Int.J.Curr.Microbiol.App.Sci (2017) *6*(9): 2386-2390

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 9 (2017) pp. 2386-2390**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.609.292

Effect of Plant Geometry, Seed Priming and Nutrient Management on Growth, Yield and Economics of Summer Greengram [*Vigna radiata* (L.) Wilczek]

K.O. Gohil[1], Surendra Kumar[2*] and A.L. Jat[3]

[1]Department of Agronomy, C.P. College of Agriculture, 2Agroforestry Research Station, [3]Castor-Mustard Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar - 385 506 (Gujarat), India
**Corresponding author*

Keywords

Plant geometry, Seed priming, Nutrient management.

Article Info

Accepted:
23 August 2017
Available Online:
10 September 2017

A B S T R A C T

A field experiment was conducted during summer season of 2016 at Sardarkrushinagar located in the north-Gujarat agro-climatic region. The experiment was laid out in factorial randomized block design with replicated thrice. Greengram was sown at distance of 30 cm × 10 cm with seed priming recorded significantly higher growth attributes *viz.* plant height, seed yield (1035 kg/ha), stover yield (2334 kg/ha), net monetary returns (Rs. 17672/ha) and B: C ratio (1.76). While, number of branches/plant and number of pods/plant was recorded higher under wider spacing of 30 cm × 20 cm with seed priming. Among the integrated nutrient management treatment application of 50% RDF through chemical fertilizer + 50% RDF through castor cake recorded significantly higher plant height, number of branches/plant, pods/plant, number of root nodules/plant, dry weight of root nodules, seed yield (994 kg/ha), stover yield (2235 kg/ha) and net monetary returns (Rs. 16679/ha) and B: C ratio (1.74).

Introduction

Mungbean is an important short duration grain legume which can be grown in varying environmental conditions, during all three crop seasons *viz*., *kharif*, *rabi* and summer in different parts of the country. Mungbean is grown throughout Asia, Australia, West Indies, South and North America, Tropical and Subtropical Africa. However, India alone accounts for 65% of the world acreage and 54% of the total world production. During 2014-15, 1.51 million tonnes of mungbean was produced from 2.71 million hectare area distributed over different seasons Anonymous, (2014). Greengram is consumed in several ways by making dal, curries, soup, sweets and snacks.

The germinated seeds have high nutritional value compared with *asparagus* or mushroom. Greengram has easily digestible protein. It is an important dietary protein food to humans.

In India about 70 per cent of cultivated land is under rain fed condition. The low productivity under rain fed condition is due to soil moisture deficit, uneven rainfall, low soil fertility and poor crop management.

Materials and Methods

A field experiment was conducted during summer season of 2016 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (24°12' N latitude, 72°12' E longitude and at an altitude of 154.5 m above mean sea level) Gujarat, India. The soil of the experimental field was loamy sand in texture, low in organic carbon (0.17 %) and available nitrogen (161.5 kg/ha), medium in available phosphorus (38.86 kg/ha) and available potash (284.0 kg/ha) with 7.2 soil pH. The experiment was laid out in factorial randomized block design with replicated thrice. The experiment was consisted sixteen treatment combinations comprising four spacing and seed priming *viz*., S_1 (30 × 10 cm without seed priming), S_2 (30 × 20 cm without seed priming), S_3 (30 × 10 cm with seed priming) and S_4 (30 × 20 cm with seed priming) and four integrated nutrient management treatments *viz*., N_1 (100% RDF through chemical fertilizer), N_2 (50% RDF through chemical fertilizer + 50% RDF through FYM), N_3 (50% RDF through chemical fertilizer + 50% RDF through vermicompost) and N_4 (50% RDF through chemical fertilizer + 50% RDF through castor cake). The recommended dose of fertilizer for greengram crop was N_{20}, P_{40}, K_0 kg/ha. Organic manures *viz*., FYM, vermicompost and castor cake were applied before 15 days of sowing in the earmarked plots. The seeds were treated uniformly with *Rhizobium* and PSB and were dried in the shade before sowing. Greengram var. GM 4 was sown on 12th March using recommended seed rate of 20 kg/ha and keeping 30 cm distance between two rows in previously opened furrows and seeds were sown manually at the depth of about 3-4 cm. The first irrigation was given immediately after sowing and second irrigation was applied three days after sowing for uniform germination and establishment of crop and total 6 irrigations were applied throughout season. Various growth parameters, yield attributes and yield were recorded. Root nodules per plant were counted at 45 days after sowing by roots were washed out with clean water in a bucket to remove the adhered soil particles and then the nodules were counted and removed & dried at room temperature for taken root dry weight. The cost of cultivation and net returns were calculated by taking into account the prevailing cost of inputs and local market price of produce. The standard analysis of variance (Gomez and Gomez, 1984) technique prescribed for randomized block design in factorial concept was performed to compare the treatment means at the 5% level of significance (P=0.05) using least significant difference (LSD).

Results and Discussion

Growth and yield attributes

Plant height, number of branches/plant and pods/plant was significantly influenced due to different spacing and seed priming (Table 1). Among different spacing, 30 x 10 cm spacing with seed priming recorded significantly higher plant height (48.6 cm) though it was remained at par with 30 x 10 cm spacing without seed priming. Hence, plants were competing to grow more in upward direction for the fulfillment of light requirement for photosynthesis. These results are close conformity with the earlier finding of Kadam and Khanvilkar (2015) and Patel *et al.,* (2016). While, 30 x 20 cm with seed priming recorded significantly the highest number of branches/plant (7.82) and pods/plant (32.50) but it was remained statistically at par with 30 x 20 cm spacing without seed priming. This might be due to plants grown with wider spacing got better opportunity of availing maximum space, light and nutrients which led

to produce maximum branches and pods/plant. The above finding is in complete agreement with earlier work done by Sonani *et al.,* (2016). However, pod length was not influenced due to different spacing and nutrient management practices.

Significantly higher plant height (48.6 cm), branches/plant (7.80) and pods/plant (33.77) was observed with application of 50% RDF through fertilizer + 50% RDF through castor cake and it was found statistically at par with 50% RDF + 50% RDF through vermicompost. The increment in number of branches and pods/plant is attributed due to beneficial effect of optimum and balanced fertilization involving organic and inorganic sources of nutrients have also been investigated by Tyagi *et al.,* (2014) and Patel *et al.,* (2016).

Root nodules and dry weight

Number of root nodules and its dry weight per plant significant influence of different spacing with seed priming (Table 1). Among different row spacing, 30 x 20 cm spacing with seed priming recorded significantly higher number of nodules (28.64) per plant and its dry weight (8.20 mg) at 45 DAS over rest of treatments. Similar results were also reported by Vivekananda *et al.,* (2015).

Application of 50% RDF through fertilizer + 50% RDF through castor cake gave significantly higher number of nodules (27.68) per plant and nodule dry weight (8.16 mg) and it was remained comparatively at par with application of 50% RDF + 50% RDF through vermicompost. This might be due to application of nutrients though organic + inorganic sources gave better soil environment for root growth and to developed more nodules per plant. These results are in close conformity with the finding of Patel *et al.,* (2016).

Yield

Significantly higher seed yield (1035 kg/ha) and stover yield (2334 kg/ha) was recorded under narrow spacing of 30 x 10 cm with seed priming which was statistically at par with 30 x 10 cm without seed priming (Table 2). This was due to more number of plants occupied in per unit areas under narrow spacing as comparatively to wider spaced crop which could be led to produce higher seed yield. Similar results were also obtained by Chaudhary *et al.,* (2014) and Sonani *et al.,* (2016). Application of 50% RDF through fertilizer + 50% RDF through castor cake proved significantly higher seed yield (994 kg/ha) and stover yield (2235 kg/ha) which remained statistically at par with application of 50% RDF through fertilizer + 50% RDF through vermicompost. This might be due to combined application of organic and inorganic sources, which created favourable soil environment for adequate and continuous supply of all nutrients for a longer time which would have resulted into increases in yield attributing parameters and yield. These results are supported by the earlier findings of Mukherjee (2015) and Patel *et al.,* (2016).

Economics

The highest gross returns (₹ 40902/ha), net monetary returns (₹ 17672 ha^{-1}) and B: C ratio (1.76) was accrued with the spacing of 30 x 10 cm with seed priming (Table 2). The lowest net returns (₹ 9138/ha) with B: C ratio (1.41) was obtained with the spacing 30 x 20 cm without seed priming. It was such due to lower plant population which ultimately gave lower yield and thus recorded lower net realization and B: C ratio. Application of 50% RDF through chemical fertilizer + 50% RDF through castor cake recorded higher net monetary returns (₹ 16679/ha) with B: C ratio (1.74).

Table.1 Effect of plant geometry, seed priming and nutrient management on growth and yield parameters of summer greengram

Treatments	Plant height at harvest (cm)	No. of branches/plant	Pods per plant	Pod length (cm)	No. of root nodules/plant	Dry wt. of root nodules (mg)
Spacing and seed priming						
S_1: 30cm × 10cm (without seed priming)	47.2	7.17	26.80	8.26	22.43	7.43
S_2: 30cm × 20cm (without seed priming)	42.9	7.68	32.41	8.40	26.42	7.97
S_3: 30cm × 10cm (with seed priming)	48.6	7.31	27.59	8.31	24.84	7.69
S_4: 30cm × 20cm (with seed priming)	44.3	7.82	32.50	8.41	28.64	8.20
SEm±	1.19	0.16	0.93	0.18	0.61	0.17
CD (P=0.05)	3.45	0.45	2.69	NS	1.76	0.48
Integrated nutrient management						
N_1: 100% RDF* by fertilizer	42.9	7.18	26.42	8.24	23.30	7.49
N_2: 50% RDF by fertilizer + 50% RDF by FYM	44.6	7.33	28.17	8.32	24.27	7.63
N_3: 50% RDF by fertilizer + 50% RDF by VC	46.8	7.66	30.94	8.39	27.08	8.01
N_4: 50% RDF by fertilizer + 50% RDF by castor cake	48.6	7.80	33.77	8.43	27.68	8.16
SEm±	1.19	0.16	0.93	0.18	0.61	0.17
CD (P=0.05)	3.45	0.45	2.69	NS	1.76	0.48

Table.2 Effect of plant geometry, seed priming and nutrient management on yield and economics of summer greengram

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)	Gross realization (Rs./ha)	Cost of cultivation (Rs./ha)	Net realization (Rs/ha)	B:C ratio
Spacing and seed priming							
S_1: 30cm × 10cm (without seed priming)	988	2235	30.7	39059	22830	16229	1.71
S_2: 30cm × 20cm (without seed priming)	795	1921	29.2	31668	22530	9138	1.41
S_3: 30cm × 10cm (with seed priming)	1035	2334	30.9	40902	23230	17672	1.76
S_4: 30cm × 20cm (with seed priming)	848	1948	30.4	33591	22930	10661	1.47
SEm±	29.7	50.6	0.9	-	-	-	-
CD (P=0.05)	85.8	146.0	NS	-	-	-	-
Integrated nutrient management							
N_1: 100% RDF* by fertilizer	836	1954	29.9	33179	21345	11834	1.55
N_2: 50% RDF by fertilizer + 50% RDF by FYM	897	2057	30.5	35521	22391	13130	1.59
N_3: 50% RDF by fertilizer + 50% RDF by VC	939	2193	30.0	37247	25191	12056	1.48
N_4: 50% RDF by fertilizer + 50% RDF by castor cake	994	2235	30.9	39273	22594	16679	1.74
SEm±	29.7	50.6	0.9	-	-	-	-
CD (P=0.05)	85.8	146.0	NS	-	-	-	-

*100% RDF: 20:40:0 kg NPK/ha; selling price: Seed Rs. 35/kg; Stover Rs. 2/kg

This might be due to produced higher yield under this treatment and more amounts of FYM and vermicompost were required under organically treated plots to supply respective quantity of 50% nitrogen which increased the cost of cultivation and thus ultimately decreased B: C ratio. Similar results were also observed by Patel *et al.*, (2016).

Thus, on the basis of one year experiment it can be concluded that higher seed yield and net return can be secured by greengram (cv. GM 4) growing at 30 × 10 cm spacing either with or without seed priming and fertilized with application of 50% RDF through fertilizer + 50% RDF through castor cake in loamy sand soil of North Gujarat.

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How to cite this article:

Gohil, K.O., Surendra Kumar and Jat, A.L. 2017. Effect of Plant Geometry, Seed Priming and Nutrient Management on Growth, Yield and Economics of Summer Greengram [*Vigna radiata* (L.) Wilczek]. *Int.J.Curr.Microbiol.App.Sci.* 6(9): 2386-2390.
doi: https://doi.org/10.20546/ijcmas.2017.609.292