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# Performance of Summer Mung Bean (*Vigna radiata* L.) at Different Organic Sources of Nutrients

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**A B S T R A C T**

An investigation was conducted on agriculture research farm, School of Agricultural Sciences, SGRRU in Dehradun district to evaluate Performance of summer mung bean (*Vigna radiata* L.) at different Organic sources of nutrients. Was conducted during kharif season of 2019 to find the effects of fertility levels and effects of bio fertilizers. There were no significant effects on plants stand, maximum plant height at 45DAS, number of branches total nodules by application of poultry manure and vermicompost. Number of pods per plant and seed per plant significantly higher by application of Rhizobium (B1) and PSB (B2).

## Introduction

Mung bean (*Vigna radiata*) is one of the most ancient and extensively grown leguminous crops of India. It is primarily a rainy season crop but with the development of early maturing varieties, it has also proved to be an ideal crop for spring and summer seasons. Mung bean is an excellent source of high-quality protein. It can be boiled or eaten whole and contains about 25 per cent protein. It also contains high quality of lysine (4600 mg/g N) and tryptophan (60 mg/g N) and consumed as whole grain or as well as in the form of dal for table purposes. Mung bean is supposed to be easily digestible, hence, is preferred by patients. The sprouted seeds of Mung bean are rich in ascorbic acid (vitamin C), riboflavin and thiamine. In spite of being widely adapted crop in India, its productivity is very low.

Crop productivity could be achieved with the help of agrochemicals. The green revolution brought impressive gains in food production but due to intensive use of Agro-chemicals soil bio-diversity is being affected. There is now tremendous pressure on growers to use integrated nutrient management approach to increase productivity and sustain soil health. Organic amendment offers an alternative or supplementing control tactic to increase production. During the last several years, considerable progress has been made in the utilization of vermicompost and seed inoculation with *rhizobium* and PSB for

integrated nutrient management approach. Organic sources of nutrients like vermicompost are extensively used in various crops. These organic additives can be used to promote the development of beneficial organisms in the soil. Several workers used organic additives to enhance the growth, yield and quality of crops. Organic amendments also increase the efficiency of bio-fertilizers. Such bio-fertilizers are cheaper, eco-friendly and based on renewable energy sources has gained momentum in recent years to supplement the parts of chemical fertilizers. The rhizosphere is inhabited by actively growing microbial population that immensely affects the root and plant metabolic activities. *Rhizobium* and PSB are beneficial for root nodule formation collectively known as rhizobia, as potential microbial inoculants have been convincingly emphasized in recent years for its nitrogen and phosphorus fixing ability. Hence, the present investigation was carried out to find out appropriate integrated nutrient management option for Mung bean productivity and to find out available NPK and organic carbon status in soil after harvest of Mung bean in Uttarakhand region. Among various bio-fertilizers, rhizobium inoculation is a cheapest, easiest and safest way of supplying nitrogen to Mung bean through well-known symbiotic nitrogen fixation process.

Phosphate solubilizing bacteria (PSB) have the consistent capacity to increase the availability of phosphate to plant by mineralizing organic phosphorus compounds. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. FYM and Bio-compost helps for better crop yield by improving soil fertility and soil structure. Hence adoptions of appropriate nutrient management strategies hold a great potential in boosting the Mung bean yield in a suitable manner.

## Materials and Methods

The field experiment was conducted during Kharif season of 2019 in the Crop Research Centre of School of Agriculture Sciences, SGRRU, Dehradun, Uttarakhand. The experiment consisted nine treatment combinations of seven fertility levels (RDF @ 20 kg N + 45 kg P2O5/ha, FYM @ 5 t/ha, FYM @ 2.5 t/ha + 50% RDF, Poultry manure @ 1.7 t/ha, Poultry manure @ 0.85 t/ha + 50% RDF, Vermicompost @ 2 t/ha, Vermicompost @ 1.0 t/ha + 50% RDF) two bio-fertilizers (Rhizobium and PSB) and an absolute control (Table 1). The experiment was laid out in randomized block design replicated three times. The treatments were allocated randomly. The climate of Dehradun is humid subtropical. Summer temperatures can reach up to 44°C for a few days and a hot wind called Loo blows over North India. Winter temperatures are usually between 1 and 20°C and fog is quite common in winters like plains. Although the temperature in Dehradun can reach below freezing during severe cold snaps, this is not common. During the monsoon season, there is often heavy and protracted rainfall. Average Rainfall is 2074 mm. Dehradun and other plain areas of Uttarakhand see almost as much rainfall as coastal Maharashtra and more than Assam. Agriculture benefits from fertile alluvial soil, adequate drainage and plentiful rain. It was recorded that Dehradun received 1734 mm rainfall from the month of July to October in 2019. The maximum and minimum temperature was recorded during the growing season of crop (i.e., July 2019 to Oct. 2019) was 25ºc and 3ºC respectively (Table 2). Observations was made Fertility levels and bio fertilizers on number and weight of nodules per plant at 45 DAS and observations of fertility levels and bio fertilizers on yield attributes the highest grain and straw yield were recorded under treatment $A_7$ - Vermicompost @ 0.7 t/ha + 50% RDF and

lowest under treatment $A_2$ - FYM @ 4 t/ha. Harvest index (HI) % were calculated as per the standard formula as well as economics of lentil/ha

## Results and Discussion

### Effect of fertility levels

Application of vermicompost @ 1.0t/ha + 50% RDF (A7) represented the maximum number of total nodules, effective nodules, fresh weight and dry weight of nodules per plant, which were significantly higher than rest of the treatments but at par with poultry manure @ 1.5t/ha + 50% RDF (A5) (Table 3). The number of pods/plant and seeds/pod increased significantly with vermicompost @ 1.0t/ha + 50% RDF (A7) which remaining at par with poultry manure @ 1.5t/ha + 50% RDF (A5) recorded appreciably higher values of above parameters over rest of the fertility levels. There was no significant effect on test weight due to varying fertility levels. However, the maximum test weight was recorded with poultry manure @ 1.5 t/ha + 50% RDF (A5) (Table 4). Seed, straw and biological yields significantly increased due to application of different fertility levels, wherein, the maximum seed yield (1351 kg/ha), straw yield (2633 kg/ha) and biological yield (3984 kg/ha) was recorded with vermicompost @ 0.7 t/ha + 50% RDF (A7) which also remained at par with poultry manure @ 1.5t/ha + 50% RDF (A5) but significantly superior to rest of the treatments. Harvest index remained unaffected due to varying fertility levels (Table 5).

### Effect of bio-fertilizers

The total nodules, effective nodules, fresh and dry weight of root nodules per plant were recorded with the application of Rhizobium (B1), which was found at par with the application of PSB (B2) but both the treatments were superior to absolute control. Application of Rhizobium (B1) and PSB (B2) fetched significantly higher number of pods per plant and seeds per pod as compared to absolute control. Application of Rhizobium (B1) and PSB (B2) recorded significantly higher seed yield by 48.00 and 47.6 per cent, straw yield by 32.9 and 31.00 per cent and biological yield by 38.00and 36.01 per cent, respectively over absolute control.

**Table.1** Treatments with their symbols

| | **Treatment** |
|---|---|
| | **Fertility levels** |
| **(i)** | ***RDF (20 kg N + 45 kg P2O5/ha)** |
| **(ii)** | **FYM @ 5 t/ha** |
| **(iii)** | **FYM @ 2.5 t/ha + 50% RDF** |
| **(iv)** | **Poultry manure @ 1.0 t/ha** |
| **(v)** | **Poultry manure @ 0.5 t/ha + 50% RDF** |
| **(vi)** | **Vermicompost @ 2.0 t/ha** |
| **(vii)** | **Vermicompost @ 1.0 t/ha + 50% RDF** |
| **viii)** | **Rhizobium** |
| **ix)** | **PSB** |

**Table.2** Weekly weather data during the experimental period (15th July 2019 to 31st Oct. 2019)

| Month & Year | Meteorology Days | Temp.(°C) Min. | Temp.(°C) Max | Relative Humidity | Rainfall | Evaporation |
|---|---|---|---|---|---|---|
| July. 2019 | 29 | 22.28 | 31.7 | 94.57 | 13.1 | 2.44 |
| | 30 | 23.78 | 32.1 | 94.57 | 16.9 | 2.87 |
| Aug. 2019 | 31 | 24.14 | 31.1 | 93.57 | 14.2 | 2.83 |
| | 32 | 23.36 | 32.5 | 96.28 | 20 | 2.73 |
| | 33 | 24.11 | 31.4 | 98.28 | 21.9 | 2.34 |
| | 34 | 23.07 | 32.1 | 94.57 | 2.47 | 2.57 |
| Sep. 2019 | 35 | 23.68 | 32.5 | 94.57 | 23.7 | 2.53 |
| | 36 | 23.97 | 33.3 | 95.85 | 3.66 | 2.5 |
| | 37 | 24.28 | 34 | 94.71 | 2.86 | 2.66 |
| | 38 | 22.36 | 32 | 92 | 0.57 | 2.08 |
| Oct. | 39 | 21.14 | 32 | 95 | 20.7 | 2.53 |
| 2019 | 40 | 18.81 | 30.2 | 95.28 | 21.1 | 2.47 |
| | 41 | 15.86 | 30.6 | 93.57 | 0 | 2.18 |
| | 42 | 15.1 | 31 | 92.86 | 0 | 1.84 |
| | 43 | 13.31 | 31 | 92.5 | 0 | 1.78 |
| Total Mean | | 21.45 | 29.1 | 92.28 | 10.8 | 2.47 |

**Table.3** Fertility levels and bio fertilizers on number and weight of nodules per plant at 45 DAS

| Treatments | Total nodules | Effective nodules | Fresh weight (mg) | Dry weight (mg) |
|---|---|---|---|---|
| $A_1$ - RDF (20 kg N + 40 kg $P_2O_5$/ha) | 28.39 | 19.17 | 351.56 | 58.55 |
| $A_2$ - FYM @ 4 t/ha | 26.72 | 13.97 | 256.14 | 50.67 |
| $A_3$ - FYM @ 2 t/ha + 50% RDF | 27.72 | 18.17 | 330.52 | 55.33 |
| $A_4$ - Poultry manure @ 1.7 t/ha | 26.94 | 14.56 | 250.65 | 52.28 |
| $A_5$ - Poultry manure @ 0.85 t/ha + 50% RDF | 29.59 | 20.61 | 391 | 62.74 |
| $A_6$ - Vermicompost @ 1.4 t/ha | 27.01 | 16.34 | 324.08 | 54.96 |
| $A_7$ - Vermicompost @ 0.7 t/ha + 50% RDF | 30.78 | 22.22 | 414.61 | 62.23 |
| SEm± | 23.11 | 12.23 | 213 | 37.33 |
| CD. (P=0.05) | 2.45 | 2.45 | 41.57 | 3.88 |
| Bio fertilizers | | | | |
| $B_1$ - Rhizobium | 28.95 | 18.47 | 341.34 | 57.79 |
| $B_2$ - PSB | 27.66 | 17.24 | 321.12 | 56.42 |
| SEm± | 0.46 | 0.46 | 7.6 | 0.7 |
| CD. (P=0.05) | NS | NS | NS | NS |
| F X B interaction | NS | NS | NS | NS |

**Table.4** Effect of fertility levels and bio fertilizers on yield attributes

| Treatments | Pods/plant | Seeds/pods | Test weight (g) |
|---|---|---|---|
| $A_1$ - RDF (20 kg N + 40 kg $P_2O_5$/ha) | 21.27 | 11.39 | 34.59 |
| $A_2$ - FYM @ 4 t/ha | 18.28 | 9.78 | 33.6 |
| $A_3$ - FYM @ 2 t/ha + 50% RDF | 21.15 | 11.17 | 34.5 |
| $A_4$ - Poultry manure @ 1.7 t/ha | 20.46 | 10.8 | 34.27 |
| $A_5$ - Poultry manure @ 0.85 t/ha + 50% RDF | 22 | 12.28 | 36.4 |
| $A_6$ - Vermicompost @ 1.4 t/ha | 21.11 | 11.12 | 34.48 |
| $A_7$ - Vermicompost @ 0.7 t/ha + 50% RDF | 23.61 | 11.52 | 35.3 |
| SEm± | 0.61 | 0.27 | 1 |
| CD. (P=0.05) | 1.78 | 0.81 | NS |
| Bio fertilizer | | | |
| $B_1$ – Rhizobium | 21.32 | 11.29 | 35 |
| $B_2$ – PSB | 20.93 | 11 | 34.4 |
| SEm± | 0.31 | 0.16 | 0.54 |
| CD. (P=0.05) | NS | NS | NS |
| F X B interaction | NS | NS | NS |

**Table.5** Effect of fertility levels and bio fertilizers on seed, straw and biological Yields and harvest index

| Treatments | Yield(kg/ha) | | | Harvest index |
|---|---|---|---|---|
| | grain | straw | Biological | |
| $A_1$ - RDF (20 kg N + 40 kg $P_2O_5$/ha) | 739 | 2679 | 3863 | 32.31 |
| $A_2$ - FYM @ 4 t/ha | 628 | 2478 | 3485 | 30.67 |
| $A_3$ - FYM @ 2 t/ha + 50% RDF | 710 | 2667 | 3836 | 32.13 |
| $A_4$ - Poultry manure @ 1.7 t/ha | 657 | 2496 | 3593 | 32.33 |
| $A_5$ - Poultry manure @ 0.85 t/ha + 50% RDF | 759 | 2686 | 3912 | 33.05 |
| $A_6$ - Vermicompost @ 1.4 t/ha | 665 | 2656 | 3788 | 31.73 |
| $A_7$ - Vermicompost @ 0.7 t/ha + 50% RDF | 800 | 2833 | 4184 | 33.91 |
| SEm± | 44 | 52 | 100 | 1.27 |
| CD. (P=0.05) | 25 | 152 | 289 | NS |
| Bio fertilizers | | | | |
| $B_1$ – Rhizobium | 710 | 2660 | 3886 | 32.15 |
| $B_2$ – PSB | 669 | 2619 | 3784 | 32.46 |
| SEm± | 22 | 27 | 52 | 0.57 |
| CD. (P=0.05) | NS | NS | NS | NS |
| F X B interaction | NS | NS | NS | NS |

In conclusion based on results of five months experimentation, it may be inferred that conjunctive application of vermicompost @ 0.7 t/ha + 50% RDF or poultry manure @ 0.85 t/ha + 50% RDF and seed inoculation with Rhizobium or PSB were found to be the most promising treatments. Since, these treatments fetched appreciably higher yield and net returns from green gram compared to their corresponding sole application of either manure or chemical fertilizer and no inoculation.

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