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# Influence of Spacing and Organic Manures on Growth, Yield and Economics of Mung Bean (*Vigna radiata* L.)

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**ABSTRACT: The present study aimed to evaluate the influence of spacing and organic manures on Mung bean (var. "NIDHI SAMRAT") conducted during *Kharif* 2020 at SMOF (SHUATS Model Organic Farm) of Agronomy, SHUATS, Prayagraj (U.P.). Spacing and Organic Manures are the important factors for increasing the production and economics The soil experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.4), low in organic carbon (0.45%), available P (27.0 kg/ha) and available K (313.6 kg/ha). With combination of spacing and organic manures *viz*: 30×10 cm$^2$, 40×10 cm$^2$, 50×10 cm$^2$ and Vermicompost 4 t/ha, FYM 10 t/ha, Poultry manure 2 t/ha. The experiment was laid out in Randomized Block Design with 9 treatments each replicated thrice. The results showed that *viz*: Plant height (50.04 cm), was recorded significantly higher with combination of spacing and organic manures. 30×10 cm$^2$ + FYM 10 t/ha. Whereas, number of branches/plant (4.26), number of nodules/plant (45.80), dry weight (8.97 g), CGR (7.89 g/m$^2$/day), RGR (0.7 g/g/day) was recorded significantly higher with combination of spacing and organic manures 40×10 cm$^2$ + FYM 10 t/ha. Number of pods/plant (40.27), seed/pod (9.13), test weight (27.33g), seed yield (1046.67 kg/ha), stover yield (2583.67 kg/ha), biological yield (3630.00 kg/ha) and H.I (28.85%) was recorded significantly higher with combination of spacing and organic manures 30×10 cm$^2$ + FYM 10 t/ha. Higher gross returns (64091.83 INR/ha), net returns (35921.83 INR/ha) and B:C ratio (2.26) was acquire with combination of spacing and organic manures 30×10 cm$^2$ + FYM 10 t/ha.**

**Keywords:** Greengram, Spacing(s), Vermicopost, FYM, Poultry manure

## INTRODUCTION

India is a major pulse growing country in the world, currently producing 18.5 million tonnes with imports of 3-5.4 million tonnes and expending about 22 million tonnes. The major pulse growing states are Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh and Andhra Pradesh with together account for about 82 per cent of the producing from an area of about 74 per cent. Greengram (*Vigna radiata* L. Wilczek) is a self-pollinated leguminous crop which is grown during *Zaid* as *Kharif* season in arid and semiarid regions of India. It is miserable that average turnout of greengram is very low (763.5 kg/ha) as compared to its potential yield of 2 to 4 t/ha. Numbers of factors have been responsible for low yield of greengram in our country. Improper nutrient management have been witnessed to be most important factors for such set back in yield of greengram. The efficiency of manure has been found enhancing yield if it in mixed with phosphorous. As phosphorous is second most deficient in Indian soils after nitrogen. Important reasons for increasing low yield in greengram at farmers field were the continuous cultivation of traditional low potential cultivars use of low seed rate and improper agronomic practices among many crop production constrints appropriate crop spacing and organic manures are the most important, which produce more seed yield in greengram.

Spacing plays an important role in supply to the high yield because thick plant population will not get proper light for photosynthesis and high infestation of diseases. On the other hand very low plant population will also reduce the output. Due to this reason normal population will also reduce the output. Advantage of optimum spacing under irrigated condition is due to reduce competition for light because when the moisture is lacking, light is no longer limiting factor and the advantage of uniform spacing is lost (Ihsanullah *et al*., 2002).

The effect of Vermicompost in combination with other mineral fertilizer and/soil is quite hearten for better crop growth and harvest of pulses. Even at the lower dose than that of recommended dose of mineral fertilizers, vermicompost has shown better results for projection and crop yield, which is not only in expensive but also favourable with soil improvement point of view (Bajracharya & Rai 2009). Farmyard manure is known to play an important role in improving the fertility and capacity of soils through its positive effects on soil physical, volatility and biological properties and level of plant nutrition. Poultry manure can be efficiently used for the crops after composting the same to save the

nutrients. (Amanullah *et al*., 2003). Plants that collect poultry manure grew taller than other plants possibly more concentrated nutrients or minerals were made readily available and easily absorbable by the receiving plants leading to faster growth and development (Enujeke, 2013).

Keeping above points in mind present investigation was conducted over evaluation of various manure of growth and yield parameters of greengram.

## MATERIALS AND METHODS

The experiment was carried out during *Kharif* season of 2020 at SMOF (SHUATS Model Organic Farm), Department of Agronomy, naini Agricultural institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj (Allahabad), Uttar Pradesh. The SMOF is situated at 25°24′41.27″ N latitude, 81°50′56″ E longitude (Google, 2019) and 98 m elevation above the mean sea level. This area is situated on the right side of river Yamuna and south east side of Prayagraj city. The experiment consisting of nine treatments that are replicated thrice in Randomized Block Design with combination of spacing and organic manures comprising with three spacing levels *viz*: 30×10 $cm^2$, 40×10 $cm^2$, 50×10 $cm^2$ and three levels of organic fertilizers *viz*: Vermicompost 4 t/ha, Farm yard manure10 t/ha, Poultry manure 2 t/ha. The treatment combination which are $T_1$: 30 × 10 $cm^2$ + Vermicompost4 t/ha, $T_2$ : 30 × 10 $cm^2$ + FYM 10 t/ha, $T_3$ : 30 × 10 $cm^2$ + Poultry manure 2 t/ha, $T_4$ : 40 × 10 $cm^2$ + Vermicompost4 t/ha, $T_5$: 40 × 10 $cm^2$ + FYM 10 t/ha, $T_6$ : 40 × 10 $cm^2$ + poultry manure 2 t/ha, $T_7$ : 50 × 10 $cm^2$ + Vermicompost4 t/ha, $T_8$: 50 × 10 $cm^2$ + FYM 10 t/ha, $T_9$: 50 × 10 $cm^2$ + Poultry manure 2 t/ha. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.4), low in organic carbon (0.45%), available P (27.0 kg/ha) and available K (313.6 kg/ha). Seeds were sown in line manually at a depth of 4-5 cm in furrows seeds are covered with soil immediately after sowing the seeds. The spacing of crop between row-row and plant to plant were according to the treatment details. The nutrient sources were Vermicompost, FYM, Poultry manure. Irrigation was based on the necessity and as per the time of sowing. The growth parameters namely, plant height, number of branches/plant, number of nodules/plant, dry weight/plant, crop growth rate, relative growth rate was recorded at harvest. The yield parameters namely., number of pods/plant, number of seeds/pod, test weight, grain yield, stover yield, biological yield, harvest index, gross returns, net returns and benefit cost ratio were recorded with standard process of observation. The data was statistically analysed using analysis of variance (ANOVA) as applicable Randomized Block Design (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

*A. Growth attributes*

The data presented in Table 1 Crop growth and development on greengram was measures in terms of plant height (cm), Number of branches (no), number of nodules (no), dry weight (g/plant), crop growth rate (g/$m^2$/day) and relative growth rate (g/g/day). At 60 DAS the data on plant height shows significantly increase with (50.04 cm) was recorded with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha (45.80) are found statistically at par to 30×10 $cm^2$ + FYM 10 t/ha compared to other treatment combination. The plant height increased due to the spacing practices had significant effects on plant height (cm); however, an increasing trend with closer geometry level could be noticed. This may be due to the competition between the inter and intra plants for sun light, water, nutrients and space at closer spacing which encouraged self-thinning of branches and enhanced vertical growth rather than the horizontal growth. Thavaprakash (2017) similar findings were also reported by Siddaraju *et al*., (2010). FYM provides favourable soil environment and supply more nutrients that resulted in better plant growth and also forming physico-chemical and organic properties of soil (Mishra *et al.,* 2016). Number of branches per plant at 60 DAS shows significantly increase with higher number of branches (4.26) was recorded in with the combination of spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha (3.75) are found statistically at par to 40×10 $cm^2$ + FYM 10 t/ha. Number of branches/plant was found to significantly higher under wider spacing; this may be attributed to more horizontal growth and plant canopy area under wider spacing due to less plant density and competition compared to those in closer spacing (Bahadur and Singh, 2005). The application of various nutrients through different sources either alone or in combination resulted in significantly higher number of branches per plant. The maximum number of branches per plant might be due to synergistic effect organic manures is known to enhance chlorophyll content, cell division shoot growth and photosynthetic rate.

**Fig. 1.** Recording of plant observations at research field.

And number of nodules per plant at 60 DAS the nodules count were decreased with non-significant data the highest number of nodules were recorded (25.47) was recorded with combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Such increase in nodulation, root growth might be due to increase in number of nodules which might have supplied sufficient nitrogen by nitrogen fixation and finally enhance productivity of greengram (Prasad *et al*., 2014).

The plant dry weight (g/plant) at 60 DAS significantly higher dry weight recorded (8.97 g/plant) with

combination of spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 40×10 $cm^2$ + Poultry manure 2 t/ha (8.37 g/plant) are found statistically at par to 40×10 $cm^2$ + FYM 10 t/ha. Due to Higher dry matter production is observed in 40×10 $cm^2$ spacing due to better photosynthetic activity due to greater exposure to light and increased availability of nutrients to plants have also resulted in higher root dry weight on the plants results reported by (Khan *et al.,* 2017). The beneficial effect of FYM, poultry manure and Vermicompost on crop yields and soil productivity is the result of their usefulness as a store house of plant nutrients. These organic sources of nutrients improved soil aeration, root development and increase microbial and biological activities in the rhizosphere. This in turn, would have improved assimilation of nutrients and thus dry weight might be increased. And crop growth rate ($g/m^2$/day) at 45-60 DAS highest CGR was recorded (7.89 $g/m^2$/day) with the combination of spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 30×10 $cm^2$ + Poultry manure 2 t/ha (6.30 $g/m^2$/day), are found statistically at par to 40×10 $cm^2$ + FYM 10 t/ha. The results obtained dry weight per plant exhibited on increasing trend up to harvest stage. It may be due to gradual accumulation of food material in different vegetative and reproductive phase of the plant. Which was mainly due to more population per unit area. Similar findings were also reported by Sathyamoorthi *et al*., (2008). And the RGR (g/g/day) at 45-60 DAS significantly higher RGR was recorded (0.07) affecting the combination as to spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 40×10 $cm^2$ + Poultry manure 2 t/ha (0.05 g/g/day), are found statistically at par to 40×10 $cm^2$ + FYM 10 t/ha. Compared to other treatment combination.

**Fig. 2.** Spraying in the research field.

*B. Yield attributes*

The data presented in Table 2, Observation regarding yield are recorded like pods per plant (No.), Seed per pod (No), Test weight (g), Seed yield (kg/ha), Strove yield (kg/ha), Biological yield (kg/ha) and Harvest index (%). Maximum number of pods per plant significantly recorded (40.27) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 50×10 $cm^2$ + FYM 10 t /ha (35.33) are statistically at par to 30×10 $cm^2$ + FYM 10 t/ha.

Due to higher number of pods per plant might have been possible due to more vigour and strength attained by the plants as a result of better photosynthetic activities with sufficient availability of light, and supply of nutrients in balanced quantity of the plants at growing stages. Resulted into higher length of the pod (Nadeem *et al*., 2003). The maximum number of seed per pod recorded (9.13) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. And test weight maximum recorded (27.33) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10t/ha compared to other treatment combination. The highest maximum number of seed yield with significantly recorded (1046.67 kg/ha) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 50×10 $cm^2$ + FYM 10 t/ha (986.67 kg/ha), are statistically at par to 30×10 $cm^2$ + FYM 10 t/ha. Maximum number of Stover yield with significantly recorded (2583.67 kg/ha) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 50×10 $cm^2$ + Vermicompost 4 t/ha (2382.33 kg/ha), are statistically at par to 30 ×10 $cm^2$ + FYM 10 t/ha. The maximum number of biological yield with significantly recorded (3630.34 kg/ha) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha (3452.67 kg/ha) are statistically at par to 30×10 $cm^2$ + FYM 10 t/ha. And maximum harvest index was recorded (28.83%) with the combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. Whereas, with spacing and organic manures 40×10 $cm^2$ + FYM 10 t/ha (27.80) and 50×10 $cm^2$ + Poultry manure 2 t/ha (27.97) are statistically at par to 30×10 $cm^2$ + FYM 10 t/ha. The probable reason for increasing yield attributing characters like seed yield, strove yield, biological yield and harvest index due to under spacing 30×10 $cm^2$ with less intra row spacing higher seed yield as compared to 40×10 $cm^2$ spacing it may be due to higher number of plants per hectare in case of 30×10 $cm^2$ row spacing. These result agreements with the findings of Patel (2005). The less intra row spacing increases competition for solar radiation that ultimately stunt growth of some intra row plants in vegetative phase and they were unable to reach reproductive phase even though the yield contributing variables were high when compared to the recommended spacing, the productivity was low due to lesser plant population reached to reproductive phase. According to Sarkar (2004) greengram planted at spacing 30×10 $cm^2$ significantly produced the highest seed yield as well Stover yield. Addition of organic matter improves soil structure, porosity, water holding capacity and decreases bulk density and chemical properties such as soil organic carbon and available nutrients will also be improved. All these promote soil health, crop growth and yield on sustained basis. Biological yield is the function of grain yield and stover yield. These findings are in confirmation to earlier reports of Balai *et al*., (2017) and Lokhande *et al*., (2018).

**Table 1: Influence of Spacing and Organic manures on Growth attributes of Greengram (*Vigna radiata* L.) at 60 DAS.**

| Sr. No. | Treatments | Plant height (cm) | Branches/plant (No.) | Nodules/plant (No.) | Dry weight (g/plant) | CGR ($g/m^2$/day) (45-60 DAS) | RGR (g/g/day) (45-60 DAS) |
|---|---|---|---|---|---|---|---|
| 1. | 30 × 10 $cm^2$ + Vermicompost - 4 t/ha | 44.93 | 3.07 | 22.93 | 7.67 | 6.14 | 0.03 |
| 2. | 30 × 10 $cm^2$ + FYM - 10 t/ha | 50.04 | 3.75 | 25.47 | 8.93 | 5.72 | 0.03 |
| 3. | 30 × 10 $cm^2$ + Poultry manure - 2 t/ha | 41.36 | 3.13 | 22.67 | 7.57 | 6.30 | 0.03 |
| 4. | 40 × 10 $cm^2$ + Vermicompost - 4 t/ha | 42.05 | 3.08 | 21.53 | 8.40 | 5.56 | 0.03 |
| 5. | 40 × 10 $cm^2$ + FYM - 10 t/ha | 45.80 | 4.26 | 23.53 | 8.97 | 7.89 | 0.07 |
| 6. | 40 × 10 $cm^2$ + Poultry manure - 2 t/ha | 41.36 | 3.97 | 21.53 | 8.37 | 6.17 | 0.05 |
| 7. | 50 × 10 $cm^2$ + Vermicompost - 4 t/ha | 41.69 | 3.11 | 18.40 | 8.47 | 5.42 | 0.04 |
| 8. | 50 × 10 $cm^2$ + FYM - 10 t/ha | 41.95 | 3.06 | 23.47 | 8.10 | 5.47 | 0.05 |
| 9. | 50 × 10 $cm^2$ + Poultry manure - 2 t/ha | 41.21 | 3.35 | 20.20 | 7.80 | 5.24 | 0.05 |
| SEm± | | 1.45 | 0.27 | 2.07 | 0.23 | 0.43 | 0.01 |
| CD (p=0.05) | | 4.36 | 0.82 | - | 0.70 | 1.29 | 0.02 |

**Table 2: Influence of Spacing and Organic manures on Yield attributes of Greengram (*Vigna radiata* L.).**

| Sr. No. | Treatments | Pods/plant (No.) | Seeds/pod (No.) | Test Weight (g) | Seed Yield (kg/ha) | Stover Yield (kg/ha) | Biological Yield (kg/ha) | Harvest Index (%) |
|---|---|---|---|---|---|---|---|---|
| 1. | 30 × 10 $cm^2$ + Vermicompost - 4 t/ha | 23.60 | 7.53 | 23.40 | 800.00 | 2155.67 | 2955.67 | 27.06 |
| 2. | 30 × 10 $cm^2$ + FYM - 10 t/ha | 40.27 | 9.13 | 27.33 | 1046.67 | 2583.67 | 3630.34 | 28.83 |
| 3. | 30 × 10 $cm^2$ + Poultry manure - 2 t/ha | 34.13 | 7.73 | 26.20 | 816.67 | 2546.33 | 3363.00 | 24.28 |
| 4. | 40 × 10 $cm^2$ + Vermicompost - 4 t/ha | 30.00 | 7.80 | 23.37 | 783.33 | 2382.33 | 3165.66 | 24.74 |
| 5. | 40 × 10 $cm^2$ + FYM -10 t/ha | 39.00 | 8.67 | 27.13 | 960.00 | 2492.00 | 3452.00 | 27.80 |
| 6. | 40 × 10 $cm^2$ + Poultry manure - 2 t/ha | 30.33 | 8.53 | 26.67 | 846.67 | 2105.00 | 2851.00 | 28.66 |
| 7. | 50 × 10 $cm^2$ + Vermicompost - 4 t/ha | 23.53 | 7.93 | 26.67 | 816.00 | 2209.00 | 3025.67 | 26.98 |
| 8. | 50 × 10 $cm^2$ + FYM - 10 t/ha | 35.33 | 7.60 | 25.53 | 986.67 | 2525.33 | 3512.00 | 28.09 |
| 9. | 50 × 10 $cm^2$ + Poultry manure - 2 t/ha | 29.67 | 7.60 | 26.33 | 800.00 | 2060.00 | 2860.00 | 27.97 |
| SEm± | | 1.73 | 0.39 | 1.61 | 22.87 | 68.75 | 60.42 | 0.57 |
| CD(p=0.05) | | 5.18 | - | - | 68.56 | 206.12 | 181.15 | 1.70 |

**Table 3: Economics on Spacing and Organic manures of Greengram (*Vigna radiata* L.).**

| Sr. No. | Treatments | Cost of Cultivation (INR/ha) | Gross Returns (INR/ha) | Net Returns (INR/ha) | B:C Ratio |
|---|---|---|---|---|---|
| 1. | 30 × 10 $cm^2$ + Vermicompost - 4 t/ha | 46170 | 47677.83 | 2907.83 | 1.04 |
| 2. | 30 × 10 $cm^2$ + FYM -10 t/ha | 28170 | 64091.83 | 35921.83 | 2.27 |
| 3 | 30 × 10 $cm^2$ + Poultry manure - 2 t/ha | 24170 | 50273.17 | 26103.17 | 2.07 |
| 4. | 40 × 10 $cm^2$ + Vermicompost - 4 t/ha | 46050 | 48134.50 | 2084.50 | 1.04 |
| 5. | 40 × 10 $cm^2$ + FYM - 10 t/ha | 28050 | 52179.83 | 29129.83 | 2.09 |
| 6. | 40 × 10 $cm^2$ + Poultry manure - 2t/ha | 24050 | 42986.50 | 24936.50 | 2.15 |
| 7. | 50 × 10 $cm^2$ + Vermicompost - 4 t/ha | 45480 | 46104.50 | 4174.50 | 1.01 |
| 8. | 50 × 10 $cm^2$ + FYM - 10 t/ha | 27930 | 55585.50 | 27655.50 | 2.16 |
| 9. | 50 × 10 $cm^2$ + Poultry manure – 2 t/ha | 23930 | 49030.00 | 25100.00 | 2.04 |

The higher biological yield s may be due to enhanced vegetative growth in terms of dry matter and number of branches per plant provided more sites for the translocation of photosynthetic and ultimately resulted in increased number of yield attributes i.e. biological yield. The beneficial effect of organic manures on yield attributes was probably due to enhanced supply of macro and micronutrients during entire growing season (Kumawat *et al*., 2010).

*C. Economics*

The data on cost of cultivation, gross returns, net returns and B:C ratio as influenced by different treatments as presented in Table 3, the treatment containing with the combination of spacing and organic manures 30×10 $cm^2$ + Vermicompost 4 t/ha showed highest cost of cultivation (46170 INR/ha). The data clearly revealed that maximum G.R (64091.83 INR/ha), N.R (35921.83 INR/ha) and B:C ratio of (2.27) was recorded with combination of spacing and organic manures 30×10 $cm^2$ + FYM 10 t/ha. The reason for increasing the gross returns, net returns and B:C ratio may be through organic sources. Provided vital role in attaining economical harvests that emphasise the need to adopt integrated nutrient management this results into increasing farmers premium as well as maintain soil nutrition (Aslam *et al*., 2010).

## CONCLUSION

Based on the findings it may be concluded that for optimum seed yield and economics, the performance of greengram at spacing of 30×10 $cm^2$ and along with the organic manures FYM 10 t/ha is the best for rain fed conditions.


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