

Original Research Article

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Production Potential of Summer Greengram [*Vigna radiata* (L) wilczek] to Different Nutrient Management Practices under South Gujarat Condition

V. M. Patel¹, K. A. Shah^{2*} and Prabhu Nayaka³

¹Department of Agronomy, Navsari Agricultural University,
Eru Char Rasta, Navsari 396 450, Gujarat, India

²Agronomy, Krishi Vigyan Kendra, Navsari Agricultural University,
Eru Char Rasta, Navsari 396 450, Gujarat, India

³Plant Protection, Krishi Vigyan Kendra, Navsari Agricultural University, Eru Char Rasta,
Navsari 396 450, Gujarat, India

*Corresponding author

ABSTRACT

A field experiment was conducted during summer season of 2018 at the college farm, Navsari Agricultural University, Navsari to study the “Production potential of summer greengram [*Vigna radiata* (L.) Wilczek] to different nutrient management practices 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 and medium in available phosphorus and available potassium. Total seven treatments viz., Control (T₁), FYM @ 2.5 t/ha + 100% RDF (T₂), FYM @ 5 t/ha + 50% RDF (T₃), FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/l of water at branching and 50 % flowering stage (T₄), vermicompost @ 1 t/ha + 100% RDF (T₅), vermicompost @ 2 t/ha + 50% RDF (T₆) and vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/l of water at branching and 50 % flowering stage (T₇) were tested in randomized block design with four replications. Most of the growth and yield attributes viz., plant population at harvest, plant height at 60 DAS, test weight and harvest index did not affected significantly by different nutrient management treatments. An application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/l of water at branching and 50 % flowering stage (T₇) recorded significantly higher plant height (47.41 cm) at harvest, number of branches per plant (4.30), dry matter production per plant (10.71 g), number of pod per plant (32.75), number of seed per pod (9.30), seed yield (1390 kg/ha) and haulm yield (1751 kg/ha) over control. Similarly, the maximum gross realization Rs 95594/ha, net realization Rs 63645/ha and the BCR value of 2.99 were observed with the application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/l of water at branching and 50 % flowering stage.

Keywords

Greengram,
Integrated nutrient
management,
Vermicompost,
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Introduction

Greengram [*Vigna radiata* (L.) Wilczek] is third important pulse crop after chickpea and pigeon pea, cultivated throughout India for its multipurpose uses as vegetable, pulse, fodder and green manure crop. In Gujarat, *kharif* and summer greengram was cultivated in an area of 129 ha with production 61 tonnes and yield 473 kg/ha (Anonymous, 2016). It is a good source of protein (20-24 %), carbohydrates (60-62 %), water (10 %), fat (1.0 %), fiber (4.0 %) and ash (3.0 %). Greengram protein is deficient in methionine and cysteine but rich in lysine making it an excellent complement to rice. It is a good source of mineral, pro-vitamin A, B complex and ascorbic acid. Besides being a rich source of protein, it maintains soil fertility through biological nitrogen fixation in soil and thus plays a vital role in furthering sustainable agriculture (Kannaiyan, 1999).

Green gram 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. In addition, it also provides nutritious fodder and feed for livestock. It is also drought resistant and prevents soil erosion due to their deep root and good ground covers, because of these good characters, pulses are called as “Marvel of Nature”.

Due to low and unstable production and increasing the population pressure, per capita availability of pulses decreasing from 69 g in 1961 to about 31.6 g in 2010-11, against the minimum requirement of 80 g per capita per day (Anonymous, 2011). To make up minimum 50 g pulses per capita per day and further demand from burgeoning population at least 24 m tones tones of pulses are

required in 2020-21 (Anonymous, 2016). To satisfy the demand of pulses requirement of ever increasing population, the production of pulses has to be increased only by increasing the yield/unit area/day.

There was continuously increasing in cost of chemical fertilizers in recent past has adversely affected the use of chemical fertilizers. Further, it is now realize that no single nutrient sources could fulfill the nutritional requirement of crop. Moreover, excess and indiscriminate use of synthetic agro-chemical has resulted in deterioration of natural resources by polluting crop environment leading to unsustainable productivity of land. In this regards, the integration of all sources *viz.*, organic, inorganic and foliar nutrition is best possible way to satisfy the demand of crop to improve the productivity and sustains the soil health and environmental safety.

Various sources of organic manures are major source of all the essential plant element nutrients which enhances the soil fertility and crop productivity. The use of farm yard manure (FYM)/vermicompost along with inorganic fertilizer increases the nutrient use efficiency and also improves the physical properties of soil. FYM helps to buffer soils against rapid chemical changes. FYM also acts as a source of energy for the growth of soil microbes. It improves physio-chemical properties of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increase in cation exchange capacity, stimulation of soil flora and fauna *etc.* Vermicompost is an aerobically degraded organic matter which has undergone chemical disintegration by the enzymatic activity in the guts of worms and also enzymes of the associated microbial population. It contains 0.80 to 1.10 % N, 0.40 to 0.80 % P₂O₅ and 0.80 to 0.98 % K₂O, 10 to 52 ppm Cu, 186.60 ppm Zn, 930.00 ppm Fe

and plant growth promoting substances such as NAA, cytokinins, gibberellins *etc.* (Giraddi *et al.*, 2006).

The foliar applied nutrients are also more effective as compared to soil applied nutrients. Because of higher uptake efficiency, foliar supply of nutrients can increase photosynthetic efficiency by delaying the onset of leaf senescence (Yadav and Choudhary, 2012).

Hence, adoption of appropriate nutrients management strategies holds a great potential in boosting the greengram yield. Therefore, integrated nutrient management is crucial not only for the increasing the yield, but also for the improvement of soil health. Considering the above facts and very less work done in south Gujarat region the experiment has been planned to study the “Production potential of summer greengram [*Vigna radiata* (L.) Wilczek] to different nutrient management practices under south Gujarat condition”.

Materials and Methods

A field experiment was conducted during summer season of 2018 at the college farm, Navsari Agricultural University, Navsari, Gujarat. The soil of the experimental field was clayey in texture having medium to poor drainage, EC (0.55 dS/m) and pH (8.10), low in available nitrogen (180.30 kg/ha) and organic carbon (0.30 %) and medium in available phosphorus (38.30 kg/ha) and available potassium (270.50 kg/ha) were determined by Kjeldahl's method, Olsen's method and Flame photometric method, respectively. Total seven treatments *viz.*, Control (T₁), FYM @ 2.5 t/ha + 100% RDF (T₂), FYM @ 5 t/ha + 50% RDF (T₃), FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/l of water at branching and 50 % flowering stage (T₄), vermicompost @ 1 t/ha + 100% RDF (T₅),

vermicompost @ 2 t/ha + 50% RDF (T₆) and vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/l of water at branching and 50 % flowering stage (T₇) were tested in randomized block design with four replications. Greengram variety “GM-6” seeds were sown at 30 cm x 10 cm spacing. Farm yard manure and vermicompost were incorporated about 15 days before sowing in soil as per treatments. The entire dose of nitrogen and phosphorus as per treatments applied at basal application just before sowing and spraying of enriched banana pseudostem sap were applied as per the treatments. Enriched banana pseudostem sap is first time prepared and patented by Navsari Agricultural University, Navsari which was developed by team of National Innovative Project on “A Value Chain on Utilization of Banana Pseudostem for fiber and Other Value Added Products.” This enriched sap is a very good source of essential plant nutrients namely N (70.0 mg/l), P (26.1mg/l), K (170 mg/l), Fe (7.44 mg/l), Mn (2.66 mg/l), Zn (0.40 mg/l) Cu (0.26 mg/l) etc as well as hormones GA₃ and Cytokinin. Urea and di- ammonium phosphate were taken as fertilizer sources for N and P, 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

Growth attributes

The difference in plant population at harvest was found to be non significant due to the application of different treatments. However, numerically higher plant population at harvest

was recorded with T₆ (vermicompost @ 2 t/ha + 50% RDF). Thus, whatever variation observed in the investigation is likely attributed to different treatments applied in the experiment (Table 1).

The variation in plant height of greengram due to different nutrient management treatments were found to be non significant at 60 DAS. However, it was significantly influenced by different treatment at harvest. Significantly the taller plant height at harvest (47.41 cm) was registered with the application of T₇ (vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage) over control, which was at par with application of vermicompost @ 2 t/ha + 50% RDF (T₆: 43.67 cm), FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage (T₄: 43.74 cm) and FYM @ 2.5 t/ha + 100% RDF (T₂: 43.29 cm). Non significantly, but numerically higher plant height at 60 DAS was also observed under the same treatment T₇, which was closely followed by the treatment T₄. The lowest plant height at harvest (38.76 cm) was recorded under control. The percentage increase in the plant height at harvest of 22.31, 12.84 and 12.66 per cent under the treatment T₇, T₄ and T₆ over control respectively. Increased in plant height under the different nutrient management practices might be due to two reason, firstly addition of either FYM or vermicompost along with inorganic fertilizers in to soil improved physical, chemical and biological properties of soil and this leads to improve the root growth and development and thereby uptake of nutrients and water from greater soil volume resulting in to better plant growth and secondly foliar application of nutrients at a critical crop growth stage (branching and flowering) helps in regulating the cell division and multiplication as well as cell elongation

and development of leaves and other plant's part. It also helps in enhance the synthesis of carbohydrates and protein in plants and ultimately the photosynthetic activity resulting in better development of plant growth. Similar results are in accordance with the findings of Rathod and Gawande (2012), Jat *et al.*, (2012), Gorade *et al.*, (2014), Elamin and Madhavi (2015) and Armin *et al.*, (2016) with respect to plant height.

An application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage (T₇) produced significantly higher number of branches per plant (4.30) over rest of the treatments, except the control and FYM @ 2.5 t/ha + 100 % RDF. Significantly the lowest number of branches per plant (2.75) was found under the control treatment. An application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage (T₇) gave significantly higher number of branches per plant (4.30) over control, which was remain at par with vermicompost @ 2 t/ha + 50% RDF (T₆: 4.10), vermicompost @ 1 t/ha + 100% RDF (T₅: 3.75), FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage (T₄: 3.95) and FYM @ 5 t/ha + 50% RDF (T₃: 3.70). This could be attributed due to favourable effect of combined application of organic and inorganic fertilizers added in to the soil helps in improvement of physico-chemical properties of soil and assures the quick and easy availability of essential plant nutrients resulted in better crop growth in terms of number of branches per plant. These findings are substantiated with those reported by Jat *et al.*, (2012), Kumar *et al.*, (2015), Misal *et al.*, (2015) and Armin *et al.*, (2016).

Dry matter production per plant was significantly affected by different nutrient management treatments application. Significantly the lowest dry matter production (8.06 g) was observed in control, where as the highest dry matter production (10.71 g) was recorded with the application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/litre of water at branching and 50% flowering stage. It might be due to the cumulative effect of an increased availability of nutrients with application of chemical and organic fertilizers along with the foliar spray at critical crop growth stage helps in solubilization of native and applied nutrients available to roots and growth promoting substances like GA₃ and *cytokinin* to plant, which might have increased growth parameters and ultimately the total biomass yield of greengram. The present findings are within the close vicinity of those reported by Patel *et al.*, (2010), Jat *et al.*, (2012) and Kumar *et al.*, (2015).

Yield attributes

The variation in the yield attributing parameters *viz.*, number of pods per plant and number of seeds per pod were remarkably influenced by different nutrient management treatments. Vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/litre of water at branching and 50% flowering stage (T₇) was observed remarkably the highest number of pods per plant (32.75) and number of seed per pod (9.30), but it was found at par with remaining all other treatments, except the control. Significantly lowest pods per plant (25.70) and number of seed per pod (7.20) registered with control. Treatment T₇ and T₄ increases the 27.43 and 24.51 as well as 30.98 and 28.87 per cent higher number of pods per plant and number of seeds per pod over control, respectively. Different nutrient

management treatments did not exert their significant influence on test weight of greengram. However, the numerically higher value of test weight (42.92 g) was observed under the application of FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/litre of water at branching and 50% flowering stage followed by 42.70g in treatment T₇. Increasing in the yield attributes may be due to the fact that farmyard manure or vermicompost increase the adsorptive power of soil for cation and anion and these absorbed ions are released slowly for the entire crop growth period resulted in better nutrient availability at active crop growth. Secondly, integrated use of organic, inorganic and foliar spray of nutrients at a critical crop growth stages resulted in better growth of plants associated with increased availability of nutrients might have resulted in greater translocation of photosynthates from source to sink site that favourably influenced flowering, fruiting and ultimately resulted into increased number of pods per plant and number of seeds per pod. Positive responses in terms of yield attributes reported by Sharma *et al.*, (2012), Elamin and Madhavi (2015), Armin *et al.*, (2016), Prajapati *et al.*, (2016) Akhila *et al.*, (2017) and Singh *et al.*, (2017).

Seed and haulm yield

The different nutrient management treatments showed significant differences on seed and haulm yields of greengram. An application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana psuedostem sap @ 10 ml/litre of water at branching and 50% flowering stage was produced significantly the highest seed (1390 kg/ha) and haulm yields (1751 kg/ha) over the rest of the treatments, except control. The lowest seed yield (658 kg/ha) and haulm yield (1045 kg/ha) of greengram registered under control. There were 111.25 and 108.03 per cent seed

yield and 67.55 and 67.27 per cent haulm yield increased under the treatment T₇ and T₄ over the control, respectively. The increase in seed yield with application of different nutrient management treatments was mainly due to cumulative effect of significant increased in the growth and yield attributing component like number of branches, number of pods per plant and number of seeds per pod. Similarly, the haulm yield was remarkably increased due to the significant improvement in the growth attributing characters viz., plant height, number of branches per plant and dry matter production per plant. The similar types of results were

supported by the findings of Dhasora and Solanki (2010), Chaudhary and Yadav (2011), Jat *et al.*, (2012), Vitnor *et al.*, (2015), Prajapati *et al.*, (2016), Dekhane *et al.*, (2017), Singh *et al.*, (2017), and Kalariya *et al.*, (2018).

An application of different nutrient management treatments failed to show any significant effect on harvest index (Table 2). However, a numerically higher value of harvest index was found under the application of vermicompost @ 2 t/ha + 50% RDF (T₆: 44.78 %). These results corroborated the findings of Rathod and Gawande (2012).

Table.1 Effect of different nutrient management practices on growth attributes of summer greengram

Treatment	Plant population at harvest (per sq. m.)	Plant height (cm)		Number of branches per plant at harvest	Dry matter production at harvest (g/ plant)
		60 DAS	at harvest		
T₁ : Control	27.05	33.57	38.76	2.75	8.06
T₂ : FYM @ 2.5 t/ha + 100% RDF	27.50	35.19	43.29	3.60	10.00
T₃ : FYM @ 5 t/ha + 50% RDF	28.00	35.41	42.77	3.70	10.12
T₄ : FYM @ 2.5 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	28.40	36.20	43.74	3.95	10.48
T₅ : Vermicompost @ 1 t/ha + 100% RDF	28.30	34.90	42.46	3.75	10.06
T₆ : Vermicompost @ 2 t/ha + 50% RDF	28.43	35.36	43.67	4.10	10.35
T₇ : Vermicompost @ 1 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	28.28	38.45	47.41	4.30	10.71
S. Em.±	0.66	1.43	1.54	0.22	0.48
CD (P=0.05)	NS	NS	4.58	0.67	1.44
CV %	4.71	8.06	7.51	11.99	9.70

Table.2 Effect of different nutrient management practices on yield attributes, yield and harvest index of greengram

Treatment	Number of pods per plant	Number of seeds per pod	Test weight (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
T₁ : Control	25.70	7.10	39.02	658	1045	38.88
T₂ : FYM @ 2.5 t/ha + 100% RDF	29.60	8.25	41.12	1218	1588	43.41
T₃ : FYM @ 5 t/ha + 50% RDF	30.70	8.30	42.12	1285	1600	44.58
T₄ : FYM @ 2.5 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	32.00	9.15	42.92	1369	1748	43.92
T₅ : Vermicompost @ 1 t/ha +100% RDF	29.75	8.35	41.60	1215	1562	43.66
T₆ : Vermicompost @ 2 t/ha + 50% RDF	30.90	8.40	41.94	1305	1603	44.78
T₇ : Vermicompost @ 1 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	32.75	9.30	42.70	1390	1751	44.26
S. Em.±	1.17	0.40	0.99	59.87	65.27	1.85
CD (P=0.05)	3.48	1.17	NS	177.88	193.92	NS
CV %	7.76	9.40	4.75	9.93	8.39	8.51

Table.3 Effect of different nutrient management practices on economics of greengram

Treatment	Yield (kg/ha)		Gross Return (Rs/ha)	Cost of Production (Rs/ha)	Net Return (Rs/ha)	BCR
	Seed	Haulm				
T₁ : Control	658	1045	45884	22864	23020	2.01
T₂ : FYM @ 2.5 t/ha + 100% RDF	1218	1588	83931	30701	53230	2.73
T₃ : FYM @ 5 t/ha + 50% RDF	1285	1600	88322	34832	53490	2.54
T₄ : FYM @ 2.5 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	1369	1748	94260	31412	62848	3.00
T₅ : Vermicompost @ 1 t/ha + 100% RDF	1215	1562	83663	31237	52426	2.68
T₆ : Vermicompost @ 2 t/ha + 50% RDF	1305	1603	89656	35905	53751	2.50
T₇ : Vermicompost @ 1 t/ha + 50% RDF + spraying of EBPS @ 10 ml/l of water at branching and 50 % flowering stage.	1390	1751	95594	31949	63645	2.99
S. Em.±	59.87	65.27	-	-	-	-
CD (P=0.05)	177.88	193.92	-	-	-	-
CV %	9.93	8.39	-	-	-	-

Economics

The data presented in Table 3 revealed that the application of vermicompost @ 1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/litre of water at branching and 50% flowering stage incur maximum gross realization (95594 ₹/ha), net realization (63645 ₹/ha) and BCR (2.99), which was closely followed by the treatment FYM @ 2.5 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/liter of water at branching and 50 % flowering stage record gross realization of 94260 ₹/ha, net realization 62848 ₹/ha and BC ratio of 3.00. The lowest gross realization of ₹ 45884 ha⁻¹, net realization of ₹ 23020/ha and BCR of 2.01 was obtained under the control treatment. The increase in net returns might be due to higher seed yield obtained under this treatment as compared to cost involved under the same treatment. Similar views in direction of present finding were also expressed by Dashora and Solanki (2010), Patel *et al.*, (2010), Jat *et al.*, (2012), Sharma *et al.*, (2012), Kumar *et al.*, (2013), Akhila *et al.*, (2017) and Meena *et al.*, (2017).

Conclusion of the study is as follows:

From the results, it can be evident that an application of either FYM @ 2.5 t/ha or vermicompost @1 t/ha + 50% RDF + spraying of enrich banana pseudostem sap @ 10 ml/l of water at branching and 50 % flowering stage improved the plant height, number of branches per plant, number of pods per plant, number of seeds per pods, seed and haulm yield as well as protein content and would be useful to enhance the productivity of summer greengram. Integrated use of organic, inorganic and foliar spray of enrich banana pseudostem sap may be suggested for the higher yield and quality along with overall betterment of summer greengram production.

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