

Original Research Article

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Response of Summer Green Gram [*Vigna radiata* (L.) Wilczek] Varieties to Different Nutrient Management under South Gujarat Condition

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ABSTRACT

An experiment was conducted during summer season of 2017 at the college farm, Navsari Agricultural University, Navsari to study the "Production potential of green gram [*Vigna radiata* (L.) Wilczek] varieties with different nutrient management under south Gujarat condition". The soil of the experimental field was clayey in texture having medium to poor drainage, low in available nitrogen and organic carbon, medium in available phosphorus, potassium and sulphur. Total eighteen treatment combinations consisting of three varieties viz., NKM-15-12 (V₁), GAM-5 (V₂) and Meha (V₃) and six levels of nutrient management practices viz., T₁ (75% RDF), T₂ (100% RDF), T₃ (75% RDF + 10 kg Sulphur/ha), T₄ (75% RDF + 20 kg Sulphur/ha), T₅ (100% RDF + 10 kg Sulphur/ha) and T₆ (100% RDF + 20 kg Sulphur/ha) were tested in factorial randomized block design with three replications. Variety NKM-15-12 (GM-6) recorded significantly higher value of plant height at 60 DAS and at harvest, number of seeds per pod, length of pod and test weight as compared to variety GA-5, Varieties Meha and GAM-5 being at par but registered remarkably higher number of pods per plant over NKM-15-12. Significantly the higher seed (1186 kg/ha), haulm (2430 kg/ha) and protein yield (226.20 kg/ha) of greengram were produced under the variety NKM-15-12 as compared to other varieties, respectively. Numerically higher protein content of greengram was registered under the variety Meha. The maximum gross realization of Rs 77264/ha, net realization of Rs 52021/ha and the BCR value of 3.06 was also observed under the variety NKM-15-12. Plant height at harvest, number of pods per plant, number of seeds per pod and test weight were found to be remarkably higher under the application of 100% RDF along with 20 kg S/ha as compared to 75% RDF. Significantly the highest seed (1184 kg/ha), haulm (2394 kg/ha) and protein yield (219.30 kg/ha) of greengram were produced due to the application of same treatment of 100% RDF along with 20 kg S/ha over control, which was at par with 100% RDF with 10 kg S/ha and 75% RDF with 20 kg S/ha. The numerically higher protein content was found under the same treatment. The maximum gross realization of Rs 77028 ha⁻¹, net realization of Rs 49381 ha⁻¹ and BCR value of 2.79 were secured under the application of 100% RDF along with 20 kg S/ha.

Keywords

Greengram,
Varieties, RDF,
Sulphur, Yield,
Economic

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Introduction

Greengram [*Vigna radiata* (L.) Wilczek] is one of the most ancient and extensively grown leguminous crops of India. It is a native of India and Central Asia and commonly known as mung bean. It is the third important pulse crop after chickpea and

pigeon pea, cultivated throughout India for its multipurpose uses as vegetable, pulse, fodder and green manure crop. Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses grown in world. The pulses are known to improve the physical characteristics of soil through tap root system which opens the soil in to the deeper strata

and their ability to use atmospheric nitrogen through biological nitrogen fixation which is economically sound and environmentally acceptable. Pulses are drought resistant and prevent soil erosion due to their deep root and good ground covers, because of these good characters, pulses are called as “Marvel of Nature”. Pulses can also be referred to as “mini fertilizer factory”, as they fix atmospheric nitrogen through symbiosis.

India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses production in India has not kept up with growth in demand calling for import to the tune of 2.0 to 4.0 million tonnes (Raj *et al.*, 2013). Even though pulses production increased significantly during the last decade but continuing the rapid growth is a challenge for researchers, extension agencies and policy makers to fulfil the domestic demand.

A variety can express its full yield potential under favourable management conditions and optimum level of required inputs. Varietal response to graded levels of fertilizer and sulphur is of great importance since varieties differ in their growth and developmental behaviour.

Greengram gives low seed yield and poor growth performance mainly due to poor management and low soil fertility. Nitrogen due to leaching and volatilization and phosphorus due to fixation may not be available adequately at flowering and pod formation stages of crop and result in shading of flowers and pods. The crop needs more nitrogen at the reproductive phase, and the nutrient uptake after flowering either becomes slow or stops due to inactivation of roots. The optimum supply of nitrogen and phosphorus influenced the growth and yield of greengram (Rathod and Gawande, 2012).

After phosphorus, sulphur nutrition has been found to be major limiting factor in greengram production. sulphur is now recognized as major plant nutrient, along with nitrogen (N), phosphorus (P) and potassium (K). Sulphur deficiency is becoming more critical with each passing year which is severely restricting crop yield, quality, nutrient use efficiency and economic returns of millions of farms. Like any essential nutrient, sulphur also has certain specific functions to perform in the plant. Thus, sulphur deficiencies can only be corrected by the application of sulphur fertilizer (Tandon and Messick, 2007). An application of sulphur has a synergistic effect on productivity of crops.

Considering the above facts and very less work done in south Gujarat region the experiment has been planned to study the “Production potential of greengram [*Vigna radiata* (L.) Wilczek] varieties with different nutrient management under south Gujarat condition” during summer season of 2017 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari.

Materials and Methods

Field experiment was conducted in *summer* season of 2017 at the college farm, Navsari Agricultural University, Navsari, Gujarat. Total eighteen treatment combinations comprising of three varieties *viz.*, NKM-15-12 (V₁), GAM-5 (V₂) and Meha (V₃) and six levels of nutrient management practices *viz.*, T₁ (75% RDF), T₂ (100% RDF), T₃ (75% RDF + 10 kg sulphur/ha), T₄ (75% RDF + 20 kg sulphur/ha), T₅ (100% RDF + 10 kg sulphur/ha) and T₆ (100% RDF + 20 kg sulphur/ha) were evaluated in factorial randomized block design with three replications. The soil of the experimental field was clayey in texture having medium to poor drainage, soil pH 7.60, EC 0.57 dS/m and

organic carbon content 0.36%. The soil is low in available nitrogen (184 kg/ha) and medium in available phosphorus (38.40 kg/ha), potassium (236.20 kg/ha) and sulphur (4.22 ppm) were determined by Kjeldahl's method, Olsen's method, Flame photometric method and Turbidimetric method, respectively. Greengram varieties NKM-15-12 (GM-6), GAM-5 and Meha seeds were sown at 30 cm x 10 cm spacing.

The entire dose of fertilizer was applied as per the treatments. Urea, DAP and gypsum were taken as fertilizer sources for N, P and S, respectively. All other operation was performed as per recommendations of the crops. The data on seed and haulm yields as well as protein content were recorded under various treatments after harvest of crop. The results were analysis statistically to draw suitable interference as per the standard ANOVA techniques suggested by Gomez and Gomez (1984).

Results and Discussion

Effect of variety

The different varieties shows their significant difference on all most all growth and yield attributes as well as yield parameters (Table 1 & 2). Number of branches per plant did not significantly influenced due to different varieties. Significantly the taller plant height at 60 DAS (47.50 cm) and at harvest (52.76 cm) were recorded under the variety NKM-15-12 over variety GAM-5, which was at par with variety Meha at 60 DAS (47.41 cm) and at harvest (52.44 cm). Significant difference in plant height was observed due to their genetically different growth habit. These results are in accordance with the findings of Rathod and Gawande (2012), Patel *et al.*, (2013b), Gorade *et al.*, (2014) and Patel *et al.*, (2016b). Non-significantly, but numerically higher value of number of branches per plant

at harvest (4.13) registered under the variety NKM-15-12 followed by GAM-5. These findings are substantiated with those reported by Dash and Rautaray (2017).

The variation in the yield attributing parameters like number of pods per plant, number of seeds per pod, length of the pod and test weight were significantly influenced due to different varieties. The yield attributing parameters *viz.*, number of seeds per pod (11.04), pod length (9.71 cm) and test weight (53.91 g) were found significantly superior under the variety NKM-15-12 (V₁) over varieties GAM-5 (V₂) and Meha (V₃).

However, remarkably the higher number of pods per plant (41.06) was recorded under the variety Meha over NKM-15-12, which was at par with variety GAM-5 (39.47). The percentage increase in the number of seeds per pod, length of pod and test weight were up to the tune of 23.21, 36.95 and 32.94 per cent under the variety NKM-15-12 over Meha, respectively. This difference in yield attributing characters among the different varieties might be due to genetic constitution of these varieties. The present findings are within the close vicinity of those reported by Gangwar *et al.*, (2013), Gorade *et al.*, (2014), Jadhav *et al.*, (2014) and Patel *et al.*, (2016b).

It is evident from the results presented in Table 2 that there was a significant difference in seed and haulm yields of greengram due to different varieties. The variety NKM-15-12 (V₁) produced significantly the higher seed (1186 kg/ha) and haulm yields (2430 kg/ha) as compared to varieties GAM-5 (V₂) and Meha (V₃). The lowest seed (974 kg/ha) and haulm yield (2145 kg/ha) of greengram were registered under the variety Meha (V₃). The magnitude of increased in green gram seed yield of 21.76 per cent and haulm yield of 13.28 per cent were registered under the variety NKM-15-12 over variety Meha.

This might be due to a variety of crop differed in its genetic built up along with almost all the yield attributing characters were found remarkably higher under the same variety, hence resulted in the higher yield. The above findings are in complete agreement with earlier work of Rathod and Gawande (2012), Shelke *et al.*, (2012), Patel *et al.*, (2013b), Gorade *et al.*, (2014), Patel *et al.*, (2016b), Dash and Rautaray (2017) and Puniya *et al.*, (2017).

The protein content of greengram seed did not affected significantly due to different varieties. The variety Mean recorded non significantly by numerically higher values of protein content (22.90%) followed by GAM-5 (22.78%) However, protein yield was influenced significantly due to the different varieties.. Variety NKM-15-12 was recorded significantly the highest protein yield (267.18 kg/ha) as compared to variety GAM-5 (247.50 kg/ha) and Meha (222.78 kg/ha). This difference in protein yield under different varieties occurs due to higher seed yield was observed under the same variety. Similar types of results were also found by Gangwar *et al.*, (2013) and Singh and Singh (2014).

The variation in gross realization, net realization and benefit cost ratio were observed due to use of different varieties. Among different varieties, V₁ (NKM-15-12) secured maximum gross realization of Rs 77264/ha, net realization of Rs 52021/ha and BCR of 3.06. While the lowest gross realization of Rs 63824/ha, net realization of Rs 38581/ha and BCR of 2.53 were registered under the variety V₃ (Meha). This might be due to the highest grain and haulm yields were recorded under same variety (V₁) as compared to rest of the varieties. The results confirm the findings of Shelke *et al.*, (2012), Patel *et al.*, (2013b), Jadhav *et al.*, (2014), Singh and Singh (2014), Dash and Rautaray (2017) and Puniya *et al.*, (2017).

Effect of nutrient management practices

Effect of various nutrient management treatments did not manifest their significant variation on growth parameters like plant height at 60 DAS and number of branches per plant at harvest (Table 1). Non significantly but numerically higher value of plant height at 60 DAS (47.97 cm) and number of branches per plant (4.16) at harvest were recorded with the treatment of 100% RDF with 20 kg S/ha (T₆) followed by treatment of 75% RDF with 20 kg S/ha (T₅). An application of 100% RDF + 20 kg S/ha (T₆) produced significantly taller plant height of greengram at harvest (53.75 cm) as compared to 75 and 100% RDF, which was at par with treatment T₅ (52.73 cm), T₄ (52.08 cm) and T₃ (51.28 cm). This might be due to the fulfillment of major nutrient requirements along with sulphur, being a fourth major nutrient, might have play an important physiological role by enhancing the cell division and multiplication, elongation and chlorophyll biosynthesis, which turn in to better plant height. Almost similar findings were also reported by Patel *et al.*, (2013a), Kumar *et al.*, (2015), Srinivasulu *et al.*, (2016) and Patel *et al.*, (2018).

Almost all the yield attributes such as number of pods per plant, number of seeds per pod and test weight (Table 1) were influenced remarkably by different nutrient management practices. Significantly the higher number of pods per plant (41.23), number of seeds per pod (10.82) and test weight (49.88 g) were produced due to application of 100% RDF + 20 kg S/ha (T₆) over rest of the treatments, except the treatment of 100% RDF with sulphur @ 10 kg/ha (T₅) and 75% RDF with 20 kg S/ha (T₄). Non significantly, but numerically higher length of pod (8.61 cm) of greengram was also found under the same treatment (T₆). All yield attributing character found remarkably lower under the treatment of 75% RDF. The increase in yield attributes

under sulphur fertilization along with major nutrient helps in improve overall nutritional environment in the rhizosphere as well as availability of the nutrients for plant, which turn in to enhanced the plant metabolism and photosynthetic activity resulting in to better growth and yield attributes of plant. Positive responses in terms of yield attributes due to application of major nutrient along with sulphur have been also reported by Thesiya *et al.*, (2013), Gorade *et al.*, (2014), Kokani *et al.*, (2015) and Rani *et al.*, (2016).

The variation in seed and haulm yield of green gram was significantly differed due to various treatments of nutrient management practices (Table 2). The seed (1184 kg/ha) and haulm yield (2394 kg/ha) were produced significantly higher under the treatment T₆ (100% RDF + 20 kg sulphur/ha) over

treatment T₁, but it was at par with treatment T₅ (100% RDF + 10 kg sulphur/ha) and T₄ (75% RDF + 20 kg sulphur/ha).

An application of 75% RDF registered the lowest seed (964 kg/ha) and haulm (2108 kg/ha) yield. The percent increasing in the seed and haulm yield of 22.82 and 13.56 per cent were noticed due to the treatment T₆ over treatment T₁. Improvement in the yield might have resulted from adequate supply of photosynthate from source to sink due to adequate supply of major nutrients under higher level of fertilizer and along with sulphur helps in significant improvements in growth and yield attributes. The present results closely resembled with those of Patel *et al.*, (2013b), Bairwa *et al.*, (2014), Kumar *et al.*, (2015), Srinivasulu *et al.*, (2015), Dharwe *et al.*, (2018) and Patel *et al.*, (2018).

Table.1 Effects of variety and nutrient management practices on growth and yield attributes of greengram

Treatment	Plant height (cm)		Number of branches /plant	Number of pods/ plant	Number of seed/ pod	Length of pod (cm)	Test weight (g)
	60 DAS	At harvest					
Variety (V)							
V ₁ : NKM-15-12	47.50	52.76	4.13	36.20	11.04	9.71	53.91
V ₂ : GAM-5	43.83	49.03	3.86	39.47	10.21	8.07	49.94
V ₃ : Meha	47.41	52.44	3.82	41.06	8.96	7.09	40.55
S. Em.±	0.77	0.81	0.11	0.71	0.20	0.18	0.59
C. D. (P=0.05)	2.23	2.34	NS	2.05	0.59	0.53	1.70
Nutrient Management Practices (T)							
T ₁ : 75% RDF	44.00	48.68	3.82	36.51	9.51	8.02	46.05
T ₂ : 100% RDF	45.66	49.88	3.87	38.24	9.76	8.28	47.50
T ₃ : T ₁ + 10 kg Sulphur/ha	45.82	51.28	3.83	38.07	9.84	8.16	47.44
T ₄ : T ₁ + 20 kg Sulphur/ha	46.65	52.08	3.94	39.82	10.23	8.35	48.94
T ₅ : T ₂ + 10 kg Sulphur/ha	47.37	52.73	4.02	39.62	10.27	8.37	49.00
T ₆ : T ₂ + 20 kg Sulphur/ha	47.97	53.75	4.16	41.23	10.82	8.61	49.88
S. Em.±	1.09	1.15	0.16	1.01	0.29	0.26	0.83
C. D. (P=0.05)	NS	3.30	NS	2.91	0.84	NS	2.40
CV%	7.13	6.71	12.84	7.81	8.75	9.60	5.22

Table.2 Effects of variety and nutrient management practices on yield, quality parameters and economics of greengram

Treatment	Seed yield (kg/ha)	Haulm yield (kg/ha)	Protein content (%)	Protein yield (kg/ha)	Cost of production (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	BCR
Variety (V)								
V ₁ : NKM-15-12	1186	2430	22.49	267.18	25243	77264	52021	3.06
V ₂ : GAM-5	1084	2210	22.78	247.50	25243	70589	45346	2.80
V ₃ : Meha	974	2145	22.90	222.78	25243	63824	38581	2.53
S. Em.±	22.76	35.34	0.28	5.75	-	-	-	-
C. D. (P=0.05)	65.48	101.66	NS	16.54	-	-	-	-
Nutrient Management Practices (T)								
T ₁ : 75% RDF	964	2108	22.00	212.23	26901	63115	36214	2.35
T ₂ : 100% RDF	1072	2149	22.79	244.18	27454	69708	42254	2.54
T ₃ : T ₁ + 10 kg Sulphur/ha	1033	2244	22.62	232.99	26998	67646	40648	2.51
T ₄ : T ₁ + 20 kg Sulphur/ha	1109	2326	22.86	253.52	27094	72384	45290	2.67
T ₅ : T ₂ + 10 kg Sulphur/ha	1126	2349	22.78	256.59	27550	73475	45925	2.67
T ₆ : T ₂ + 20 kg Sulphur/ha	1184	2394	23.29	275.41	27647	77028	49381	2.79
S. Em.±	32.19	49.98	0.40	8.13	-	-	-	-
C. D. (P=0.05)	92.60	143.78	NS	23.39	-	-	-	-
CV%	8.93	6.63	5.41	9.93	-	-	-	-

Application of different nutrient management practices did not exert any significant effect on protein content, but it found remarkable variation on protein yield (Table 2). Significantly the highest protein yield (275.41 kg/ha) was recorded due to the application of 100% RDF with sulphur @ 20 kg/ha (T₆) over other treatments, which was remained at par with treatment T₅ and T₄.

Similarly, protein content was found numerically higher under the same treatment. The improvement in protein yield might be due to higher seed yield of greengram couple with protein content under the treatment of 100% RDF with sulphur @ 20 kg/ha. These finding are in agreement with the

experimental results reported by Elamin and Madhavi (2015) and Patel *et al.*, (2016a). A perusal of data presented in Table 2 revealed that application of 100% RDF with 20 kg S/ha (T₆) recorded maximum gross realization of Rs 77028 ha⁻¹, net realization of Rs 49381 ha⁻¹ with BCR of 2.79, which was followed by gross realization of Rs 73475 ha⁻¹, net realization of Rs 45925 ha⁻¹ with BCR of 2.67 under treatment T₅. The treatment of 75% RDF incurve the lowest gross realization of Rs 63115 ha⁻¹, net realization of Rs. 36214 ha⁻¹ with BCR of 2.35. Similar views in direction of present finding were also expressed by Patel *et al.*, (2013a), Patel *et al.*, (2013b), Srinivasulu *et al.*, (2015) and Patel *et al.*, (2016a).

On the basis of results obtained in the present investigation, following conclusions are made. NKM-15-12 (GM-6) is better variety of summer greengram for the south Gujarat condition over cv. GAM-5 and Meha. For getting more profitable yield as well as considering minimum input cost, summer greengram should be fertilized with 75% RDF (15-30-00 NPK kg/ha) + 20 kg S/ha through gypsum under south Gujarat condition.

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