 5 kg/ha + P @ 60 kg/ha and sulfuric. The most common pods/plants were observed in treatment with 5 kg/ha 70 kg/ha + sulfur @70 kg/ha + sulfur. The highest total yield, net turn, and profit quota were observed with 5 kg/ha 60 kg/ha + treatment underlying + phosphorus.

Kumar *et al.*(2020) public a report on economic feasibility of biofertilizers and found biofertilizers are low-cost materials that sustain plant nutrient availability and They play a crucial role with chemical fertilizers. Biofertilizers are composed of plant-associated microbes that increase plant development, yield, and quality by supplying enough nutrients in the pulses. Pulses for nitrogen fixation, P mobilization, and solubilization are examples of traditional biofertilizers. New types of biofertilizers were added to the list, including K-solubilizers, Zn-solubilizers, and other microbial consortiums capable of providing various nutrients to pulses. Many of these bacteria help pulse crops endure abiotic stress in addition to providing nutrients. Biofertilizers have recently grown in popularity as a result of the increased attention on soil health, pollution reduction, and reduced chemical usage in agriculture.

Parmanik *et al.* (2014) From February to June 2010, field experiments will be conducted at the Agricultural Field Research Institute at Bangladesh University of Agriculture to investigate the growth of Mymen Singh , weed growth, weed effects, and faucet yield (CV. BINAMOOG-7). Experimental treatment consists of (a) five bio water extraction levels: 0, 1, 2, 3, 4 kg HA-1 and (b) four levels of weed levels: no. weeding, one weeding, two weeding, and three weeding. The experiment was laid out in a randomized complete block design with three replications. The results show that the highest plant height (58.83 cm) was preserved in 60's measurements of 4 kg biofertilizer HA-1, and the highest dry weight plant 1 (17.78 g) was preserved on the 60's date, made with 2 kg biofertilizer. Weights of 1.9-1.9-hiair and 1.9-1-1-1-1.09 g) (18.09 g) were generated (18.09

g). We have achieved a significant amount of reach at the maximum level of the HA-1 Biofertilizer, up to 2 kg. The use of 2 kg of biofertilizer HA-1 with 3x weeds has proven as the best possible combination.

Sandilya *et al.*(2023) The aim of this experiment was to determine the performance of mun beans when treated with sheets of organic fruit meat, neem-coated urea, and NPK (12:32:16). The experiment was conducted during the 2022 Kharif season at a research farm at a lovely professional university in Phagwara, Punjab. This experiment was created with a randomized block design using eight treatments, a T1 control (20:40:00 kg/ha). T2-npk level as application (12:32:16); T3-75% neem coated urea + rhizobium; T4-75% neem coated urea + VAM; T5-50% neem coated urea + rhizobium. T6-50% Neem Coated Urea+ VAM; T7- NPK Foliar application+ Rhizobium; T8- NPK application (12:32:16) + VAM. The outcome showed that among all of the therapies, determines that both T7 (NPK Foliar Application 12:32:16 + Rhizobium) and (T8- NPK application 12:32:16 + VAM) showed the best results in all the parameters.

Yadav *et al.* (2024) Conduct a field experiment and analyse several factors such as shoot length, biomass, and pH during a three-month period in field experiments. Farmyard manure and commercial chemical fertilizers were utilized as comparison controls. Plants planted with individual Rhizobium sp. biofertilizers produced no meaningful results in morphological or physical characteristics. On the contrary, consortium biofertilizers Rhizobium sp., P. putida, and F. aurantia produced visible Mun bean yields. The findings suggest that using biofertilizers in various combinations might be an effective environmentally friendly way to increase Mun bean crop output, boosting farmer revenue and enhancing pulse supply in our country.

3. Conclusion

In conclusion, the collective findings of review, current research and study, it can be concluded that applying nutrients in an integrated manner-for example, using a mix of inorganic and bio fertilizers has a significant impact on growth traits and yields like Fresh weight, Dry weight, yield parameters and quality of seeds such as number of pods/plant, no. of seeds/pod, Pod length and seed yield of mung bean.

COMPETING INTERESTS Authors have declared that no competing interests exist.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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