



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(6): 1683-1686

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Received: 06-09-2020

Accepted: 17-10-2020

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Effect of fertilizer levels with respect to yield contributing characters and yield of summer green gram (*Vigna radiata* L.)

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i6x.11007>

Abstract

The agronomic investigation entitled, "Performance of summer green gram (*Vigna radiata* L.) To fertilizer levels" was undertaken at Post Graduate Research Farm, Agronomy Section of Rajarshree Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur (M.S.), India, during summer, 2019. The experiment was laid out in a factorial randomized block design were replicated thrice with twelve treatment combinations comprises three NP fertilizer levels NP₁-75% of RDF, NP₂-100% of RDF and NP₃-125% of RDF and four potassium levels as a K₀- 00 K₂O Kg ha⁻¹, K₁- 15 K₂O Kg ha⁻¹, K₂- 20 K₂O Kg ha⁻¹ and K₃- 25 K₂O Kg ha⁻¹. The yield contributing characters viz., number of pods plant⁻¹, weight of pods plant⁻¹ (g), length of pod (cm), weight of dry pod yield plant⁻¹ (g), number of seeds pod⁻¹, 1000 grains weight (g), grain yield (q ha⁻¹) and Stover yield (q ha⁻¹) were influenced significantly with different fertilizer levels. The mean of these attributes were recorded highest with the application of NP₃-125% of RDF followed by NP₂-100% of RDF and K₃- 25 K₂O Kg ha⁻¹. The mean grain yield (q ha⁻¹) was highest with application of K₃-25 kg K₂O ha⁻¹ (15.19 q ha⁻¹) which was comparable with K₂-20 kg K₂O ha⁻¹ (14.67 q ha⁻¹) and stover yield (q ha⁻¹) was significantly highest with application of K₃-25 kg K₂O ha⁻¹ (34.62 q ha⁻¹) over K₂-20 kg K₂O ha⁻¹ (33.00 q ha⁻¹).

Keywords: NP fertilizer levels, potassium levels, yield contributing characters, yield

Introduction

Green gram (*Vigna radiata* L.) is commonly known as *moong*, golden gram, *mug* or *mung* belongs to the family *Leguminosae*. According to Vavilov (1926) [22] it was originated from India and central Asia. Green gram is one of the important pulse crop and rank third in area and production after pigeon pea and chickpea. It is one of the most important pulse crop, grown in almost all parts of the country over a wide range of agro-climatic condition. Green gram (*Vigna radiata* L. Wilczec) is one of the most ancient and extensively grown leguminous crops of India. It is valued for the protein enriched seed as an important dietary ingredient to overcome protein malnutrition of human beings. It occupies prime position among pulses by virtue of its short growth period, high biomass and outstanding nutrient value as food, feed and forage. It is an ideal source of protein and amino acids and its seed contain, 24.7 % protein, 0.6 % fat, 0.9 % fiber and 3.7 % ash as well as sufficient quantity of calcium, phosphorus and important vitamins. Due to cheaper protein source it is designated as "poor man's meat" Aslam *et al.*, (2010) [3]. It does not produce heaviness or flatulence is fairly rich in carbohydrate and appreciable amount of riboflavin and thiamine. In sprouted seeds of green grams synthesized Vitamin C and it is consumed as salad and also after roasting. Looking to the food habit of majority of Indian population, which is vegetarian, it becomes more important because it full-fill the protein requirement of the peoples. It is consumed as *dal*, *halwa*, *namkeen*, snacks and many other preparations. It also provides nutritive and laxative green and dry fodder to cattle. In India, green gram occupies an area of about 3.51 million hectare, producing 1.80 million tones with the productivity of 511 kg ha⁻¹ (Anonymous, 2012) [2]. Whereas in Maharashtra it is grown over 6.71 lakh hectare with production of 3.71 lakh tones and productivity of 552.91 kg ha⁻¹ (Anonymous, 2012) [2]. Green gram has tremendous scope for improving pulse production and area, because green gram cultivation is done during summer season has received wider acceptance from farming community as it provides extra

income, improve soil fertility, efficient land utilization, low incidence of pest and diseases and long term sustainability of agriculture without any harm to main crops (Idnani and Gautam, 2008) as well as it is good for sowing because of its short duration and good quality protein (Dewangan *et al.* 1992).

In India, the major green gram growing states are Madhya Pradesh, Maharashtra, Andhra Pradesh, Rajasthan, Bihar, Orissa, Karnataka, Gujarat and Tamil Nadu. In Maharashtra, area under total pulses is 26.31 lakh ha with the production of 19.12 lakh tones and area under green gram is 6.15 lakh ha with production of 4.05 lakh tones during the year 2016-17 (Anonymous, 2017)^[1].

The increase in productivity is not according to hope. Though, there are many reasons of low productivity including cultivation by small and poor farmers on marginal lands but lack of scientific cultivation is also a major factor responsible for low yields, so adoption of scientific methods for pulse cultivation is necessary. Being a short duration crop and having wider adaptability, it can be grown in summer as well as in *Kharif* season. It is an important ruling crop in summer season, locally known as '*Vaishakhi Mug*'. In summer season green gram crop gives good production with lustrous and bold seeds. This is only due to ideal weather conditions and absence of insect-pest and diseases during the crop season.

Fertilizer is the most critical input for any crop, for utilizing the yield potential of improve high yielding crop. However, in recent days i.e. post green revolution era, due to indiscriminate nutrient mining, soil fertility depleting at an alarming rate and to provide food for 121 crore population there is need to add fertilizers to augment the sustainable crop production.

Pulses occupy a unique position in every farming system *viz.*, main, catch, cover, green manure, intercrop and mix crop. Their inclusion in rotation kept the soil alive and productive. Pulse crops enrich the soil fertility by means of addition of organic matter and fixation of atmospheric nitrogen mediated by root nodule of *Rhizobium* bacteria. They are the cheapest source of quality protein for the human being. In general, pulses have two to three times more protein than the cereals or any other group of plants besides supply of micronutrients, low fat, high dietary fiber and complex carbohydrates. Thus pulses occupy a unique position in the diet of our people by supplying the major portion of the balance protein requirement and also serve as excellent forage as a feed of the large cattle population in the country.

Materials and methods

The experiment was laid out in a factorial randomized block design replicated thrice with twelve treatment combinations comprising of NP fertilizer levels NP₁-75% of RDF, NP₂-100% of RDF and NP₃-125% of RDF and four potassium levels as a K₀- 00 K₂O Kg ha⁻¹, K₁- 15 K₂O Kg ha⁻¹, K₂- 20 K₂O Kg ha⁻¹ and K₃- 25 K₂O Kg ha⁻¹. The gross and net plot size were 5.4 m x 4.5 m and 4.2 m x 3.6 m, respectively. The lines were marked by marker at the spacing of 30 cm apart from each other and seeds were sown in these lines at spacing of 10 cm. The soil of the experimental field was silt clay in texture, slightly alkaline in reaction (pH 7.70), having electrical conductivity 0.31 dS m⁻¹ and organic carbon content was very low (0.18%), low in available nitrogen (218.84 kg ha⁻¹), moderate in available phosphorus (21.65 kg ha⁻¹) and high in available potassium (229.10 kg ha⁻¹). The crop sowing was done on 15th February, 2019 by line sowing method with different fertilizer levels. The crop was fertilized as per

treatments by using urea, single super phosphate and muriate of potash by placement method.

Result and discussion

I. Effect on yield contributing characters of green gram

A. Effect of NP fertilizer levels

The data (Table1) recorded on mean number of pods plant⁻¹ after harvest shown that among the fertilizer levels, treatment NP₃ observed highest number of pods plant⁻¹ and which was significantly superior over the treatment NP₁, while it was at par with NP₂ level. Higher number of pods plant⁻¹ could be attributed to favorable changes in physical and chemical characteristics of the soil which might have enabled better pod formation. Similar results were also reported by Yein *et al.*, (1981). The treatment NP₃ recorded highest weight of pods plant⁻¹ (15.13 g) which was significantly superior over the treatment NP₁ (12.71), however it was comparable with NP₂ level. Thus, higher uptake of nutrients might have favored significant increase in weight of pods plant⁻¹. Similar results were also reported by Yein *et al.*, (1981)^[20]. Among different NP levels, the treatment NP₃ recorded maximum length of pod (9.05 cm), which was significantly superior over the treatment NP₁, but it was found comparable with NP₂ level. Similar results were also reported by Manpreet *et al.*, 2004^[15]. Number of grains pod⁻¹ (10.53) recorded highest with treatment NP₃ which was significantly superior over the treatment NP₁, however it was found comparable with treatment NP₂. Similar result was also reported by Sanullah Jamro *et al.* (2017)^[18]. NP₃ treatment recorded highest test weight of grains (49.80 g) and which was found significantly superior over the NP₁ treatment, however it was found comparable with treatment NP₂ (47.52 g). Similar results reported by Manpreet *et al.*, (2004)^[15].

B. Effect of potassium levels

The yield contributing characters were influenced significantly by different K₂O levels. The data in table shows that the application of 25 kg K₂O ha⁻¹ recorded highest number of pods plant⁻¹ and which was significantly superior over the treatment K₀ and K₁ (15.19). At the same time treatment K₃, K₂ and K₁ found at par with each other. Thus, the optimum growth of the plant due to favorable nutritional environment and higher uptake of nutrients and thus more number of pods plant⁻¹. Similar results were also reported by Saxena *et al.* (1996)^[19] and Khairnar and Solanke (2009). Application of 25 kg K₂O ha⁻¹ recorded more weight of pods plant⁻¹ (15.02 g), which was significantly superior over the treatments K₁ and K₀, however it was found at par with K₂ level of potassium. Similar results were obtained by Khairnar and Solanke (2009)^[10]. Among the different levels, application of 25 kg K₂O ha⁻¹ recorded maximum length of pod (8.88 cm) which was significantly superior over the K₀ treatment. The treatment K₃, K₂ and K₁ were found at par with each other. Similar results were obtained by Patil and Dhonde (2009)^[16]. Numerically mean of the number of grains pod⁻¹ (10.70) was recorded highest with the application of 25 kg K₂O ha⁻¹ which was statistically superior over the K₀ treatment, however it was found on par with treatment K₂ and K₁. Similar results were also reported by Mondal *et al.* (2003)^[14]. Among the different levels the application of 25 kg K₂O ha⁻¹ recorded the highest test weight of grains (49.28 g) which was significantly superior over the K₀ treatment, while treatment K₃ was found at par with treatment K₂ and K₁. Similar results reported by Saxena *et al.* (1996)^[19].

C. Effect of interaction

Effect of interaction of NP and potassium fertilizer levels were found non-significant in respect of number of pods plant⁻¹, weight of pods plant⁻¹(g), length of pod (cm), number of grains pod⁻¹, test weight (1000 grains in g) of green gram after harvest.

I. Effect on yield green gram

A. Effect of NP fertilizer levels

Data presented in (Table 2) indicates that the treatment NP₃ recorded higher grain yield (15.14 q ha⁻¹) which was significantly more over NP₁, while NP₃ and NP₂ and NP₂ and NP₁ found statistically at par with each other. Similar results reported by Himani B. Patel *et al.* (2017) [9]. The treatment NP₃ recorded higher stover yield (32.99 q ha⁻¹) which was significantly more over NP₁, while NP₃ and NP₂ and NP₂ and NP₁ found statistically at par with each other. Similar result were also reported by Patel *et al.*, (1984) [8]. Harvest index (%) of summer green gram was not influenced by different NP fertilizer levels.

B. Effect of potassium levels

Data pertaining to (Table 2) shows that the maximum grain yield (15.19 q ha⁻¹) was recorded by application of 25 kg K₂O ha⁻¹ which was significantly higher over K₀. However K₃, K₂, K₁ was found to be at par with each other. Higher grain yield could be attributed to favorable changes in physical and chemical characteristics of the soil which might have enabled better pod formation. These findings are in conformity with Khairnar and Solanke (2009) [10]. The treatment NP₃ recorded higher stover yield (32.99 q ha⁻¹) which was significantly more over NP₁, while NP₃ and NP₂ and NP₂ and NP₁ found statistically at par with each other. These findings are in conformity with Asgar Ali *et al.*, (1996) [4]. Harvest index (%) of green gram is not influenced by different potassium levels.

C. Effect of interaction

Interaction among fertilizer levels and potassium levels with grain yield (15.14 q ha⁻¹), stover yield (14.17 q ha⁻¹) and harvest index (30.69%) were also found non-significant.

Table 1: Yield attributing characters of green gram at harvest as influenced by different treatments at harvest

Treatments	Number of pods plant ⁻¹	Weight of pods plant ⁻¹ (g)	Length of pod (cm)	Number of grains pod ⁻¹	Test weight (g)
Nitrogen and Phosphorus levels					
NP ₁ - 15, 30 (kg N, P ₂ O ₅ ha ⁻¹)	16.83	12.71	6.97	9.04	44.07
NP ₂ - 20, 40 (kg N, P ₂ O ₅ ha ⁻¹)	19.05	14.31	8.15	10.03	47.52
NP ₃ - 25, 50 (kg N, P ₂ O ₅ ha ⁻¹)	20.62	15.13	8.97	10.53	49.96
S. Em±	0.42	0.32	0.28	0.30	0.82
C. D. at 5%	1.26	0.97	0.82	0.88	2.41
Potassium levels					
K ₀ - 00 (kg K ₂ O ha ⁻¹)	15.19	12.64	7.04	8.74	44.56
K ₁ - 15 (kg K ₂ O ha ⁻¹)	19.04	13.57	7.77	9.75	46.52
K ₁ - 20 (kg K ₂ O ha ⁻¹)	20.13	14.97	8.47	10.27	48.39
K ₁ - 25 (kg K ₂ O ha ⁻¹)	20.96	15.02	8.82	10.70	49.28
S. Em±	0.49	0.38	0.32	0.34	0.94
C. D. at 5%	1.46	1.12	0.95	1.02	2.78
Interactions (NP × K)					
S. Em±	0.85	0.65	0.56	0.60	1.64
C. D. at 5%	NS	NS	NS	NS	NS
General mean	18.83	14.05	8.03	9.86	47.19

Table 2: Grain, stover, biological yield and harvest index of green gram as influenced by different treatments

Treatments	Grain yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Harvest index (%)
Nitrogen and Phosphorus levels				
NP ₁ - 15, 30 (kg N, P ₂ O ₅ ha ⁻¹)	13.29	29.65	42.94	30.94
NP ₂ - 20, 40 (kg N, P ₂ O ₅ ha ⁻¹)	14.29	32.31	46.52	30.56
NP ₃ - 25, 50 (kg N, P ₂ O ₅ ha ⁻¹)	15.14	34.17	49.30	30.69
S. Em±	0.34	0.66	0.95	0.32
C. D. at 5%	1.00	1.96	2.82	NS
Potassium levels				
K ₀ - 00 (kg K ₂ O ha ⁻¹)	12.95	28.92	41.87	34.92
K ₁ - 15 (kg K ₂ O ha ⁻¹)	14.04	31.62	45.67	30.72
K ₁ - 20 (kg K ₂ O ha ⁻¹)	14.67	33.00	47.67	30.79
K ₁ - 25 (kg K ₂ O ha ⁻¹)	15.19	34.62	49.81	30.49
S. Em±	0.39	0.77	0.10	0.37
C. D. at 5%	1.15	2.26	3.25	NS
Interactions (NP × K)				
S. Em±	0.68	1.33	1.91	0.65
C. D. at 5%	NS	NS	NS	NS
General mean	14.21	32.04	46.25	30.73

Conclusion

On the investigation of one year data the conclusions were drawn as the application of fertilizer with 100 % of RDF (20: 40 N, P₂O₅ kg ha⁻¹) was found beneficial in increasing contributing characters and yield of summer green gram of

Potassium levels showed the significant influence on yield contributing characters and yield of summer green gram. Summer green gram is more responsive to application of 100 % RDF and 20 K₂O kg ha⁻¹ and it can be recommended for gaining good yield.

By and large fertilizer levels of NP_2 and K_2 showed good yield and yield contributing characters of summer green gram.

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