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Effect of rhizobium, foliar spray of nutrients and plant growth regulators on growth and yield of summer Green Gram (*Vigna radiata* L.)

Vejju Yeswanth and Harmit Singh Thind

Abstract
A field study entitled 'Effect of rhizobium, foliar spray of nutrients and plant growth regulators on growth and yield of summer green gram [*Vigna radiata* (L.)]' was conducted during summer 2021 at LPU, Phagwara. The treatments comprised of four main plots of foliar sprays (S_0, $S_{19:19:19}$, S_{GA} and S_{NAA}) and three subplots of fertilizers (no fertilizer, rhizobium, recommended dose fertilizer + rhizobium designated as F_0, F_R and F_{RDF+R}, respectively) with three replications in split plot design. Irrespective of fertilizers, there was significant increase in grain yield with foliar spray of S_{GA} as compared to S_0. There was further significant increase in grain yield with foliar spray of $S_{19:19:19}$ and S_{NAA}. The higher grain yield under the foliar spray of $S_{19:19:19}$ was accompanied by significant increase in growth and yield attributes. Irrespective of foliar sprays, the fertilizers F_R increased the grain yield significantly as compared to F_0 but F_{RDF+R} resulted in further significant increase as compared to F_R. The higher grain yield of green gram under the application of F_{RDF+R} was accompanied by significant increase in growth and yield attributes. The interaction between foliar sprays and fertilizers was significant. The highest grain yield (1242 kg ha^{-1}) was under the application of F_{RDF+R} with $S_{19:19:19}$ which was 19% higher than $S_{19:19:19}$ F_0 and 22% higher than S_0F_{RDF+R}. F_{RDF+R} when applied in combination with $S_{19:19:19}$ resulted in maximum gross returns, net returns and B: C ratio.

Keywords Fertilizers, foliar sprays, growth attributes, green gram grain yield, net returns, nutrient content, plant growth regulators

Introduction

Green gram [*Vigna radiata* (L.) *Wilczek*.] originated in Indo-Burma and the surrounding South-East Asian region. It is a high-protein legume (23-24%) that accounts for 14% of total pulse area and 7% of total pulse production in India. Green gram is a leguminous crop that is self-pollinated. It is a member of the Fabaceae family and the Papilionoideae subfamily. It is an ancient and well-known crop in Asian countries for its nutritional and dietary value (Shanmuga, 2004) [33] which is grown in India's arid and semi-arid regions during the *kharif* (July-October) and summer (March-June) seasons. It is primarily a rainy season crop, but with the development of early maturing varieties, it has proven to be an excellent crop for the spring and summer seasons as well. It is drought tolerant and can be grown successfully on well-drained loamy to sandy loam soils, as well as in areas with erratic rainfall. Green gram is extremely susceptible to water logging and is not suitable for cultivation in saline or alkaline soils. It is a short-season crop that fits well in a variety of intercropping and multiple-cropping systems. Green gram plants can be used as green fodder or green manure after the pods have been harvested. Green gram is a high-quality protein source (24.5%) with high levels of lysine (460 mg g^{-1} of N) and tryptophan (60 mg g^{-1} of N). It also has a high concentration of ascorbic acid and riboflavin (0.21 mg 100 g^{-1}) (Azadi and Chandra, 2013) [2]. It has 334 calories 100 g^{-1}, is high in carbohydrate (56.7 g 100 g^{-1}), is high in magnesium (127 mg 100 g^{-1}), calcium (124 mg 100 g^{-1}), phosphorus (326 mg 100 g^{-1}) and iron (4.4 mg 100 g^{-1} (Kavya and Lalita, 2014) [20]. Pulse crop yield is low due to a lack of awareness about the use of improved technology (Kumar, 2013, Kumar, 2014) [21]. The use and development of improved technology, particularly integrated nutrient management, will aid in closing the pulse supply-demand gap.

It was observed that inoculation of mung bean with Rhizobium spp. increased plant height, leaf area, photosynthetic rate and dry matter production. Under Rhizobium inoculation, plants synthesize more photosynthates and enhance the protein content in grain and nodulation in plants. Increased nodulation in legumes, helps in promoting free-living nitrogen fixing bacteria (Henzell, 1988) [12].

Foliar feeding is the best method of fertilizer application because it provides rapid and efficient nutrient utilization, prevents nutrient loss by eliminating leaching and nutrient fixation in the soil, and regulates plant nutrient uptake (Rahman *et al*., 2014; Manonmani and Srimathi, 2009) [27,23]. The application of essential nutrient elements via foliar spray at appropriate crop growth stages is critical for their use and improved crop production (Anandakrishnaveni, 2004) [1].

Plant growth regulators are known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates thereby helping in effective flower formation, fruit and seed development and ultimately enhance the productivity of the crop. Growth regulators improves the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source and sink in the field crops (Solaimalai, 2001) [37]. Several reports indicated that application of growth regulators improved the plant growth and yield (Hernandez, 1997) [13].

Keeping in the view of importance of Rhizobium, the application of nutrients and growth regulators as a foliar spray the present investigation is entitled "Effect of rhizobium, foliar spray of nutrients and plant growth regulators on growth and yield of summer green gram (*Vigna radiata* L.)", was undertaken.

Materials and Methods

The experiment was conducted during the *summer* season of 2021 at Crop Research Farm, Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India. The Crop Research Farm is situated at 31.22^0 N latitude, 75.77^0 E longitude and at an altitude of 234 meter above mean sea level. The experimental site was uniform in topography and loamy sand in texture, medium in organic carbon (0.36%), high in available Nitrogen (221.5 kg ha^1), medium in available Phosphorus (7.3 kg ha^{-1}) and very high (135 kg ha^{-1}) in available Potassium. The pH of the soil was 8.1 and EC was 0.14 dS m^{-1}. SML-668 variety is used for sowing of green gram. The experiment consists of 4 main plots of foliar sprays (S_0, $S_{19:19:19}$, S_{GA} and S_{NAA}) and three subplots of fertilizers (no fertilizer, rhizobium, recommended dose fertilizer + rhizobium designated as F_0, F_R and F_{RDF+R}, respectively). The experiment was conducted in split plot design with three replications consisted of twelve treatment combinations *viz.* T_1: (S_0+ F_0), T_2: (S_0+F_R), T_3: (S_0+F_{RDF+R}), T_4: ($S_{19:19:19}$+ F_0), T_5: ($S_{19:19:19}$+ F_R), T_6: ($S_{19:19:19}$+ F_{RDF+R}), T_7: (S_{GA}+F_0), T_8: (S_{GA}+ F_R), T_9: (S_{GA}+ F_{RDF+R}), T_{10}: (S_{NAA}+F_0), T_{11}: (S_{NAA}+ F_R) and T_{12}: (S_{NAA}+F_{RDF+R}). The RDF of green gram is (33.27 kg N ha^{-1}, - 122.7 kg P_2O_5 ha^{-1}, 0-kg K ha^{-1}). Full dose nitrogen is applied through basal application in the form of urea and full dose of phosphorus also applied through basal application in the form of single super phosphate. The plots were sprayed with 19:19:19, GA_3 and NAA at 30 days after sowing and there after second spray was carried out at 45 days after sowing. For the foliar application of 19:19:19 @ 2%, 20 g l^{-1} of water was dissolved and utilized as per treatment for foliar application. For the foliar application of gibberellic acid and naphthalene acetic acid a stock solution of 1000ppm was prepared by using 1.1g gibberellic acid and 1.1 naphthalene acetic acid technical grade (90%) along with solvent dissolved in distilled water and made the volume of 1000ml using volumetric flask and from this stock solution required amount of the gibberellic acid and naphthalene acetic acid were utilized as per treatments for foliar application. The plots were sprayed with 19:19:19, GA_3 and NAA as per treatments in morning hours at 9.00 to 10.00 AM. The experimental data for various growth, yield attributing characters, yield, quality parameters and nutrients uptake was statistically analysed by using OPSTAT software at LSD (0.05) 95% level of significance. Relative economics was calculated as per prevailing market prices of inputs and produced during *summer* season.

Results and Discussion

Growth attributes

Growth parameters of green gram *viz:* Plant height (cm), Number of leaves $plant^{-1}$, Leaf area index, Number of branches $plant^{-1}$ varied due to different treatments and are presented in Table 1**.**

Table 1: Effect of rhizobium, foliar spray of nutrients and plant growth regulators on growth and growth attributes of green gram

Foliar sprays	Fertilizers			Mean
	F_0	F_R	F_{RDF+R}	
Plant height (60DAS)				
S_0	43.6	44.1	47.3	45.0
$S_{19:19:19}$	51.0	52.9	55.7	53.2
S_{GA}	52.0	53.2	54.6	53.3
S_{NAA}	52.4	53.7	55.3	53.8
Mean	49.7	51.0	53.2	
Number of leaves $plant^{-1}$ (60DAS)				
S_0	19.0	20.3	21.2	20.1
$S_{19:19:19}$	21.9	22.9	25.4	23.4
S_{GA}	21.9	23.0	23.9	22.9
S_{NAA}	21.8	23.0	25.1	23.3
Mean	21.1	22.3	23.9	
Leaf area index (60DAS)				
S_0	0.080	0.084	0.087	0.084
$S_{19:19:19}$	0.095	0.106	0.119	0.107
S_{GA}	0.096	0.105	0.110	0.104
S_{NAA}	0.094	0.106	0.117	0.107
Mean	0.092	0.100	0.108	
Number of branches $plant^{-1}$ (60DAS)				
S_0	4.80	4.93	5.53	5.08
$S_{19:19:19}$	4.93	5.33	7.40	5.88
S_{GA}	5.26	5.53	6.53	5.77
S_{NAA}	5.80	5.80	7.13	6.24
Mean	5.20	5.40	6.65	
		Foliar sprays	**Fertilizers**	**Interaction**
LSD (0.05)	Plant height 60 (DAS)	0.54	0.52	0.57
	Number of leaves $plant^{-1}$ (60DAS)	0.62	0.40	0.90
	Leaf area index (60 DAS)	0.0041	0.0032	0.0061
	Number of branches $plant^{-1}$ (60DAS)	0.302	0.212	0.536

Plant height (cm)

At 60 DAS, irrespective of fertilizers, all the three foliar sprays resulted in significant increase in plant height as compared to S_0. The foliar sprays were not significantly different among themselves. Irrespective of foliar sprays, F_R increased plant height significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction between sprays and fertilizers was significant. At F_0 and F_R, the foliar spray with S_{NAA} significantly increased the plant height. At F_{RDF+R} spray with $S_{19:19:19}$ and S_{NAA} were significantly superior than S_{GA} for increasing the plant height. Tyagi *et al*. (2014) [41] found that foliar spray of 19:19:19 @ 0.5% along with combined application of RDF + Rhizobium significantly increased the plant height in green gram. Shrinivas and Shaik (2002) [34] reported that Rhizobium inoculation increased the plant height significantly than no inoculation in green gram. Sarkar *et al*. (2002) [30] observed that GA_3 at 100 ppm increased the plant height significantly in soy bean. Subramani *et al.* (2002) [40] found that combined application of RDF + 40 ppm NAA significantly increased the plant height in black gram over no RDF + NAA application.

Number of leaves plant^{-1}

At 60 DAS, irrespective of fertilizers, all the three foliar sprays resulted in significant increase in number of leaves plant^{-1} as compared to S_0. The foliar sprays were not significantly different among themselves. Irrespective of sprays, F_R increased the number of leaves plant^{-1} significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction between sprays and fertilizers was significant. All the three sprays increased the number of leaves plant^{-1} significantly when sprayed at F_R but the differences among three sprays were non-significant. At F_{RDF+R} spray with $S_{19:19:19}$ and S_{NAA} was significantly superior than S_{GA} for increasing the number of leaves plant^{-1}. Bhoye *et al*. (2016) [7] found that foliar spray of 19:19:19 @ 1% along with RDF + Rhizobium significantly increased the number of leaves plant^{-1} in chick pea. Shrinivas and Shaik (2002) [34] reported that Rhizobium inoculation significantly increased the number of leaves plant^{-1} in green gram. Srinivas *et al*. (2002) [39] observed that Rhizobium inoculation increased the number of leaves plant^{-1} significantly in green gram. Sarkar *et al*. (2002) [30] found that GA_3 at 100 ppm significantly increased the number of leaves plant^{-1} in soy bean. Doss *et al.* (2013) [9] reported that NAA increased the number of leaves plant^{-1} significantly in green gram over no NAA application.

Leaf area index (LAI)

At 60 DAS, irrespective of fertilizers, foliar sprays resulted in significant increase in leaf area index as compared to S_0. But all the three foliar sprays were statistically at par. Irrespective of sprays, F_R increased leaf area index significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. However the interaction effect between sprays and fertilizers was significant. All the three sprays increased the leaf area index significantly when sprayed at F_0 and F_R but in case of F_{RDF+R} spray with $S_{19:19:19}$ and S_{NAA} was significantly superior than S_{GA} for increasing the leaf area index. Mamtashree *et al*. (2014) found that foliar spray of 19:19:19 @ 2% along with RDF + Rhizobium significantly increased the leaf area index of the plant in pigeon pea. Singh and Pareek (2003) [35] reported that Rhizobium inoculation significantly increased the leaf area index in green gram. Rajesh *et al*. (2013) [28] observed that leaf area index was significantly increased with Rhizobium inoculation in green gram. Tiwari *et al*. (2018) [42] reported that GA_3 application increased the leaf area index significantly in green gram over no GA_3 application.

Number of branches plant^{-1}

At 60 DAS, irrespective of fertilizers, foliar sprays resulted in significant increase in number of branches plant^{-1} as compared to S_0. The foliar spray of S_{GA} and $S_{19:19:19}$ increased the number of branches plant^{-1} significantly as compared to S_0 which was further increased significantly at S_{NAA}. Irrespective of sprays, F_{RDF+R} increased number of branches plant^{-1} significantly as compared to F_0 and F_R. The interaction effect between sprays and fertilizers was significant. At F_0, the foliar spray with S_{NAA} significantly increased the number of branches plant^{-1} and all the three foliar sprays were statistically at par with F_R but in case of F_{RDF+R} spray with $S_{19:19:19}$ and S_{NAA} was significantly superior than S_{GA} for increasing the number of branches plant^{-1}. Jadhav *et al*. (2017) [18] found that RDF + rhizobium along with foliar spray of 19:19:19 @ 1% significantly increased the number of branches plant^{-1} in black gram. Shrinivas and Shaik (2002) [34] reported that Rhizobium inoculation increased the number of branches plant^{-1} significantly. Sarkar *et al*. (2002) [30] reported that GA_3 at 100 ppm significantly increased the number of branches plant^{-1} in soybean. Basavarajappa *et al.* (2013) [4] revealed that RDF + NAA increased the number of branches plant^{-1} significantly over no RDF + NAA application.

Yield attributes

Number of pods plant^{-1}

Number of pods plant^{-1} is a significant character which influences grain yield of green gram. The number of pods plant^{-1} observed after the harvest of the crop which are presented in Table 2. Irrespective of fertilizers, foliar sprays resulted in significant increase in number of pods plant^{-1} as compared to S_0. The foliar spray of S_{GA} increased the number of pods plant^{-1} as compared to S_0 and both S_{NAA} and $S_{19:19:19}$ further increased the number of pods plant^{-1} significantly. Irrespective of sprays, F_R increased the number of pods plant^{-1} significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction effect between foliar sprays and fertilizers was non-significant. Gowda *et al*. (2014) [11] found that RDF + Rhizobium along with 19:19:19 @ 0.4% showed significant increase on number of pods plant^{-1} in pigeon pea. Choudhary *et al*. (2010) [8] reported that application of RDF + Rhizobium significantly increased the number of pods plant^{-1} in green gram. Sorvari (2001) [38] reported that NAA spray significantly increased the number of pods plant^{-1} in black gram over no NAA spray.

Table 2: Effect of rhizobium, foliar spray of nutrients and plant growth regulators on yield and yield attributes of green gram

Foliar sprays	Fertilizers			Mean
	F_0	F_R	F_{RDF+R}	
No of pods plant^{-1}				
S_0	21.8	22.8	23.8	22.8
$S_{19:19:19}$	25.0	26.4	28.5	26.6
S_{GA}	24.1	26.0	27.3	25.8
S_{NAA}	25.4	26.7	28.1	26.7
Mean	24.1	25.5	26.9	

No of grains pod^{-1}				
S_0	7.73	8.26	9.50	8.50
$S_{19:19:19}$	10.2	11.0	12.3	11.1
S_{GA}	10.3	10.6	11.4	10.8
S_{NAA}	10.2	10.8	11.7	10.9
Mean	9.63	10.1	11.2	
Test weight (g)				
S_0	38.9	39.5	40.9	39.7
$S_{19:19:19}$	42.2	43.9	46.1	44.1
S_{GA}	42.0	43.5	44.8	43.4
S_{NAA}	42.8	44.2	45.7	44.2
Mean	41.5	42.8	44.3	
Grain yield (kg ha^{-1})				
S_0	946	986	1,016	983
$S_{19:19:19}$	1,047	1,079	1,242	1,123
S_{GA}	1,037	1,069	1,149	1,085
S_{NAA}	1,065	1,103	1,206	1,124
Mean	1,024	1,059	1,153	
Straw yield (kg ha^{-1})				
S_0	1,636	1,697	1,770	1,701
$S_{19:19:19}$	1,846	1,933	2,095	1,958
S_{GA}	1,821	1,893	2,033	1,915
S_{NAA}	1,795	1,856	2,012	1,887
Mean	1,774	1,845	1,977	
Harvest index (%)				
S_0	35.7	35.9	36.0	35.8
$S_{19:19:19}$	36.1	36.5	37.1	36.5
S_{GA}	36.2	36.0	36.1	36.1
S_{NAA}	37.2	37.2	37.4	37.3
Mean	36.3	36.4	36.6	
		Foliar sprays	**Fertilizers**	**Interaction**
LSD (0.05)	No of pods plant^{-1}	0.52	0.33	NS
	No of grains pod^{-1}	0.53	0.36	NS
	Test weight	0.79	0.40	NS
	Grain yield	15.0	14.0	27.3
	Straw yield	42.3	23.5	57.1
	Harvest index	0.48	NS	NS

Number of grains pod^{-1}

Number of grains pod^{-1} is one of the important yield contributing and deciding parameter of grain yield. The data observed related to number of grains pod^{-1} are presented in Table 2. Irrespective of fertilizers, foliar sprays resulted in significant increase in number of grains pod^{-1} as compared to S_0 but all the three foliar sprays were statistically at par. Irrespective of sprays, F_R increased number of grains pod^{-1} significantly as compared to F_0 which was not further

Test weight (g)

Test weight is weight of 1000 grains which is an important parameter in influencing the grain yield are presented in Table 2. Irrespective of fertilizers, foliar sprays resulted in significant increase in test weight as compared to S_0. The foliar spray of S_{GA} increased the test weight significantly as compared to S_0 but both S_{NAA} and $S_{19:19:19}$ were statistically at par. Irrespective of sprays, F_R increased the test weight significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction effect between sprays and fertilizers was non-significant. Mamathasree (2014) found that RDF + Rhizobium along with foliar spray of 19:19:19 @ 2% showed significant increase on test weight of seeds in pigeon pea. Rathi *et al.* (2009) [29] reported that Rhizobium inoculation increased the test weight significantly than no inoculation in black gram. Bhadra (2004) [5] found that GA_3 application significantly increased the test weight in green gram over no GA_3 application.

Grain yield (kg ha^{-1})

Irrespective of fertilizers, foliar sprays resulted in significant increase in grain yield as compared to S_0. The foliar spray of S_{GA} increased the grain yield significantly as compared to S_0 but both S_{NAA} and $S_{19:19:19}$ resulted in further significant increase. Irrespective of foliar sprays, F_R increased grain yield significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction effect between sprays and fertilizers was significant. All the three sprays were statistically at par with F_0. At F_R, the foliar spray with S_{NAA} significantly increased the grain yield but in case of F_{RDF+R} spray with S_{NAA} was significantly superior than S_{GA} for increasing the grain yield which was further increased significantly with foliar spray of $S_{19:19:19}$. Jadhav and Kulkarni (2012) [16] found that RDF + Rhizobium along with 19:19:19 @ 1% showed significant increase on grain yield in green gram. Pathak *et al.* (2001) [26] reported that Rhizobium inoculation increased the grain yield significantly than no inoculation in green gram. Sarwar *et al.* (2017) [31] found that GA_3 at 150 ppm significantly increased the grain yield in maize over no GA_3 application.

Straw yield (kg ha^{-1})

Irrespective of fertilizers, foliar sprays resulted in significant increase in straw yield as compared to S_0. But $S_{19:19:19}$

produced significantly higher straw yield as compared to S_{NAA} and S_{GA}. Irrespective of sprays, F_R increased straw yield significantly as compared to F_0 which was further increased significantly at F_{RDF+R}. The interaction effect between sprays and fertilizers was significant. All the three sprays were statistically at par with F_0. At F_R, the foliar spray with $S_{19:19:19}$ significantly increased the straw yield but in case of F_{RDF+R} spray with $S_{19:19:19}$ was significantly superior than S_{GA} and S_{NAA} for increasing the straw yield. Jadhav and Shyamrao (2016) [17] found that effect between sprays RDF + Rhizobium along with 19:19:19 @ 1% showed significant increase on straw yield in green gram. Sivakumar and Jayapriya (2017) [36] reported that GA_3 application significantly increased the straw yield in black gram. Senthilkumar and Jayakumar (2004) [32] observed that NAA application increased the straw yield significantly in green gram over no NAA application.

Harvest index (%)

Irrespective of fertilizers, foliar sprays resulted in significant increase in harvest index as compared to S_0. The foliar spray of S_{GA} and $S_{19:19:19}$ significantly increased the harvest index as compared to S_0 but S_{NAA} further increased the harvest index significantly. Irrespective of foliar sprays, the fertilizers did not increase the harvest index and were statistically at par. However the interaction effect between sprays and fertilizers on harvest index was non-significant. Mudalagiriyappa *et al.* (2013) found that RDF + Rhizobium along with foliar spray of 19:19:19 @ 1.5% showed significant increase on harvest index in chick pea. Rathi *et al*. (2009) [29] found that Rhizobium inoculation significantly increased the harvest index in black gram. Hoque (2001) reported that foliar application of GA_3 increased the harvest index significantly in green gram over no GA_3 application.

Economics

Economics evaluation of the treatments was done on the basis of gross return, net return and B:C ratio. In table: 3, maximum gross returns (90379 ₹ ha^{-1}), net returns (49091 ₹ ha^{-1}) and benefits cost ratio (2.18) which were recorded with the application of T_6 - ($S_{19:19:19}$+F_{RDF}+R). This might be due to higher yield in this treatment compared to other treatments. Navaz *et al.* (2017) [25] found that F_{RDF+R} along with foliar application of 19:19:19 @ 0.5% showed significant increase in cultivation cost, gross returns, net returns and B:C ratio in lathyrus crop over no foliar application. Banasode and Math (2018) [3] revealed that foliar application of 19:19:19 @ 1% significantly increased the gross returns, net returns and B:C ratio in soy bean. Bhalu *et al*. (1995) [6] reported that Rhizobium inoculation significantly increased the net returns and B:C ratio in green gram over no un-inoculation. Giri *et al.* (2018) [10] reported that GA_3 application significantly increased the economics of pigeon pea over no application of GA_3.

Table 3: Economics of green gram cultivation

Treatments	Cost of cultivation (Rs ha^{-1})	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
T1: S_0+F_0	37011	68843	31832	1.86
T2: S_0+F_R	37061	71753	34692	1.93
T3: S_0+F_{RDF}+R	39426	73962	34536	1.87
T4: $S_{19:19:19}$+F_0	38823	76193	37370	1.96
T5: $S_{19:19:19}$+F_R	38873	78521	39648	2.01
T6: $S_{19:19:19}$+F_{RDF}+R	41288	90379	49091	2.18
T7: S_{GA}+F_0	38433	75490	37057	1.96
T8: S_{GA}+F_R	38483	77793	39310	2.02
T9: S_{GA}+F_{RDF}+R	40898	83589	42691	2.04
T10: S_{NAA}+F_0	38645	77478	38833	2.00
T11: S_{NAA}+F_R	38695	80243	41548	2.07
T12: S_{NAA}+F_{RDF}+R	41110	87760	46650	2.13

Conclusion

On the basis of one season experiment on green gram (*Vigna radiata* L.*)* treatment T_6 - ($S_{19:19:19}$+F_{RDF}+R) was found more productive (1242 kg ha^{-1}) and registered maximum net return (49091 ₹ ha^{-1}) and B:C ratio was found to be (2.18) respectively. The combined application of fertilizers, foliar spray of nutrients and plant growth regulators are known to improve the source–sink relationship, translocation of photo assimilates and thereby photosynthetic ability of the plants and thus play a significant role in realization of high productivity levels and thus maximum crop yields.

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