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## Effect of fertilizer levels on yield, nutrient content and uptake of summer green gram (*Vigna radiata* L.)

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### Abstract

The agronomic investigation entitled, "Performance of summer green gram (*Vigna radiata* L.) to fertilizer levels" was undertaken at Post Graduate Research Farm, Agronomy Division 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 NP<sub>1</sub>-75% of RDF, NP<sub>2</sub>-100% of RDF and NP<sub>3</sub>-125% of RDF and four potassium levels as a K<sub>0</sub>- 00 K<sub>2</sub>O Kg ha<sup>-1</sup>, K<sub>1</sub>- 15 K<sub>2</sub>O Kg ha<sup>-1</sup>, K<sub>2</sub>- 20 K<sub>2</sub>O Kg ha<sup>-1</sup> and K<sub>3</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup>. Yield and economics of summer green were influenced significantly by different NP fertilizer levels. The grain yield (15.14q ha<sup>-1</sup>) and stover yield (32.99 q ha<sup>-1</sup>) of green gram were recorded significantly highest with treatment NP<sub>3</sub> (125% of RDF) and which was followed by NP<sub>2</sub> (100% of RDF) (14.21 q ha<sup>-1</sup> grain and 31.55 q ha<sup>-1</sup> stover yield respectively), Nutrient content viz., NPK (%) in grain and straw of green gram were found non-significant with different NP fertilizer levels. NPK uptake (kg ha<sup>-1</sup>) by green were recorded significantly higher with treatment NP<sub>3</sub> (125% of RDF) and which was found at par with treatment NP<sub>2</sub> (100% of RDF) among NP fertilizer levels. Among the potassium levels application of K<sub>3</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup> was recorded significantly maximum grain yield (15.19 q ha<sup>-1</sup>) and stover yield (33.32 q ha<sup>-1</sup>) however, it was found at par with K<sub>2</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup> (14.67 q ha<sup>-1</sup> grain and 32.25q ha<sup>-1</sup> stover yield respectively). NPK content (%) in grain and straw of green gram were remain unaffected due to different potassium levels. NPK uptake (kg ha<sup>-1</sup>) was recorded significantly more with treatment K<sub>2</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup> and which was found comparable with treatment K<sub>2</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup>.

**Keywords:** NP fertilizer levels, potassium levels, yield, economics

### 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) [12] 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). It does not produce heaviness or flatulence is fairly rich in carbohydrate and appreciable amount of riboflavin and thiamine. In sprouted seeds of green gram 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*, snack 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<sup>-1</sup> (Anonymous, 2012)<sup>[2]</sup>. 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<sup>-1</sup> (Anonymous, 2012)<sup>[2]</sup>. 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)<sup>[5]</sup> as well as it is good for sowing because of its short duration and good quality protein (Dewangan *et al.* 1992)<sup>[3]</sup>.

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)<sup>[1]</sup>.

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.

Phosphorus is an integral component of virtually all the biochemical compounds that make plant life possible. Its response is known in presently available green gram varieties. Nitrogen as well as phosphorus is essential for normal growth and development of green gram. Phosphorus application to green gram increases plant growth, yield attributes and grain yield. Phosphorus promotes early root formation and the formation of lateral, fibrous and healthy roots which is very important for nodule formation and to fix atmospheric nitrogen.

## 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 NP<sub>1</sub>-75% of RDF (15, 30 kg N, P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>), NP<sub>2</sub>-100% of RDF (20, 40 kg N, P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>), and NP<sub>3</sub>-125% of RDF (25, 50 kg N, P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>), and four potassium levels as a K<sub>0</sub>- 00 K<sub>2</sub>O Kg ha<sup>-1</sup>, K<sub>1</sub>- 15 K<sub>2</sub>O Kg ha<sup>-1</sup>, K<sub>2</sub>- 20 K<sub>2</sub>O Kg ha<sup>-1</sup> and K<sub>3</sub>- 25 K<sub>2</sub>O Kg ha<sup>-1</sup>. 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 silty clay in texture, slightly alkaline in reaction (pH 7.70), having electrical conductivity 0.31 dS m<sup>-1</sup> and organic carbon content was very low (0.18%), low in available nitrogen (238.84 kg ha<sup>-1</sup>), moderate in available phosphorus (23.65 kg ha<sup>-1</sup>) and high in available potassium (249.10 kg ha<sup>-1</sup>). The crop was sown on 15<sup>th</sup> 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

### 1) Effect on yield and NPK content of green gram:

#### A. Effect of NP fertilizer levels

The data presented in table 1 revealed that, the treatment NP<sub>3</sub> (125% of RDF) recorded higher grain yield (15.14 q ha<sup>-1</sup>) which was significantly more over NP<sub>1</sub>, while NP<sub>3</sub> and NP<sub>2</sub> and NP<sub>2</sub> and NP<sub>1</sub> found statistically at par with each other. The lowest grain yield (13.29 q ha<sup>-1</sup>) was recorded in NP<sub>1</sub> treatment. The positive influence of these treatments through immediate supply of fertilizer at the early stage of the crop, which might have improved adequate biomass production and improvement in yield parameters resulting in higher grain yield. Similar results reported by Himani B. Patel *et al.* (2017)<sup>[4]</sup> and Sanaullah Jamro *et al.* (2017)<sup>[10]</sup>. Stover yield (32.99 q ha<sup>-1</sup>) of green gram was recorded significantly more by treatment NP<sub>3</sub> over NP<sub>1</sub>, while NP<sub>3</sub> and NP<sub>2</sub> and NP<sub>2</sub> and NP<sub>1</sub> found statistically at par with each other. The lowest stover yield (29.65 q ha<sup>-1</sup>) was recorded in NP<sub>1</sub> treatment. Similar results reported by Himani B. Patel *et al.* (2017)<sup>[4]</sup>. The data on harvest index (%) in given table by application of different NP levels shown not significant difference.

The data revealed that mean N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per cent in grain and stover of green gram were found not significantly different by the application of different NP fertilizer levels as presented in Table 1

#### B. Effect of potassium levels

The potassium levels affect significantly on grain and stover yield (Table 1) of summer green gram. The maximum grain yield (15.19 q ha<sup>-1</sup>) was recorded by treatment K<sub>3</sub> (25 kg K<sub>2</sub>O ha<sup>-1</sup>) which was significantly higher over K<sub>0</sub> (00 kg K<sub>2</sub>O ha<sup>-1</sup>). However K<sub>3</sub>, K<sub>2</sub> and K<sub>1</sub> was found to be at par with each other. The positive influence of these treatments through immediate supply of potassium at the early stage of the crop, which might have improved adequate biomass production and improvement in yield parameters resulting in higher grain yield. These findings are in conformity with Patil and Dhonde (2009)<sup>[9]</sup>. The maximum stover yield (33.32 q ha<sup>-1</sup>) was recorded by application of K<sub>3</sub> (25 kg K<sub>2</sub>O ha<sup>-1</sup>) and which was significantly higher over K<sub>0</sub> (00 kg K<sub>2</sub>O ha<sup>-1</sup>). However it was found at par with treatment K<sub>2</sub> (20 kg K<sub>2</sub>O ha<sup>-1</sup>) and K<sub>1</sub> (15 kg K<sub>2</sub>O ha<sup>-1</sup>). These findings are in conformity with Oad *et al.* (2003)<sup>[7]</sup>.

The data pertaining to N, P and K per cent in grain and stover of green gram with the application of different K<sub>2</sub>O levels which were found non-significant as shown in table 1.

#### C. Effect of interaction

Effect of interaction among the NP levels and potassium levels were found non-significant in respect of grain yield (q ha<sup>-1</sup>) and stover yield (q ha<sup>-1</sup>) and NPK content (%) in grain and stover of green gram after harvest.

### 2) Effect on uptake of NP and K by green gram

#### A. Effect of NP fertilizer levels

Data from the (Table 2) shows that, the significant influence on the uptake of nitrogen by green gram due to the NP level. The treatment NP<sub>3</sub> recorded higher uptake of nitrogen (52.67 kg ha<sup>-1</sup>) which was significantly maximum over NP<sub>1</sub>, while NP<sub>3</sub> and NP<sub>2</sub> were found statistically at par with each other. The lowest uptake of nitrogen (44.86 kg ha<sup>-1</sup>) was recorded in NP<sub>1</sub> treatment. Similar results revealed by Pandrangi *et al.* (1991)<sup>[8]</sup>. The treatment NP<sub>3</sub> recorded higher uptake of phosphorus (8.82 kg ha<sup>-1</sup>) which was significantly maximum over NP<sub>1</sub>, while NP<sub>3</sub> and NP<sub>2</sub> and NP<sub>2</sub> and NP<sub>1</sub> were found

statistically at par with each other. The lowest uptake of phosphorus ( $6.91 \text{ kg ha}^{-1}$ ) was recorded in NP<sub>1</sub> treatment. Similar results reported by Srivastava and Srivastava (1994)<sup>[11]</sup>. The treatment NP<sub>3</sub> recorded higher uptake of potassium ( $18.24 \text{ kg ha}^{-1}$ ) by green gram and which was found significantly higher over treatment NP<sub>1</sub>, while NP<sub>3</sub> and NP<sub>2</sub> were found statistically at par with each other.

### B. Effect of potassium levels

The potassium levels affect significantly on uptake of nitrogen by green gram (Table 2). The maximum uptake of nitrogen ( $52.69 \text{ kg ha}^{-1}$ ) was recorded by application of  $25 \text{ kg K}_2\text{O ha}^{-1}$  which was significantly higher over K<sub>0</sub>. However K<sub>3</sub> and K<sub>2</sub> and K<sub>2</sub> and K<sub>1</sub> was found to be at par with each other. Similar results revealed by Khairnar and Solanke (2009)<sup>[6]</sup>. The potassium levels affect significantly on uptake of

phosphorus by green gram. The maximum uptake of phosphorus ( $9.23 \text{ kg ha}^{-1}$ ) was recorded by application of  $25 \text{ kg K}_2\text{O ha}^{-1}$  which was significantly higher over K<sub>0</sub>. However K<sub>3</sub> and K<sub>2</sub> and K<sub>2</sub> and K<sub>1</sub> was found to be at par with each other. Similar results revealed by Patil and Dhonde (2009)<sup>[9]</sup>. The maximum uptake of potassium ( $18.49 \text{ kg ha}^{-1}$ ) was recorded by application of  $25 \text{ kg K}_2\text{O ha}^{-1}$  which was significantly higher over K<sub>0</sub>. However K<sub>3</sub> and K<sub>2</sub> and K<sub>2</sub> and K<sub>1</sub> were found to be at par with each other. Similar results were also reported by Khairnar and Solanke (2009)<sup>[6]</sup>.

### C. Effect of interaction

Effect of interaction of NP and potassium fertilizer levels were found non-significant in respect of mean uptake of nitrogen, phosphorus and potassium by green gram.

**Table 1:** Grain and stover yield and NPK content (%) of green gram as influenced by different treatments

Treatments	Grain yield (q ha <sup>-1</sup> )	Stover yield (q ha <sup>-1</sup> )	Nitrogen (%)		Phosphorous (%)		Potassium (%)	
			Grain	Straw	Grain	Straw	Grain	Straw
<b>Nitrogen and Phosphorus levels (NP)</b>								
NP <sub>1</sub> -75% of RDF (15, 30 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	13.29	29.65	3.37	1.31	0.52	0.44	0.86	1.07
NP <sub>2</sub> -100% of RDF (20, 40 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	14.21	31.55	3.45	1.38	0.53	0.43	0.93	1.14
NP <sub>3</sub> -125% of RDF (25, 50 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	15.14	32.99	3.48	1.44	0.58	0.51	0.94	1.19
S. Em±	0.34	0.68	0.040	0.010	0.007	0.006	0.010	0.009
C. D. at 5%	1.00	2.01	NS	NS	NS	NS	NS	NS
<b>Potassium levels (K<sub>2</sub>O)</b>								
K <sub>0</sub> -00 (kg ha <sup>-1</sup> )	12.95	28.92	3.36	1.29	0.49	0.42	0.84	1.06
K <sub>1</sub> -15 (kg ha <sup>-1</sup> )	14.04	31.10	3.44	1.38	0.54	0.44	0.92	1.11
K <sub>2</sub> -20 (kg ha <sup>-1</sup> )	14.67	32.25	3.46	1.41	0.54	0.47	0.93	1.17
K <sub>3</sub> - 25 (kg ha <sup>-1</sup> )	15.19	33.32	3.47	1.43	0.61	0.50	0.95	1.20
S. Em±	0.39	0.79	0.046	0.013	0.010	0.008	0.013	0.012
C. D. at 5%	1.15	2.32	NS	NS	NS	NS	NS	NS
<b>Interactions (NP × K)</b>								
S. E m±	0.68	1.36	0.081	0.041	0.031	0.026	0.041	0.037
C. D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
General mean	14.21	31.40	3.43	1.38	0.54	0.46	0.91	1.13

**Table 2:** Mean uptake of nutrients (N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O) kg ha<sup>-1</sup> by green gram as influenced by different treatments

Treatments	Nutrient uptake (kg ha <sup>-1</sup> )		
	Nitrogen	Phosphorous	Potassium
<b>Nitrogen and Phosphorus levels (NP)</b>			
NP <sub>1</sub> -75% of RDF (15, 30 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	44.86	6.91	14.36
NP <sub>2</sub> -100% of RDF (20, 40 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	49.30	7.68	17.00
NP <sub>3</sub> -125% of RDF (25, 50 kg N, P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> )	52.67	8.82	18.24
S. Em±	1.27	0.39	0.49
C. D. at 5%	3.75	1.17	1.45
<b>Potassium levels (K<sub>2</sub>O)</b>			
K <sub>0</sub> - 00 (kg K <sub>2</sub> O ha <sup>-1</sup> )	44.11	6.34	13.84
K <sub>1</sub> - 15 (kg K <sub>2</sub> O ha <sup>-1</sup> )	48.29	7.58	16.25
K <sub>2</sub> - 20 (kg K <sub>2</sub> O ha <sup>-1</sup> )	50.68	8.06	17.54
K <sub>3</sub> - 25 (kg K <sub>2</sub> O ha <sup>-1</sup> )	52.69	9.23	18.49
S. Em±	1.47	0.46	0.57
C. D. at 5%	4.33	1.35	1.68
<b>Interactions (NP × K)</b>			
S. E m±	2.55	0.79	0.98
C. D. at 5%	NS	NS	NS
General mean	48.94	7.80	16.53

### Conclusion

Based on the investigation of one year data the following conclusions were drawn as:

The application of 100% of RDF (20: 40 N, P<sub>2</sub>O<sub>5</sub> kg ha<sup>-1</sup>) was found beneficial in increasing the yield, nutrient content (%) and uptake of NPK by summer green gram.

Among the potassium levels application of  $20 \text{ K}_2\text{O kg ha}^{-1}$  was found maximum yield, nutrient content (%) and uptake of NPK of summer green gram.

By and large, summer green gram is more responsive to application of 100% RDF and  $20 \text{ K}_2\text{O kg ha}^{-1}$  and it can be

recommended for obtaining better yield, nutrient content (%) and increasing uptake of nitrogen, phosphorus and potassium.

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