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Effect of different organic sources on growth and yield attributes of summer greengram (*Vigna radiata* L.)

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Abstract

A field experiment was carried out at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer 2020 to study the effects of different organic sources on growth and yield of summer greengram. The results of investigation revealed that different sources of organic manures were found to be non-significant with respect to plant population and plant height while, significantly the highest branches per plant (3.76) was found with application of castor cake. In case of bioenhancers, seaweed extract resulted in the higher stature of plant height (36.52 cm) and number of branches per plant (3.73). Interaction effect was found not significant for all plant growth parameters. The yield attributes of greengram viz., number of pods per plant, pod length, number of seeds per pod, seed index, seed and stover yield were found to be non-significant due to different sources of organic manures. Seaweed extract spray has resulted highest value of yield attributes viz., number of pods per plant (13.23), pod length (9.18 cm), number of seeds per pod (8.61), seed yield (872 kg/ha) and stover yield (2046 kg/ha) of greengram. Interaction was found to be non-significant for yield attributes. The maximum net returns (₹26,213) was recorded with FYM incorporation and the maximum B:C ratio (1.75) was recorded with castor cake incorporation. As regards the bioenhancers tested, banana pseudostem sap spray resulted in maximum net returns (₹30,976) and B:C ratio (1.94).

Keywords: Organic manures, bioenhancers, greengram, seed and stover yield, growth, economics

Introduction

Greengram is the third most important pulse crop of India covering an area of 4.2 million ha with a total production of 2 million tonne and an average productivity of 461 kg/ha. The coverage of area and its production is maximum in Rajasthan (17.21 lakh ha and 7.47 lakh tonne) followed by Maharashtra (4.53 lakh ha) for the total area and third for production (1.64 lakh tonne). Madhya Pradesh ranked third in area (4.34 lakh ha) and second in production (2.66 lakh tonne) and Karnataka is on fourth position for area and production (3.97 lakh ha and 1.28 lakh tonne) (Anon., 2017-18) [1].

In Gujarat, it is cultivated in 0.868 lakh hectares with an annual production of 0.4915 lakh metric tonne having average productivity of 566 kg/ha (Anon., 2018-19) [2]. It is mainly grown in districts of Kutch, Banaskantha, Mahesana and Panchmahal in *kharif* season. Due to vagaries of monsoon in Gujarat, summer cultivation of greengram is initiated to assure production, where, irrigation water is available. Its cultivation in summer has great scope due to short duration, higher price and additional advantage of improving soil fertility.

Material and Methods

The experiment was laid out at Agronomy Instructional Farm, C. P. College of Agriculture, SDAU, Sardarkrushinagar. Geographically, Sardarkrushinagar comes under North Gujarat Agro-climatic Zone-IV and Agro-ecological situation (AES-II). The soil of the experimental field was loamy sand in texture, with low in organic carbon (0.30%) and available nitrogen (162.72 kg/ha), medium in available P₂O₅ (47.82 kg/ha) and available K₂O (258.6 kg/ha) with soil pH of 7.5.

The experiment was laid out in a Split Plot Design (SPD) with four replications. As main plot factors three organic manures viz., Farm yard manure @ 5 t/ha (O₁), Vermicompost @ 2 t/ha (O₂) and Castor cake @ 0.75 t/ha (O₃) were incorporated in soil before sowing and as sub-plot factors four sprays of bioenhancers viz., Panchagavya @ 3% (B₁), Seaweed extract @ 10% (B₂), Banana pseudostem sap @ 1% (B₃) and Control (Water spray) (B₄) were sprayed as foliar spray at 20, 40 and 60 DAS.

The greengram variety GM 4 was sown on 4th March 2020 at 45 cm row to row spacing by using recommended seed rate of 20 kg/ha. All other agronomic practices were adopted as per need of the crop.

Results and Discussion

Effect on growth attributes

The data presented in Table 1 revealed that different organic manures, bioenhancers and interaction tried in this experiment did not exert significant effect on plant population at 20 DAS and at harvest. This means that the plant population in all the organic sources were found uniform. It is ascertained from the data that the plant population in all the treatments indicating that variation in growth and yield attributes as well as yield were obtained due to treatment effect and not due to plant population.

Plant height of greengram measured at harvest was not differed significantly due to different organic manures and interaction, but significantly higher plant height (36.52 cm) was attained in foliar spray of seaweed extract @ 10% at 20, 40 and 60 DAS (B₂) and it was at par with *panchagavya* @ 3% at 20, 40 and 60 DAS (B₁) and banana pseudostem sap @ 1% at 20, 40 and 60 DAS (B₃) (Table 1). This could be due to the presence of growth promoting substances such as IAA, GA, cytokinin, essential plant nutrients and effective microorganisms in *panchagavya* and seaweed extract, which improves the cell division, cell elongation and chlorophyll content of leaves thus improves the photosynthetic activity and so higher plant height. While, the plants were of the

shortest stature (32.50 cm) with control (water spray) (B₄) might be due to non-availability of sufficient quantity of nutrients for crop growth. These findings were in close conformity with those of Chaudhary (2008) [4], Kavitha *et al.* (2008) [7], Patel *et al.* (2008) [8], Gurusaravanan *et al.* (2010) and Paul and Yuvraj (2014).

Among various organic manures, application of castor cake @ 0.75 t/ha (O₃) recorded significantly the highest number of branches per plant (3.76), while farm yard manure @ 5 t/ha (O₁) and vermicompost @ 2 t/ha (O₂) were found statistically at par with each other (Table 1). Higher number of branches might be due to accumulation of more amounts of nutrients through castor cake and presence of microbes in the crop rhizosphere stimulates the vegetative growth of plant which ultimately increased the number of branches per plant. These results are in close vicinity with the findings of Chaudhary (2008) [4]. Among various bioenhancers, foliar spray of seaweed extract @ 10% at 20, 40 and 60 DAS (B₂) recorded significantly the highest number of branches per plant (3.73). Treatment B₄ (control) recorded significantly the lowest number of branches per plant (2.97). This might be due to presence of growth promoting hormone in seaweed extract attributed to the activation of cell division and cell elongation in the axillary buds which promote and increased number of branches. These results are in close vicinity with the findings of Patel *et al.* (2008) [8] and Akhila *et al.* (2017) [1]. Interaction effect of organic manures and bioenhancers on number of branches per plant was found to be non-significant for greengram.

Table 1: Effect of organic manures and bioenhancers on growth parameters of summer greengram

Treatment	Plant population (Per Meter row length)		Plant height (cm) at harvest	Number of branches per plant
	20 DAS	At harvest		
Organic manures (O)				
O ₁ : Farm yard manure @ 5 t/ha	9.25	9.00	34.94	2.99
O ₂ : Vermicompost @ 2 t/ha	9.44	8.88	33.91	3.06
O ₃ : Castor cake @ 0.75 t/ha	9.25	8.56	35.46	3.76
S.Em.±	0.23	0.19	0.92	0.09
C.D. (P=0.05)	NS	NS	NS	0.31
C.V.%	9.76	8.72	10.60	11.11
Bioenhancers foliar spray (B)				
B ₁ : <i>Panchagavya</i> @ 3%	9.42	8.92	35.60	3.28
B ₂ : Seaweed extract @ 10%	9.00	8.33	36.52	3.73
B ₃ : Banana pseudostem sap @ 1%	9.33	9.00	34.47	3.10
B ₄ : Control (water spray)	9.50	9.00	32.50	2.97
S.Em.±	0.24	0.22	1.00	0.10
C.D. (P=0.05)	NS	NS	2.90	0.30
Interaction (O × B)				
S.Em.±	0.41	0.38	1.73	0.18
C.D. (P=0.05)	NS	NS	NS	NS
C.V.%	8.90	8.68	9.97	10.86

Effect on yield attributes and yield: The mean data presented in Table 2 revealed that number of pods per plant, pod length, number of seeds per pod, seed yield, stover yield and seed index was not differed significantly due to different sources of organic manures and interaction effect of organic manures and bioenhancers (O × B). Eventhough numerically maximum values were found with farm yard manure @ 5 t/ha (O₁) incorporated plots for number of pods per plant (11.89), pod length (8.84), seed yield (850 kg/ha, Fig. 1) and stover yield (1930 kg/ha, Fig. 1), Also maximum number of seeds per pod (8.38) and seed index (5.50) were observed in castor cake @ 0.75 t/ha (O₃) and vermicompost @ 2 t/ha (O₂) incorporated plots, respectively. Among various bioenhancers,

foliar spray of seaweed extract @ 10% at 20, 40 and 60 DAS (B₂) recorded significantly the highest number of pods per plant (13.23), pod length (9.18 cm), number of seeds per pod (8.61), seed yield (872 kg/ha) and stover yield (2046 kg/ha). In case of seed yield treatment B₁, B₂ and B₃ recorded 7.68, 13.54 and 11.97% higher seed yield over B₄ (control), respectively and for stover yield treatments B₁, B₂ and B₃ recorded 13.96, 23.17 and 12.04% higher stover yield over B₄ (control), respectively. While significantly lowest seed yield (768 kg/ha) and stover yield (1661 kg/ha) were registered under treatment B₄ (control). Significantly higher seed index (5.51 g) of greengram was recorded with foliar spray of banana pseudostem sap @ 1% at 20, 40 and 60 DAS (B₃).

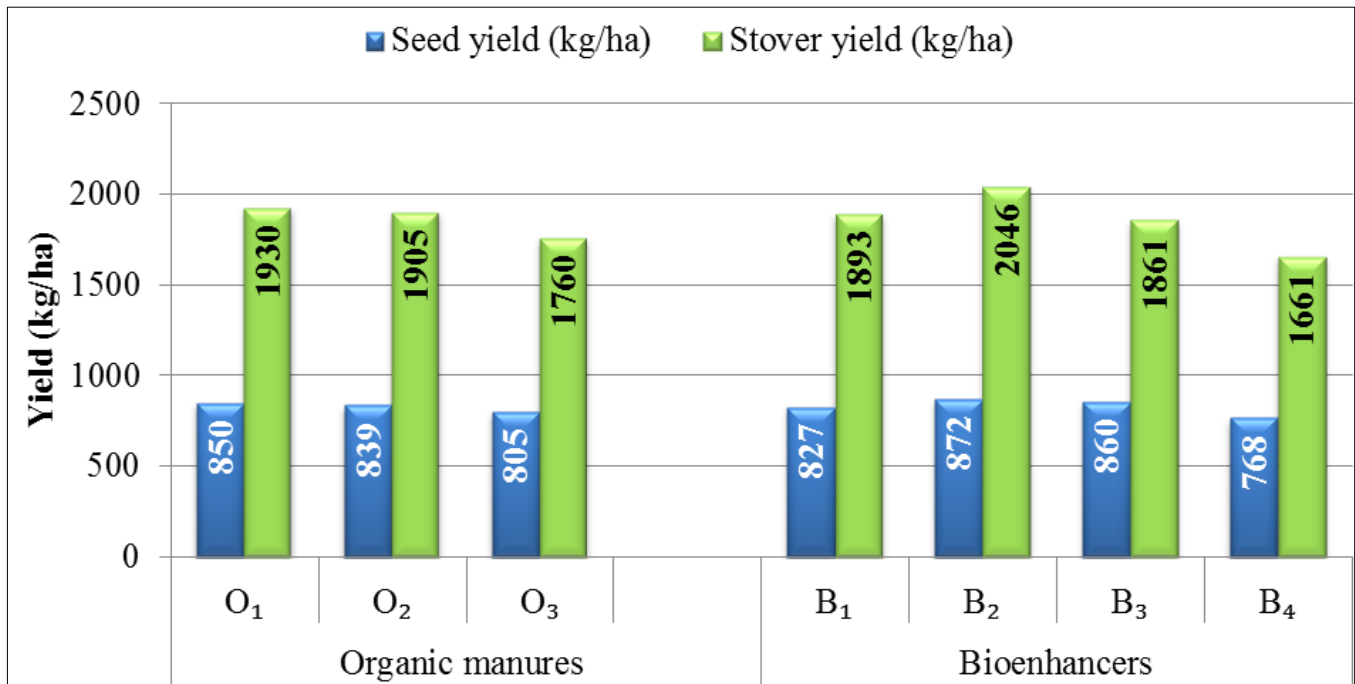


Fig 1: Effect of organic manures and bioenhancers on seed and stover yield of summer greengram

Table 2: Effect of organic manures and bioenhancers on number of pods per plant, pod length and number of seeds per pod of summer greengram

Treatment	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Seed yield (kg/ha)	Stover yield (kg/ha)	Seed index (g)
Organic manures (O)						
O ₁ : Farm yard manure @ 5 t/ha	11.89	8.84	8.34	850	1930	5.30
O ₂ : Vermicompost @ 2 t/ha	11.30	8.30	8.17	839	1905	5.50
O ₃ : Castor cake @ 0.75 t/ha	11.24	8.58	8.38	805	1760	5.32
S.Em.±	0.48	0.23	0.14	21	71	0.10
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
C.V.%	16.90	10.58	6.54	10.13	15.28	7.25
Bioenhancers foliar spray (B)						
B ₁ : Panchagavya @ 3%	10.93	8.93	8.55	872	2046	5.48
B ₂ : Seaweed extract @ 10%	13.23	9.18	8.61	860	1861	5.51
B ₃ : Banana pseudostem sap @ 1%	11.33	8.25	8.14	768	1661	5.05
B ₄ : Control (water spray)	10.40	7.93	7.88	16	82	0.08
S.Em.±	0.55	0.20	0.15	47	238	0.25
C.D. (P=0.05)	1.60	0.58	0.42	28	142	0.15
Interaction (O × B)						
S.Em.±	0.96	0.35	0.25	6.72	15.24	5.45
C.D. (P=0.05)	NS	NS	NS	850	1930	5.30
C.V.%	16.69	8.15	6.11	839	1905	5.50

This might be accounted to the increased supply of almost all essential plant nutrients by translocation of photosynthates accumulated under the influence of the source of organic nutrients. Further, the translocation and accumulation of photosynthates in the economic sinks thus increased yield attributes, chlorophyll content and nitrate reductase activity resulted in increased grain yield. The results These results are in close vicinity with the findings of Somasundaram *et al.* (2003) ^[11], Zodape *et al.* (2010) ^[12], Patel *et al.* (2013) ^[9], Akhila *et al.* (2017) ^[11], Choudhary *et al.* (2017) ^[5].

Economics

On the basis of prevailing market price of greengram seed and different variable and non variable inputs, the cost of

cultivation, gross and net realization and benefit-cost ratio (B:C ratio) of various treatments were calculated and presented in Table 3 as well as illustrated graphically in Fig. 2. Among the manurial plots maximum net returns of ₹26,213/ha was obtained from farm yard manure @ 5 t/ha (O₁) as soil incorporation. Data presented in Table 3 revealed that net returns of ₹30,976/ha secured with foliar spray of banana pseudostem sap @ 1% at 20, 40 and 60 DAS (B₃). The treatment O₃ (castor cake @ 0.75 t/ha) secured maximum B:C ratio of 1.75, followed by O₁ (farm yard manure @ 5 t/ha) and O₂ (vermicompost @ 2 t/ha). Among bioenhancers maximum B:C value of 1.94 was obtained by foliar spray of banana pseudostem sap @ 1% at 20, 40 and 60 DAS (B₃) spray

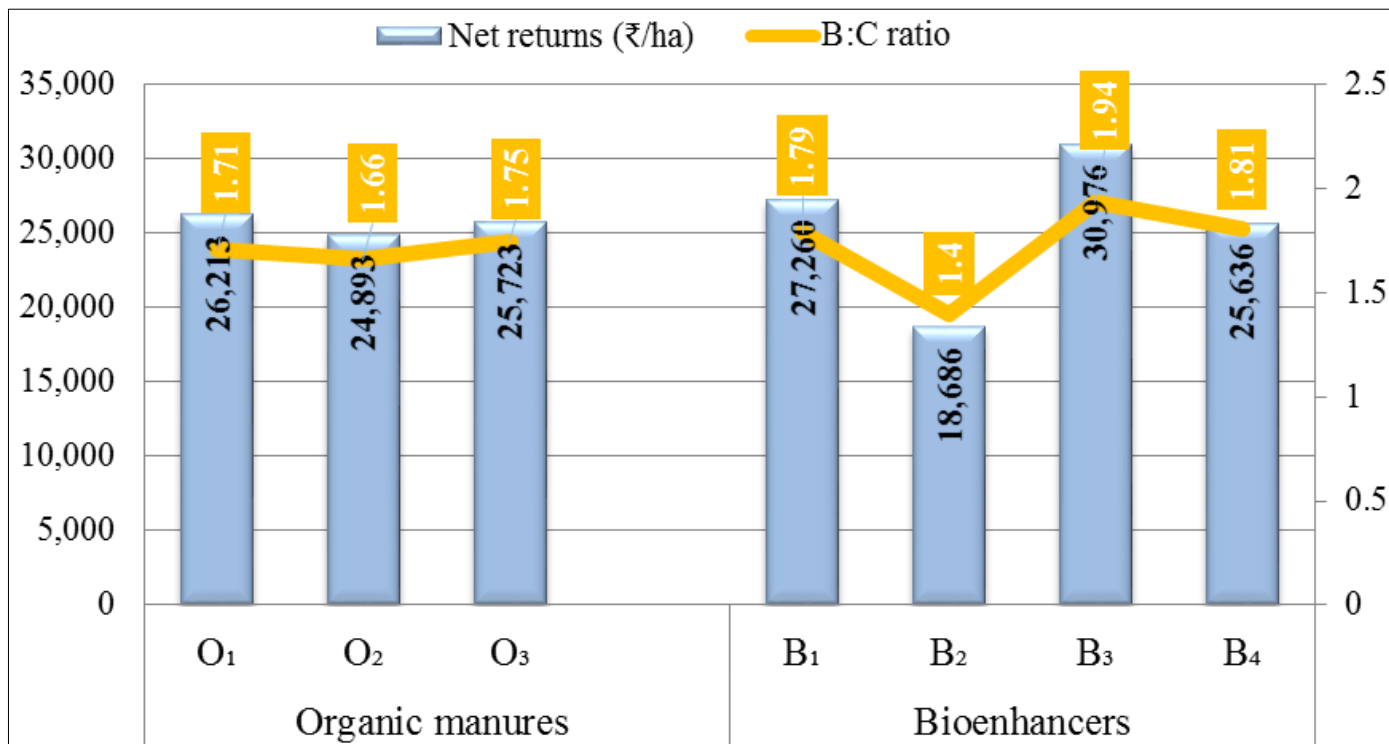


Fig 2: Effect of organic manures and bioenhancers on economics of summer greengram

Table 3: Effect of organic manures and bioenhancers on economics of summer greengram

Treatment	Seed yield (kg/ha)	Stover yield (kg/ha)	Gross returns (₹/ha)	Total cost of cultivation (₹/ha)	Net returns (₹/ha)	B:C ratio
Organic manures (O)						
O ₁ : Farm yard manure @ 5/ha	850	1930	63,360	37,147	26,213	1.71
O ₂ : Vermicompost @ 2 t/ha	839	1905	62,540	37,647	24,893	1.66
O ₃ : Castor cake @ 0.75 t/ha	805	1760	59,870	34,147	25,723	1.75
Bioenhancers foliar spray (B)						
B ₁ : Panchagavya @ 3%	827	1893	61,676	34,416	27,260	1.79
B ₂ : Seaweed extract @ 10%	872	2046	65,132	46,446	18,686	1.40
B ₃ : Banana pseudostem sap @ 1%	860	1861	63,922	32,946	30,976	1.94
B ₄ : Control (water spray)	768	1661	57,082	31,446	25,636	1.81

Conclusion

From the results of one year experimentation, it is concluded that for obtaining higher yield and growth under organic farming, summer greengram should be fertilized either with farm yard manure @ 5 t/ha, vermicompost @ 2 t/ha or castor cake @ 0.75 t/ha and three foliar sprays of either panchagavya @ 3%, seaweed extract @ 10% or banana pseudostem sap @ 1% at 20, 40 and 60 days after sowing under North Gujarat Agro-climatic condition.

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