

Original Research Article

Effect of levels of FYM, and Phosphorus and with and without PSB on growth, yield attributes, yield and economics of Mungbean-mungbean (*Vigna radiata* (L.) Wilczek).

Abstract

A field experiment was carried out ~~for two consecutive years (2020 and 2021)~~ during the ~~Kharif 2020 and 2021~~ season at the Student's Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture & Technology, at Kanpur, (Uttar Pradesh) India. The main objective was to find out the effect of FYM, phosphorus ~~levels,~~ and PSB on ~~the~~ growth and yield of the ~~Kharif Mungbeanmungbean.~~ Mungbean variety Shweta, (K.M. 2241) was sown in Randomized Block Design with a factorial arrangement and replicated thrice. There were twenty treatment combinations of ~~The levels of 4 levels of~~ FYM ~~were:~~ control (F₀), 1.0 t (F₁), 2.0 t (F₂), and 3.0 t (F₃), and ~~5~~ levels of phosphorus ~~and PSB viz., were:~~ PSB only (P₁), 20 kg P₂O₅ (P₂), 20 kg P₂O₅ + PSB (P₃), 40 kg P₂O₅ (P₄) and 40 kg P₂O₅ + PSB (P₅) ~~laid out in Randomized Block Design and replicated thrice.~~ The FYM, phosphorus, and PSB were applied as per treatment. The ~~maximum-hiher~~ growth attributes and number of pods per plant (~~14.70~~), pod weight/plant (~~7.44 g~~), test weight (~~41.36 g~~), seed yield (~~894 kg/ha~~), gross income (~~Rs 68744/ha~~), net income (~~Rs 40790.8/ha~~) and B:C ratio (~~2.46~~) were recorded with ~~(F₃)~~ 3t FYM/ha ~~among the FYM levels and 40 kg P₂O₅/ha + PSB among the levels of PSB and phosphorus.~~

~~As regards the phosphorus levels, it also improved growth, yield attributes, and yield of Kharif Mung. The maximum number of pods per plant (13.99), pod weight/ plant (6.57 g), test weight (40.85 g), seed yield (825 kg/ha), gross income (Rs 63431.25/ha), net income (Rs 35191.50/ha and B: C ratio (2.23) were recorded with the application of (P₅) 40 kg P₂O₅/ha + PSB.~~

Keywords: ~~Mungbean,~~ Economics FYM, Mungbean, Phosphorus, PSB, ~~Phosphorus,~~ Yield, Economics.

1. INTRODUCTION

Mungbean [*Vigna radiata* (L.) Wilczek] is one of the important pulse crops grown in the arid and semi-arid regions of India. ~~Mungbean stands third after chickpea and pigeon pea among pulses (Joshi & Saxena 2002).~~ It is basically a short duration *kharif* pulse crop which and can also be grown as catch crop between *rabi* and *kharif* seasons. ~~It is fairly tolerant to drought and can be grown successfully on well drained loamy to sandy loam soil in areas of erratic rainfall. During summer, it can also be used as a green manure crop.~~ Being a leguminous crop, it has the capacity to can fix atmospheric nitrogen. Its green plants are used as fodder after removing the mature pods. ~~Mungbean is an excellent source of protein (25%) with high quantity of lysine (4600 mg/g N) and tryptophan (60 mg/g N) and consumed as whole grain as well as dal in different ways for table purposes (Bhavva et al., 2018). India is the largest producer, consumer and importer of pulses in the world. India produces 25% of the global pulses production. It consumes 27% of the total world consumption of pulses and also largest importer (14%) of pulses in the world.~~ In India, Mungbean-mungbean occupies 34.37 lakh ha area and contributes to 17.83 lakh tonnes in pulse production (Anonymous, 2019-20). ~~The important Mungbean~~

growing states in India are Rajasthan, Maharashtra, Karnataka, Madhya Pradesh, Gujrat, Tamil Nadu and Uttar Pradesh. In, Uttar Pradesh the total area under Mungbean was 0.49 lakh ha with the annual production of 0.14 lakh tonnes (Anonymous, 2019-20). In India, the mixed farming system with livestock raising is an integral part of crop production, which is an economic enterprise under existing conditions (Gill, *et al.*, 2009). The availability of large quantity of FYM being rich in organic matter necessitates the need for supplementing it with the fertilizers. Green manuring seems to be difficult under intensive cropping system so, recycling of different organic wastes in the form of compost would also be the good source of organic manures. Among organic manures, FYM is rich in organic matter and is a good source of plant nutrients. On decomposition, it produces organic acids and carbon dioxide, which help to dissolve minerals and make them more available to the growing plants. It helps to buffer soils against rapid chemical changes. FYM also acts as a source of energy for the growth of soil microbes. It improves the physical, chemical and biological conditions of the soil. Improvement in physical properties of the soil, organic carbon and available nitrogen, phosphorus and potassium has been well documented by Babulkar *et al.*, (2000) due to long term application of FYM and fertilizers. Application of FYM to farm-field crops also avoids its wasteful use for burning purposes. Indian soils have are poor to medium status in available phosphorus. Phosphorus is immobile in soil system and hardly 15-20 % of the applied P is utilized by a crop to which it is applied. While, The rest remains in a fixed state in soil, being influenced by various physico-chemical and biological properties of the soil (Sammauria *et al.* 2020). In addition to The P solubilizationsolubilizing mcicroorganisms, these micro-organisms can mineralize organic P into a soluble form. These reactions take place in the rhizosphere and because the micro-organisms render more P into solution than is required for their own growth and metabolism, the surplus is available for plants to absorb. Normally, these bacteria can solubilize about 15-20 kg P₂O₅ ha⁻¹ per season and inoculation was found to increase the crop yield of by 10-20 % (Gangasuresh *et al.*, 2010). Phosphorus (P) is one of the major essential elements required for the growth and development of the plants. P is present in both organic and inorganic form in the soil. Plants generally take up P in inorganic form (H₂PO₄⁻, HPO₄²⁻) from soil solution (Hocking, 2001). Some growth factors/processes associated with P in plants are seed germination, cell division, stem strength, flowering, fruiting, crop quality, synthesis of starch & fat and many biochemical activities. In leguminous crops, P promotes root nodulation, nitrogen fixation, nutrient use efficiency, efficient partitioning of photosynthesis between source and sink, and biomass production (Rao, 2009). The chemical fertilizers, no doubt, are important source which can meet the nutrient requirement but their imbalance and continuous use has led to environmental pollution and deterioration of physico-chemical properties of the soil. Furthermore, The non-availability of fertilizers at economic prices is another problem for the farmers. Under these circumstances, a system comprising balanced use of fertilizer along with multinutrient organic manures and low cost bio fertilizer needs to be evolved. At present soil health is a serious problem in agriculture. It is going to reduce day by day due to continuous use of chemicals in crops and no use of organic manures in soil as well as no inclusion of pulse crops in system, while pulses are very helpful to maintain the soil health and productivity with sustainable production. FYM is a good source of plant nutrients having growth enhancing substances and a number of beneficial micro-organisms like nitrogen fixing; P solubilizing and cellulose decomposing, thus FYM could be added advantageous in crop production. Application of phosphorus increase grain yield of pulse crops by promoting growth and hardiness to shoot, seed quality, regulate photosynthesis and also development of roots and nodulation. The PSB

also enhances the availability of phosphorus from the soil into soluble form thus make available to plant. Keeping the above facts in view, the an present investigation was planned and carried out at the SIF of C.S. Azad University of Agriculture and Technology, Kanpur during kharif seasons of 2020 and 2021 with the following objectives: to study the effect of FYM, phosphorus with and without PSB on growth, and yield attributes, and yield and economics of Mungbean, to find out the effect of phosphorus with PSB on growth, yield attributes and yield of Mungbean, to see the interaction effect of the treatments, to work out the economics of the treatment.

2. MATERIALS MATERIAL AND METHODS

A field experiments experiment were was carried out at the Student's Instructional Farm of C.S. Azad University of Agriculture and Technology, Kanpur during kharif season of 2020 and 2021. The experimental field was well leveled with good drainage system and was irrigated with tube well. Geographically Kanpur is situated at 25.26–28.58 °N latitude and 79.31–80.34 °E longitude with an altitude of 125.9 meter above the mean sea level in the central part of Uttar Pradesh, India. The soil samples from of the experimental area were collected from 0 to 15 cm soil depth randomly from various places before basal fertilizer and FYM application in both the year of experimentation after thoroughly mixing of these samples and respective soil sample was taken and physio-chemical analysis was done in laboratory. The results obtained from analytical work are as follows i.e. Soil texture was Sandy sandy loam in texture, slightly alkaline in reaction Soil (pH (7.7, 7.8), EC ds/m (0.33, 0.33), Olow in organic Carbon-carbon % (0.41, 0.42), %) and Available-available N (Kg/ha) (184.5, 186.0 kg/ha), medium in Available available P (Kg/ha) (16.53, 16.9 kg/ha), and Available-available K (Kg/ha) (149.36 151.3 kg/ha) for in 2020 and 2021, respectively. The data on weather conditions that prevailed during the crop season of both years at the meteorological observatory located at the Student's Instructional Farm as the total rainfall received during crop season was 374.7 mm and 333.2 mm in 2020 and 2021, respectively. The weekly mean maximum and minimum temperature during the crop season ranged from 32.3–35.1 °C and 20.6–27.8 °C in 2020 and 31.5–34.5 °C and 22.7–27.6 °C in 2021, respectively. The average relative humidity ranged from 33.92 % in 2020 and 45.73 % in 2021. The treatments comprised of combinations of 4 levels of FYM viz., control (F₀), 1.0 t/ha (F₁), 2.0 t/ha (F₂), and 3.0 t/ha (F₃), and 5 levels of phosphorus and PSB viz., PSB only (P₁), 20 kg P₂O₅/ha (P₂), 20 kg P₂O₅/ha + PSB (P₃), 40 kg P₂O₅/ha (P₄) and 40 kg P₂O₅/ha + PSB (P₅) laid out in Randomized Block Design and replicated thrice. The experiment was laid out in Factorial Randomized Block Design with three replications. In all twenty treatment combinations of two factors (FYM, Phosphorus and PSB) with 4 and 5 levels were tested during both years. Factor A Levels of FYM (t ha⁻¹)—4 F₀—Control, F₁—1.0, F₂—2.0, F₃—3.0, Factor B Levels of phosphorus (kg ha⁻¹)—5 P₁—PSB only, P₂—20 kg P₂O₅, P₃—20 kg P₂O₅+PSB, P₄—40 kg P₂O₅, P₅—40 kg P₂O₅+PSB. With Net plot size of 3.60 m x 2.60 m = 9.36 m². Where, The mungbean variety shweta variety of Mungbean was selected used for experiment during both years. It is a short duration variety developed by C.S. Azad University of Agriculture & Technology, Kanpur in 2013. It is short stature, yielding (10–12 q/ha) with shining seeds and greenish appearance, matures in 60–65 days. The Crop was sown in lines 45 cm apart with a plant to plant distance of 10 cm using a seed rate of 15 kg/ha⁺ seed.

The dry matter accumulation was recorded from five plant sampled from third row of

each plot leaving 0.5 m row length both side as border. ~~Plant was~~ The sampled plants uprooted as whole and cut close to the ground, ~~surface the sampled plants were~~ dried and after that placed in hot air oven at 60 °C till constant weight, ~~from the point of recorded dry weight of plants under different treatments.~~ The dry matter per plant was divided by 5 to get dry weight/plant. Nodules collected from five sample plants were dried in open for two days and then transferred dried in to oven at 65 °C for 36 hours ~~and weight of nodules was recorded and averaged for recording dry weight.~~ Total The number of branches was counted on tagged plants and average number of branches per plant was calculated. Yield attribute viz. ~~Total~~ number of pods/plant, pod weight/plant, was counted on tagged plants and averaged for number of pods/plant. ~~Total pods were collected from five tagged plants, weighted and averaged for recording mean pod weight per plant. Five pods were selected at random from each plot. Seeds of such pods were separated and counted in each case. Mean values were recorded as number of seeds/-pod were recorded~~ 5 sampleld plants, from different treatments. Five plants were selected at random from each plot and weight of such plants and average weight of seed/plant was recorded. One thousand grain from each ~~sample treatment~~ were collected at the time of threshing, counted and ~~weighted-weighed from the point of view to~~ and recorded as thousand grain weight. Before threshing, bundle weight ~~of crop produce~~ in each net plot was taken with the help of spring dial balance. The figures were converted into kg/ha. After threshing, winnowing and cleaning, seed ~~produce yield~~ of each net plot was weighed ~~on digital balance in kg which was computed into and converted into~~ kg/ha. Grain yield from each net plot was subtracted from the biological yield to get ~~Stover-stover~~ yield per net plot, ~~in kg and converted into kg/ha.~~ HThe harvest index was also recorded by dividing the economic yield by the each the percent contribution of grain yield in total biological yield, ~~which was computed as under:~~ The common cost of cultivation of ~~Mungbean-mungbean~~ was worked out ~~at first~~ considering the prevailing market rates of different inputs and operations. ~~The cost of treatments estimated separately.~~ Then the cost of each treatment was added to common cost and thus total cost of cultivation for each treatment was worked out. ~~It was recorded in and recorded~~ (Rs/ha). The income received from grain and straw ~~produce of in~~ each treatment were added together to get gross income under different treatments, ~~it was calculated from MSP for current year for grain and local market price for stover.~~ The cost of cultivation of each treatment was subtracted from gross income of respective treatments ~~and Figures so obtained were~~ and recorded as net profit. The total gross return was divided by total cost of cultivation to get return per rupee of investment.

The data recorded on different crop characters during two years of experimentation were subjected to statistical analysis. Year wise analysis was done as suggested by (Gomez and Gomez 1984) and subsequently pooled over years after testing the homogeneity of error variances of two years. Statistical analysis was done with the help of window-based SPSS (Statistical Product and Service Solutions) Version 10.0, SPSS, Chicago, IL Software on computer.

$$\text{Harvest index} = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$$

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

The data regarding plant population as influenced was non-significant by different doses of FYM and Phosphorus and PSB but numerically influenced under different doses of FYM, Phosphorus and PSB are summarized in Table 1. during both the years and pooled. However, higher number of plants/meter per running meter was recorded at 40 kg P₂O₅ + PSB in both the years and pooled. However, The interaction effect of among FYM levels and Phosphorus levels and with and without PSB was also non-significant (Table 1). It might be due to fact that the experimental crop was shown with uniform seed rate at uniform row spacing under same climatic condition. Similar finding supported observations were also made by (Keerthi *et al.*, (2015) and (Rekha *et al.*, (2018). The data regarding Dry weight (g) at Maturity maturity as influenced was significantly affected by different doses of FYM and Phosphorus with and without PSB, as presented in Table 1 however FYM and phosphorus levels and PSB the interaction effect was not found. The interactions were however non significant. At maturity stage significantly higher dry matter/plant was produced recorded in 3t FYM/ha (11.59 g) which and it being at was at par with 2t FYM/ha but was significantly superior over to 1 t FYM/ha and control. Similar Finding findings was were reported by (Katara *et al.*, (2022). At maturity data indicated that Further the highest dry matter accumulation/plant (11.31 g) was noted recorded in 40 kg P₂O₅/ha + PSB which and it was being at par with 40 kg P₂O₅/ha alone but was significantly superior over to 20 kg P₂O₅/ha + PSB, 20 kg P₂O₅/ha and PSB alone in both the years and in pooled basis analysis. It might be due to favorable condition for regulating the metabolic and enzymatic process in plants as stated reported by (Aslam *et al.*, (2010), (Chesti *et al.*, (2012), (Verma *et al.*, (2017) and (Patel *et al.*, (2018). It is clear from the data recorded at maturity regarding The number of branches/plant was also influenced significantly under different treatments of FYM and different levels of phosphorus and PSB. Table 1 however However their interaction effect was non-significant. The highest number of branches/plant was recorded with the application of FYM 3t/ha (4.95) which and it was significantly superior to rest of the treatments. It is also clear that The application of 2t FYM/ha was also significantly superior than 1t/ha FYM and control. Similar Finding finding are were also reported by (Choudhary *et al.*, (2011),) and (Hossain *et al.*, (2018). Where significantly Further the highest number of branches/plant at maturity was recorded in 40 kg P₂O₅ + PSB (4.52) which and it was being at par with 40 kg P₂O₅/ha as alone and 20 kg P₂O₅/ha + PSB but was significantly superior over 20 kg P₂O₅/ha and PSB alone. This might be due to application of higher doses of FYM which provide favorable condition for growth and development. The results was are in agreement with those of supported by (Ehsan *et al.*, (2017), (Kumar & Yadav, (2018) and (Kumar *et al.*, (2022). Dry weight of nodules/plant (g) among the different levels of FYM and phosphorus and PSB increased under upto 60 DAS was influenced significantly due to different levels of FYM and phosphorus with and without PSB however their interaction effect of different levels of FYM and phosphorus and PSB was found non-significant. With The highest dry weight of nodules was recorded at application of with 3t FYM/ha (14.34 g) at 60 DAS which and it was significantly superior over to rest of the treatments in both the years and in pooled basis analysis. Similar finding also conforms This was in conformity with those of (Choudhary *et al.*, (2011), (Malik *et al.*, (2014),) and (Sutrisno & Yusnawan, (2018). Where with The phosphorus and PSB the highest dry weight of nodules was recorded at with the application of 40 kg P₂O₅/ha + PSB (13.42 g) under upto 60 DAS which and it was significantly superior than to rest of the treatments. It is also clear from the data that different doses of phosphorus with PSB increased dry weight of nodules/plant as compare to alone application of phosphorus in both the years and pooled basis at 60 DAS. The highest dry weight of nodules/plant might be due to favorable condition provided by FYM which increased the dry weight of nodules as stated reported by (Singh *et al.*, (2010), (Mahetele *et al.*, (2011), Tagore *et al.*, (2013),) and (Rathour *et al.*, (2015).

3.2 Yield attribute

Data presented in Table 2 shows that The number of Podspods/Plantplant, weight of pods/plant (g),

~~Number-number~~ of seeds/pod, weight of seeds/plant (g) and ~~Test-test Weight-weight~~ (g) among the different levels of FYM and phosphorus and PSB increased significantly ~~due to different levels of FYM and phosphorus with and without PSB.~~ However their interaction effect ~~of-among~~ different levels of FYM and phosphorus ~~with and without~~ and PSB was ~~found~~ non-significant (Table 2). The ~~data showed that maximum~~ highest number of ~~Pods/pods/Plant-plant~~ (14.70), weight of pods/plant (7.44 g), ~~Number-number~~ of seeds/pod (9.62), weight of seeds/plant (4.01g) and ~~Test-test Weight-weight~~ (41.36g) were recorded ~~at~~ with 3t/ha FYM ~~which~~ and it was significantly superior ~~than~~ to other levels of FYM and control in both the years and ~~in~~ pooled ~~basis~~ analysis. ~~It is also clear from the data that~~ The increasing doses of FYM increased number of ~~Pods/pods/Plant-plant~~, weight of pods/plant (g), ~~Number-number~~ of seeds/pod, weight of seeds/plant (g) and ~~Test-test Weight-weight~~ (g) as compared to control. Similar ~~Finding-findings~~ are also reported by (~~Rahman et al. (-2008), (Kumawat et al., (2010), (Choudhary et al., (2011), (Yadav et al., (2021),-) and (Choudhary et al., (2022).~~ However ~~data showed that significantly~~ Further the highest number of ~~Pods/pods/Plant-plant~~ (13.99), weight of pods/plant (6.57g), ~~Number-number~~ of seeds/pod (8.82), weight of seeds/plant (3.68g) and ~~Test-test Weight-weight~~ (40.85g) was ~~counted-recorded~~ with application of 40 kg P₂O₅ + PSB ~~which~~ and it was significantly superior ~~than~~ to other doses of P₂O₅ + PSB except 40 kg P₂O₅/ha ~~applied as~~ alone, ~~which was at par.~~ ~~It is also clear from the data that~~ The combined application of phosphorus with PSB increased number of ~~Pods/pods/Plant-plant~~, weight of pods/plant (g), ~~Number-number~~ of seeds/pod, weight of seeds/plant (g) and ~~Test-test Weight-weight~~ (g) as compared to phosphorus applied ~~as~~ alone. ~~The~~ This increase might be due to application of higher doses of FYM and phosphorus ~~&~~ with PSB which provided favorable condition for growth and better development of plant ~~which increases overall growth attributes by increasing by providing~~ favorable condition for regulating the metabolic and enzymatic process in plants. ~~The finding supported~~ Similar observations were reported by (~~Kumawat et al., (2009), Pir et al. (-2009), (Singh et al., (2018),-) and (Singh et al. (-2022).~~

3.3 Yield

The ~~data presented in Table 3 showed that~~ ~~Seed-seed Yield-yield~~ (kg ha⁻¹), ~~Stover-stover Yield-yield~~ (kg ha⁻¹), ~~Biological-biological Yield-yield~~ (kg ha⁻¹), and ~~Harvest-harvest Index-index~~ (%) ~~was~~ were influenced significantly ~~under~~ due to different doses of FYM and phosphorus ~~with and without~~ and PSB however ~~their~~ interaction effect was non-significant (Table 3). ~~Significantly~~ The highest ~~Seed-seed Yield-yield~~ (894 kg ha⁻¹), ~~Stover-stover Yield-yield~~ (1486 kg ha⁻¹), ~~Biological-biological Yield-yield~~ (2371 kg ha⁻¹), and ~~Harvest-harvest Index-index~~ (37.65%) ~~was~~ were recorded with the application of 3t/ha FYM ~~which~~ and it was significantly superior ~~than~~ to lower doses of FYM and control on pooled basis. Similar findings were also reported by (~~Kumawat et al., (2010), (Rekha et al., (2018), (Choudhary et al., (2022),-) and (Kumar et al., 2022).~~ However ~~with~~ The application of levels of phosphorus ~~with and without~~ and PSB ~~also~~ influenced significantly ~~which increased in the~~ ~~Seed-seed Yield-yield~~ (825 kg ha⁻¹), ~~Stover-stover Yield-yield~~ (1351 kg ha⁻¹), ~~Biological-biological Yield-yield~~ (2171 kg ha⁻¹), and ~~Harvest harvest Index-index~~ (37.98%). ~~was~~ recorded with ~~the~~ application of 40 kg P₂O₅ + PSB ~~which~~ was significantly superior ~~than~~ to the rest of the treatments on pooled basis. It may be due to favourable condition provided by higher dose of FYM and phosphorus and PSB which increased the better growth and development of crop with better yield attributes. ~~Thus increase in overall yield.~~ Similar ~~findings observations~~ ~~was~~ were reported by (~~Malik et al., (2013), (Singh et al. (-2018), (Rekha et al., (2018),-) and (Sharma et al., (2021).~~

3.4 Economics

The ~~data presented in Table 4 showed that~~ cost of cultivation (Rs ha⁻¹), gross income (Rs ha⁻¹), net income (Rs ha⁻¹) and B:C ratio under different level of FYM and Phosphorus and PSB. Highest cost of cultivation (27955 Rs ha⁻¹), gross income (68744 Rs ha⁻¹), net income (40790 Rs ha⁻¹) and B:C (2.46) ratio ~~was~~ calculated under ~~were~~ recorded with 3 t FYM/ha ~~which~~ was highest followed by 2 t/ha FYM ~~while~~ and the minimum cost of cultivation was ~~ealculated-observed~~ under control in both the years and ~~in~~ pooled ~~basis~~ analysis (Table 4). This may be due to ~~higher~~ positive effect of FYM ~~and~~ over all on on

yield of crop through increased growth and yield attributes. Similar findings were also reported by (Singh *et al.*, (2011), (Jat *et al.*, (2014), (Kishor *et al.*, (2021) and (Gurjar *et al.*, (2022). However effect of the Phosphorus-phosphorus with and without and PSB showed recorded increased the cost of cultivation (28292 Rs ha⁻¹), gross income (63431 Rs ha⁻¹), net income (35191 Rs ha⁻¹) and B:C (2.23) ratio with the application of 40 kg P₂O₅/ha + PSB followed by 40 kg P₂O₅ alone, 20 kg P₂O₅/ha + PSB, 20 kg P₂O₅ alone, while the minimum was calculated-observed in PSB alone in both the years and in pooled basis analysis. Overall the B:C ratio determines the effectiveness of treatment. The increase in net income and B:C ratio might be due to more output as compared to input. over rest of the treatment. Similar findings were supported-reported by (Meena *et al.*, (2015), (Singh *et al.*, (2018), (Kumar & and Yadav, (2018),) and (Teja *et al.*, (-2022).

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Table -1. Effect of FYM and Phosphorus with and without PSB level on growth attribute of Mungbeanmungbean.

Treatment	Plant population/ <u>m row length-per-running meter</u>			Dry weight/ <u>plant (g) at Maturity</u>			No. of branches/plant at maturity			Dry weight of nodules/plant (g) at 60 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
Level of FYM t ha⁻¹												
F₁- 0 t ha⁻¹	10.86	10.99	10.93	10.41	10.52	10.47	3.90	3.91	3.91	11.91	11.99	11.95
F₂- 1 t ha⁻¹	10.66	11.00	10.83	10.93	11.04	10.99	4.18	4.15	4.16	12.79	12.76	12.77
F₃- 2 t ha⁻¹	10.73	10.86	10.80	11.17	11.30	11.23	4.48	4.47	4.48	13.27	13.26	13.27
F₃- 3 t ha⁻¹	10.60	10.99	10.88	11.49	11.69	11.59	4.94	4.96	4.95	14.34	14.34	14.34
SEd <u>SEm</u> ±	0.254	0.306	0.199	0.139	0.173	0.103	0.082	0.099	0.063	0.169	0.196	0.128
CD at 5%	N.S.	N.S.	N.S.	0.281	0.351	0.203	0.166	0.200	0.125	0.342	0.396	0.253
Level of <u>Phosphorusphosphorus and PSB</u>												
P₁- PSB	10.50	10.91	10.71	10.70	10.85	10.77	4.14	4.15	4.15	12.63	12.69	12.66
P₂- 20 Kg P₂O₅	10.75	10.75	10.75	10.94	11.09	11.02	4.36	4.35	4.35	12.85	12.76	12.80
P₃- 20 Kg P₂O₅+ PSB	10.75	11.00	10.87	11.01	11.13	11.07	4.39	4.39	4.39	13.06	13.17	13.11
P₄- 40 Kg P₂O₅	10.66	10.99	10.83	11.15	11.21	11.18	4.47	4.46	4.46	13.42	13.42	13.42
P₅- 40 Kg P₂O₅+ PSB	10.92	11.17	11.04	11.20	11.41	11.31	4.52	4.51	4.52	13.43	13.41	13.42
SEd <u>SEm</u> ±	0.284	0.342	0.222	0.155	0.173	0.115	0.092	0.110	0.071	0.189	0.219	0.143
CD at 5%	N.S.	N.S.	N.S.	0.314	0.351	0.227	0.185	0.223	0.140	0.382	0.443	0.282

Table-2. Effect of FYM and Phosphorus level with and without PSB on yield attributes of Mungbeanmungbean.

Treatment	Number of Podspods/Plantplant			Weight of pods/plant (g)			Number of seeds/pod			Weight of seeds/plant (g)			Test weight (g)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
Level of FYM t ha⁻¹															
F ₁ - 0 t ha ⁻¹	11.64	11.75	11.70	4.54	4.54	4.55	7.58	7.63	7.60	2.76	2.75	2.76	40.12	40.13	40.13
F ₂ - 1 t ha ⁻¹	13.49	13.58	13.54	4.63	5.60	5.62	7.93	7.93	7.93	3.13	3.15	3.14	40.29	40.30	40.30
F ₃ - 2 t ha ⁻¹	13.94	14.10	14.02	6.44	6.42	6.43	8.49	8.50	8.50	3.61	3.62	3.62	40.73	40.75	40.74
F ₃ - 3 t ha ⁻¹	14.54	14.86	14.70	7.46	7.43	7.44	9.62	9.62	9.62	4.01	4.01	4.01	41.35	41.36	41.36
SEd SEM ±	0.188	0.198	0.135	0.170	0.185	0.124	0.163	0.179	0.120	0.041	0.052	0.033	0.113	0.087	0.071
CD at 5%	0.381	0.401	0.267	0.344	0.375	0.246	0.330	0.363	0.237	0.083	0.106	0.065	0.228	0.175	0.140
Level of Phosphorusphosphorus and PSB															
P ₁ - PSB	12.85	12.98	12.91	5.31	5.32	5.31	7.94	8.01	7.97	2.99	2.99	2.99	40.30	40.31	40.31
P ₂ - 20 Kg P ₂ O ₅	13.06	13.19	13.13	5.84	5.82	5.83	8.24	8.26	8.25	3.28	3.28	3.28	40.58	40.59	40.59
P ₃ - 20 Kg P ₂ O ₅ + PSB	13.54	13.73	13.63	6.07	6.03	6.05	8.40	8.40	8.40	3.39	3.40	3.40	40.64	40.65	40.65
P ₄ - 40 Kg P ₂ O ₅	13.68	13.88	13.78	6.29	6.27	6.28	8.62	8.62	8.62	3.55	3.55	3.55	40.76	40.78	40.77
P ₅ - 40 Kg P ₂ O ₅ + PSB	13.89	14.10	13.99	6.58	6.55	6.57	8.82	8.81	8.82	3.68	3.68	3.68	40.84	40.86	40.85
SEd SEM ±	0.210	0.221	0.151	0.190	0.207	0.139	0.182	0.201	0.134	0.046	0.059	0.037	0.126	0.097	0.079
CD at 5%	0.426	0.448	0.299	0.384	0.419	0.275	0.369	0.406	0.265	0.093	0.119	0.072	0.255	0.196	0.167

Table- 3. Effect of FYM and Phosphorus level with and without PSB on yield of Mungbeanmungbean.

Treatment	Seed Yield-yield (kg ha ⁻¹)			Stover Yield-yield (kg ha ⁻¹)			Biological Yield-yield (kg ha ⁻¹)			Harvest Index-index (%)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
Level of FYM t ha⁻¹												
F ₁ - 0 t ha ⁻¹	615	616	616	1023	1030	1027	1638	1646	1642	37.54	37.41	37.47
F ₂ - 1 t ha ⁻¹	697	701	699	1195	1163	1179	1885	1864	1874	36.98	37.60	37.29
F ₃ - 2 t ha ⁻¹	825	793	809	1394	1335	1365	2219	2144	2182	37.15	37.70	37.43
F ₃ - 3 t ha ⁻¹	996	891	894	1499	1473	1486	2392	2354	2371	37.44	37.85	37.65
SEd-SEm ±	1.79	2.08	1.35	2.88	3.35	2.18	3.33	3.76	2.48	0.070	0.084	0.055
CD at 5%	3.63	4.20	2.68	5.82	6.78	4.32	6.73	7.62	4.91	0.141	0.170	0.110
Level of Phosphorus phosphorus with PSB												
P ₁ - PSB	665	666	666	1141	1138	1139	1805	1791	1798	36.85	37.17	37.01
P ₂ - 20 Kg P ₂ O ₅	734	712	723	1248	1221	1234	1982	1953	1967	37.03	37.47	37.25
P ₃ - 20 Kg P ₂ O ₅ + PSB	766	761	764	1298	1258	1278	2060	2019	2039	37.21	37.69	37.45
P ₄ - 40 Kg P ₂ O ₅	799	790	795	1337	1298	1318	2136	2088	2112	37.40	37.82	37.61
P ₅ - 40 Kg P ₂ O ₅ + PSB	828	823	825	1366	1337	1351	2184	2159	2171	37.89	38.06	37.98
SEd-SEm ±	2.01	2.32	1.51	3.22	3.75	2.44	3.72	4.21	2.77	0.078	0.094	0.062
CD at 5%	4.06	4.70	3.00	6.51	7.59	4.83	7.53	8.52	5.49	0.158	0.190	0.123

4. CONCLUSION

It can be concluded from the above study that ~~effect of FYM and Phosphorus level on Mungbean has better effect on growth, yield attributes, yield and economics of Mungbean. With treatment F₃—application of 3 t ha⁻¹ FYM has better growth, yield attributes, yield and economics of Mungbean as compared to other treatment with FYM and Control. However with Phosphorus level treatment P₅— and 40 Kg/kg P₂O₅+ PSB has better effect on is optimum for higher growth, and yield attributes, yield and economics of monetary returns in Mungbeanmungbean.~~

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