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## Effect of Row Spacing and Foliar Sprays on Summer Green Gram (*Vigna radiata* L.) Varieties under South Gujarat Condition

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### ABSTRACT

A field experiment was conducted during summer season of 2019 at the College Farm, Navsari Agricultural University, Navsari to study the response of summer green gram (*Vigna radiata* L.) varieties to row spacing and foliar sprays under south Gujarat condition. Significantly the higher seed yield (1318 kg ha<sup>-1</sup>) and stover yield (2301 kg ha<sup>-1</sup>) were recorded with variety GM-7. The maximum net return (₹ 70490 ha<sup>-1</sup>) with BCR (3.19) were obtained by variety GM-7. Significantly higher seed yield (1408 kg ha<sup>-1</sup>), stover yield (2252 kg ha<sup>-1</sup>) and harvest index (38.58 per cent) were recorded by 30 cm row spacing. The maximum net returns of ₹ 75673 ha<sup>-1</sup> with BCR 3.35 were recorded under 30 cm row spacing, significantly higher seed yield (1352 kg ha<sup>-1</sup>), stover yield (2280 kg ha<sup>-1</sup>) and harvest index were recorded by foliar spray of 2% Enriched banana pseudostem sap which were statistically at par with 2% urea spray as compared to water spray. The maximum net returns of ₹ 68660 ha<sup>-1</sup> with B:C ratio 2.63 were recorded under foliar spray of 2 % Enriched Banana Pseudostem sap followed by 2% Urea spray.

**Key words:** *Vigna radiata*, Foliar spray, Row spacing, Growth, Yield

Green gram (*Vigna radiata* L.) is one of the most ancient and extensively grown leguminous crops of India. Its native is India and Central Asia and commonly known as mung bean. It is a 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 India, green gram occupies a total area of 43.05 million hectares with the total production of 20.70 million tonnes with an average production of 481 kg ha<sup>-1</sup> in the year 2016-2017. It is grown in an area of 3.44 million ha with a total production of 1.4 million tonnes and productivity of 407 kg ha<sup>-1</sup> [1]. In Gujarat it occupies 2.3 lakh hectares area with production of 1.21 lakh tonnes with an average productivity of 526 kg ha<sup>-1</sup> during *kharif* - rabi season [2].

Green gram has the potential of producing higher seed yield from 1295 to 2261 kg ha<sup>-1</sup> depending on the genotypes studied. Optimum row spacing plays an important role in contributing to the high yield because thick plant population will not get proper light for photosynthesis and can easily be attacked by diseases. Foliar application of

nutrients using water soluble fertilizer is one of the possible ways to enhance the productivity of pulses like green gram. Looking into importance of foliar spray of nutrients in enhancing crop productivity of various field crops, a field experiment was conducted with the objective of studying the green gram productivity enhancement through foliar spray of nutrients. Hence, an attempt has been made to study the suitability of both varieties in summer season with row spacing and foliar feeding.

### MATERIALS AND METHODS

The field experiment was conducted during summer season of 2019 at the College Farm, Navsari Agricultural University, Navsari, Gujarat. The weekly mean maximum and minimum temperature varies from 31.6°C to 39.4°C and 12.2°C to 24.1°C, respectively during the course of investigation. The relative humidity ranged from 80.7 to 94.2 per cent at morning and 38.6 to 65.3 per cent at evening. Bright sunshine hours per day available in the range of 7.5 to 10.8 were available during the crop period. The evaporation ranged from minimum 4.7 mm to 6.8 mm maximum during the crop period. The soil of the experimental field was clayey in texture having medium to poor drainage, soil pH 7.77, EC 0.68 dSm<sup>-1</sup> and organic carbon content 0.52% with low in available nitrogen (195.34 kg ha<sup>-1</sup>), medium in available phosphorus (22.45 kg ha<sup>-1</sup>) and very high in available potassium (302.36 kg ha<sup>-1</sup>) and

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slightly alkaline in reaction. The experiment was laid out in RBD (Factorial concept) design with 12 treatment combinations consisting of three factors i.e., Two varieties (V<sub>1</sub>- GM-6 and V<sub>2</sub>- GM-7), two row spacing (S<sub>1</sub>- 30 cm and S<sub>2</sub>- 45 cm) and three foliar sprays [F<sub>1</sub>- Water spray (Control), F<sub>2</sub>- 2% Urea and F<sub>3</sub>- 2% Enriched banana pseudostem sap] replicated three times. The entire dose of fertilizer was 20-40-00 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>. Foliar sprays of water spray (Control), 2% Urea and 2% Enriched banana pseudostem sap were given at 31 DAS and 46 DAS.

RESULTS AND DISCUSSION

Effect of variety

Growth attributes

The result pertaining to growth parameters (Table 1) showed that variety GM-7 recorded significantly higher plant height at 60 DAS and at harvest, number of branches plant<sup>-1</sup>, dry matter production at 30, 60 DAS and at harvest and leaf area index as compared to variety GM-6. It has been justified with reason that the varieties with different

genes from different parental material adapt and grow differently in the given suitable environment [3].

Yield and yield attributes

The result pertaining to yield and yield attributes (Table 1) showed that variety GM-6 gave numerically higher values of 1000 seed weight (50.17 g) and harvest index (38.27 per cent) as compared to variety GM-7. Significantly higher number of pods plant<sup>-1</sup> (35.51), seed yield (1318 kg ha<sup>-1</sup>) and stover yield (2301 kg ha<sup>-1</sup>) were observed with variety GM-7 as compared to variety GM-6. This was due to better performance of GM-7 in terms of growth parameters and yield attributes resulted into higher seed yield and stover yield as compared to GM-6 [3].

Economics

It is obvious from the data reported in (Table 2) that the maximum net realization (₹ 70490 ha<sup>-1</sup>) and B:C ratio (3.19) was obtained from variety GM-7 as compared to variety GM-6 which realized minimum net realization (₹ 62597 ha<sup>-1</sup>) and BCR (2.83). This is due to the higher yields produced by variety GM-7 of green gram [3].

Table 1 Effect of row spacing and foliar spray on growth and yield attributes on summer green gram varieties

Treatment	Plant height (cm)			No. of branches plant <sup>-1</sup>	Dry matter production (g plant <sup>-1</sup> )			Leaf area index (LAI)	No. of pods plant <sup>-1</sup>	1000 seed weight (g)
	At	At	At		At	At	At			
	30 DAS	60 DAS	harvest		30 DAS	60 DAS	harvest			
Variety (V)										
V <sub>1</sub> : GM-6	20.44	49.40	58.88	3.94	3.28	10.74	15.28	4.02	30.30	50.17
V <sub>2</sub> : GM-7	21.11	55.06	66.94	4.39	3.58	11.64	16.49	4.47	35.51	47.17
S.Ed	0.71	1.66	2.24	0.15	0.10	0.28	0.38	0.13	0.71	0.65
CD (p=0.05)	NS	4.88	6.56	0.43	0.28	0.83	1.13	0.38	2.08	1.89
Row Spacing (S)										
S <sub>1</sub> : 30 cm	20.71	54.77	66.43	3.89	3.28	10.71	15.22	3.97	31.59	47.28
S <sub>2</sub> : 45 cm	20.84	49.68	59.39	4.44	3.59	11.68	16.54	4.52	34.22	50.06
S.Ed	0.71	1.66	2.24	0.15	0.10	0.28	0.38	0.13	0.71	0.65
CD (p=0.05)	NS	4.88	6.56	0.43	0.28	0.83	1.13	0.38	2.08	1.89
Foliar Spray (F)										
F <sub>1</sub> : Water spray (Control)	20.59	47.49	54.40	3.67	3.45	10.13	14.66	3.62	28.92	45.17
F <sub>2</sub> : 2% Urea	20.72	53.69	66.34	4.25	3.43	11.62	16.30	4.41	33.84	49.75
F <sub>3</sub> : 2% Enriched banana pseudostem sap	21.02	55.50	67.99	4.58	3.42	11.83	16.69	4.70	35.95	51.08
S.Ed.	0.87	2.04	2.74	0.18	0.12	0.35	0.47	0.16	0.87	0.79
CD (p=0.05)	NS	5.98	8.04	0.53	NS	1.02	1.38	0.47	2.55	2.32
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Effect of row spacing

Growth parameters

The result pertaining to growth parameters (Table 1) showed that significantly higher plant height was recorded by row spacing of 30 cm i.e., 54.77 cm at 60 DAS and 66.43 cm at harvest. Thus, there was an increase in plant height with narrow row spacing due to the higher plant population attributed to more intra species competition which help in proper utilization of natural growth resources i.e., space, light, moisture, nutrient uptake and translocation, which ultimately linked with the plant growth and development in terms of plant height [4]. Significantly higher number of branches/plant (4.44) was recorded by row spacing of 45 cm than row spacing of 30 cm. The higher number of branches/plant would be attributed to the fact that wider row spacing interact more radiation than narrow row spacing owing to proper utilization of nutrients as well as moisture under optimum plant population [5]. The result pertaining to

dry matter accumulation of 3.59, 11.68 and 16.54 g plant<sup>-1</sup> were recorded significantly higher by row spacing of 45 cm at 30, 60 DAS and at harvest, respectively and leaf area index (4.52) as compared to row spacing of 30 cm [6].

Yield and yield attributes

The result pertaining to yield attributes and yield (Table 1) showed that number of pods plant<sup>-1</sup> (34.22) and 1000 seed weight (50.06 g) was improved significantly due to row spacing of 45 cm over row spacing of 30 cm [7]. The result pertaining to yield (Table 1) showed that seed and stover yield of green gram were influenced significantly due to different row spacing. Significantly higher seed yield (1408 kg ha<sup>-1</sup>) and stover yield (2252 kg ha<sup>-1</sup>) was found under row spacing of 30 cm over row spacing of 45 cm. This might be due to fact that proper row spacing or plant population might be attributed to minimum intra row species competition in crop plants and proper utilization of natural

resources i.e., space, light, moisture and nutrients which might have remained underutilized due to mutual plant competition developed by more plants in closer row spacing [8]. The result pertaining to harvest index in (Table 1) showed that the harvest index was affected significantly due to different row spacing. Significantly higher harvest index (38.58 per cent) was recorded in row spacing of 30 cm as compared to row spacing of 45 cm (36.07 per cent) [9].

Economics

It is obvious from the data reported in (Table 2) that the maximum net realization (₹ 75673 ha<sup>-1</sup>) and BCR (3.35) were obtained from 30 cm row spacing as compared to 45 cm row spacing. This is due to the higher yields of green gram produced in the 30 cm narrow row spacing [10].

Effect of foliar spray

Growth parameters

The result pertaining to growth parameters (Table 1) showed that periodical plant height was significantly higher was recorded at 60 DAS (55.50 cm), at harvest (67.99 cm) and branches/plant (4.58) by foliar application of 2% enriched banana pseudostem sap which was statistically at par with 2% Urea spray i.e., 53.69 cm at 60 DAS and 66.34 cm at harvest. This might be due to favorable function of nitrogen being a major structural constituent of cell helps in stimulating the cell division and cell enlargement, which increased plant height. This could be attributed to favourable effect of foliar application spray 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 [11]. The data of (Table 1) indicated that dry matter production plant<sup>-1</sup> at 30 DAS was not differed significantly due to different foliar sprays. Significantly the highest dry matter production plant<sup>-1</sup> was recorded at 60 DAS (11.83 g) and at harvest (16.69 g) and leaf area index (4.70) by foliar application of 2% enriched banana pseudostem sap which was statistically at par with 2% urea foliar spray i.e., 11.62 g at 60 DAS and 16.30 g at harvest. Moreover, nitrogen and phosphorus might have

increased the photosynthetic efficiency and thus increased the production of photosynthates [11].

Yield and yield attributes

The yield attributing parameters like pods per plant and 1000 seed weight (Table 1) were significantly influenced by different foliar spray treatments. Significantly higher number of pods plant<sup>-1</sup> (35.95) and 1000 seed weight (51.08 g) were recorded under foliar spray of 2% Enriched banana pseudostem sap which was statistically at par with 2% urea foliar spray i.e., number of pods/plant (33.84) and 1000 seed weight (49.75 g). This may be due to the fact that integrated use of foliar spray of nutrients at a critical crop growth stage 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 plant<sup>-1</sup> and 1000 seed weight. Positive response in terms of yield attributes reported by [12].

It is evident from the results presented in (Table 1) that application of different foliar spray had significant differences on seed yield and stover yield of green gram. Significantly higher seed yield (1352 kg ha<sup>-1</sup>) and stover yield (2280 kg ha<sup>-1</sup>) were recorded under foliar spray of 2% Enriched banana pseudostem sap which was statistically at par with 2% urea foliar. The increase in seed yield with application of different foliar application treatments was mainly due to cumulative effect of significant increase in the growth and yield attributing components like number of branches/plant and number of pods/plant. Similarly, the stover yield was remarkably increased due to the significant improvement in the growth attributing characters viz., plant height, number of branches/plant and dry matter production/plant. The overall improvement in all the growth and yield attributing components may be due to synergistic effect of use of foliar application as well as their spray at critical crop growth stage. An application of different foliar spray failed to show any significant effect on harvest index. However, the values of harvest index were numerically higher (37.37 per cent) under the application of 2% enriched banana pseudostem sap foliar spray [13].

Table 2 Effect of row spacing and foliar spray on yield and economics on summer green gram varieties

Treatment	Seed yield (kg ha <sup>-1</sup> )	Haulm yield (kg ha <sup>-1</sup> )	Harvest index (%)	Gross realization (₹ ha <sup>-1</sup> )	Cost of production (₹ ha <sup>-1</sup> )	Net realization (₹ ha <sup>-1</sup> )	B:C ratio
Variety (V)							
V <sub>1</sub> : GM-6	1213	1945	38.27	84680	22083	62597	2.83
V <sub>2</sub> : GM-7	1318	2301	36.38	92573	22083	70490	3.19
S.Ed	28	47	0.58				
CD (p=0.05)	81	139	1.71				
Row Spacing (S)							
S <sub>1</sub> : 30 cm	1408	2252	38.58	98276	22603	75673	3.35
S <sub>2</sub> : 45 cm	1122	1994	36.07	78912	22083	56829	2.57
S.Ed	28	47	0.58				
CD (p=0.05)	81	139	1.71				
Foliar spray (F)							
F <sub>1</sub> : Water spray (Control)	1158	1936	37.28	81078	23564	57514	2.44
F <sub>2</sub> : 2 % Urea	1286	2153	37.32	90049	23687	66362	2.80
F <sub>3</sub> : 2 % Enriched banana pseudostem sap	1352	2280	37.37	94720	26060	68660	2.63
S.Ed	34	58	0.71				
C.V.%	9	9	6.62				
Interaction	NS	NS	F*V				

Selling Price: Seed – Rs. 65 kg<sup>-1</sup>, Haulm- Rs. 3.0 kg<sup>-1</sup>

Economics

An economic analysis of the data (Table 2) revealed that application of 2% enriched banana Pseudostem sap foliar spray maintained its superiority by recording the highest net realization (₹ 68660 ha<sup>-1</sup>) and B:C ratio (2.63) followed by 2% urea. The lowest value of net realization (₹ 57514 ha<sup>-1</sup>) and B:C ratio (2.44) were registered with water spray (Control) [14].

Table 3 Interaction effect between variety, row spacing and foliar sprays on harvest index (%) on green gram

Treatment	Harvest index (%)		
	Foliar spray (F)		
Variety (V)	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>
V <sub>1</sub>	37.16	37.69	39.95
V <sub>2</sub>	37.39	36.96	34.79
S.Ed		1.01	
CD (p=0.05)		2.96	

Interaction effect

The data of (Table 3) indicated that the interaction effects between variety, row spacing and foliar spray was found non-significant for all the growth parameters, yield attributes and yield except harvest index. Significantly higher harvest index (39.95 per cent) was obtained under the V<sub>1</sub>F<sub>3</sub> treatment combination as compared to rest of the treatment combinations except V<sub>1</sub>F<sub>1</sub>, V<sub>2</sub>F<sub>1</sub> and V<sub>1</sub>F<sub>2</sub> treatment combinations.

CONCLUSION

Based on the results of the one year experimentation, it can be concluded that for getting profitable yield of summer green gram can be obtained by sowing GM-7 variety at 30 cm row spacing and foliar spray application of 2% enriched banana pseudo stem sap with recommended dose of fertilizer i.e. 20: 40: 00 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup> under south Gujarat conditions.

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