Legume Research, 40 (2) 2017 : 388-392
Print ISSN:0250-5371 / Online ISSN:0976-0571

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com/www.legumeresearch.in

Effect of organics on seed yield and quality of green gram (*Vigna radiata* L.)

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Received: 17-08-2015 Accepted: 26-11-2015 DOI:10.18805/lr.v0i0f.11297

ABSTRACT

A field experiment was conducted on clay textured soil during *Kharif* season of 2013 to study the effect of soil amendments and organic foliar sprays on crop growth, seed yield and quality of green gram (*Vigna radiata* L.). The soil application of organic manures and liquid organic foliar sprays at flower initiation and 15 days after flowering (DAF) significantly enhanced the seed yield and seed quality parameters of green gram. Application of FYM (1/3)+ Vermicompost (1/3) + glyricidia leaf manure (1/3) equivalent to 100% RDP and foliar spray of panchagavya (3%) at flower initiation and 15 DAF recorded significantly more number of pods per plant (21.27), pod length (10.25 cm), number of seeds per pod (12.10), seed yield (12.89 g/plant) and seed yield (1263.68 kg/ha) with concomitant higher seed quality parameters like 100 seed weight (5.86 g), seed germination percentage (95.67 %), shoot length(16.53cm) root length (18.25 cm), seedling vigour index (3308) and protein content (23.79 %) as compared to other treatment combinations and control.

Key words: Farm yard manure, Glyricidia, Green gram,Growth, Panchagavya, Quality, Seed yield, Vermicompost.

Green gram [*Vigna radiata* (L.) Wilczek] is one of the most ancient and extensively grown leguminous crops grown in India. It is a short duration crop and rich in protein and vitamin B. In India it occupies an area of 3.44 million ha with a production of 1.88 million tonnes with the average yield 526 kg per ha. Whereas, in Karnataka it occupies an area of about 2.86 lakh ha with a production of about 0.67 lakh tonnes with an average productivity of 237 kg per ha (Anonymous, 2012).

The continuous use of chemical fertilizers has led to reduction in the crop yield and resulted in imbalance of nutrients in the soil, which has adverse effects on soil health. Use of organic manures alone or in combination with liquid organic manures will help to improve soil physico-chemical properties and effective utilization of applied organic manures for improved seed yield and seed quality. Organic manures provide a good substrate for the growth of microorganisms and maintain a favorable nutritional balance for productive soil ecosystem. The main drawback in organic seed production is the non-availability of organic seeds for its further multiplication. In view of this ,the present investigation was carried out to know the effect of soil organic manures and organic foliar sprays on crop growth, seed yield and quality of green gram.

A field experiment was conducted during *Kharif* 2013 at Bio-Organic farm, Main Agricultural Research Station, UAS, Dharwad, Karnataka, India. The soil of the experimental site was clayey in texture with bulk density of 1.27 g /cc, pH of 7.70, organic carbon of 0.55 %. The soil was low in available N (211.40 kg/ha) and P_2O_5 (27.34 kg/ha) and medium for K_2O (346.19 kg/ha).

There were 12 treatments consisting of soil amendments of four organic manures and three organic foliar sprays laid out in RCBD with three replications. The green gram variety DGGV-1 was sown with a spacing of 30 cm x 10 cm. The recommended dose of phosphorus for green gram was supplemented with different combinations of soil organic manures with equal proportions based on their P content. The required quantity of organic manures *viz*., Farm yard manure, Vermicompost, Glyricidia green leaf manure and neem cake were applied uniformly as per the treatment combinations and incorporated into the soil three weeks before sowing. The quantity of organic manures was worked out equivalent to RDF. The recommended dose of fertilizers (RDF- 25 kg N + 50 kg P_2O_5 + 0 kg K_2O ha^{-1}) was applied to the plots as per the treatment details in the form of urea, diammonium phosphate and muriate of potash. All the fertilizers were applied in a single basal dose at the time of sowing in furrows opened 5 cm away and 5 cm deep in the soil as basal dose. The organic foliar sprays of 3% panchagavya, 10% vermiwash and water spray (absolute control) were sprayed at two times, one at initiation of flowering and another at fifteen days after flowering according to the treatment combinations. The growth and yield attributing parameters were recorded. The seed quality such as germination test (Anonymous, 1999) was conducted using four replicates of 100 seeds each in the paper (between papers) medium in the cabinet germinator. The temperature

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in cabinet germinator was maintained at 25 ± 1ºC temperature and 90 ± 2% RH. On the seventh day of putting seeds in germination paper the number of normal seedlings in each replication was counted and the germination was calculated and expressed in percentage. The seedling vigour index was computed using the formula suggested by Abdul-Baki and Anderson (1973) and expressed as whole number. About five grams of seed sample from each treatment was made into fine powder with the help of grinder. Then, 0.5 g of ground seed material was taken for estimation of nitrogen by adopting Microkjeldhal's method (Jackson, 1973). The protein content in the seeds was obtained by multiplying the nitrogen content with conversion factor (6.25) and then expressed in percentage. The data was analysed by employing completely randomized block design.

Among the organic soil amendments, application of P as FYM + Vermicompost + Glyricidia green leaf manure in equal proportions resulted in higher seed yield and seed yield attributing characters. The application of FYM (1/3) + Vermicompost (1/3) + glyricidia green leaf manure (1/3) in equal proportion to RDP recorded significantly more number of pods/plant (18.99), pod length (9.38 cm), number of seeds per pod (11.20), seed yield per plant (11.55 g/plant) and seed yield per hectare (1145.05 kg/ha) over control (S_1) RDF+FYM @ 5 t ha^{-1} and all the other organic soil amendments (Table 1). The increased seed yield and yield attributing characters of green gram by application of soil organic amendments might be due to higher availability of nutrients to plants, besides increased water holding capacity and other physical properties which might have caused increased rate of infiltration and this might be also due to formation of more root nodules, vigorous root development, better nitrogen fixation (Shete *et al.* ,2010) and better development of plant growth leading to higher photosynthetic activity and

Table 1: Effect of organics on number of pods per plant, pod length (cm), Number of seeds per pod and seed yield per plant (g) in green gram variety DGGV-1

Treatments Soil amendments (S)	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Seed yield per plant (g)
S_1	**16.91**	**8.14**	**9.83**	**9.39**
S_2	**17.40**	**8.90**	**10.37**	**10.19**
S_3	**17.64**	**9.04**	**10.47**	**10.69**
S_4	**18.99**	**9.38**	**11.20**	**11.55**
S.Em ±	0.17	0.06	0.12	0.13
C.D.(0.05)	**0.51**	0.17	0.36	0.37
		Foliar sprays (F)		
F_1	**18.85**	9.49	11.15	11.44
F_2	**18.06**	9.20	10.65	10.83
F_3	**16.30**	7.29	9.60	9.09
S.Em ±	0.27	0.05	0.11	0.11
C.D.(0.05)	0.80	0.15	0.31	0.32
		SxF		
S_1 **F_1**	17.54	8.70	10.20	10.13
S_1 **F_2**	17.40	8.50	10.10	9.62
S_1 **F_3**	15.80	7.23	9.20	8.42
S_2 **F_1**	18.13	9.50	11.10	10.80
S_2 **F_2**	17.87	9.20	10.40	10.61
S_2 **F_3**	16.20	8.00	9.60	9.15
S_3 **F_1**	18.47	9.50	11.20	11.94
S_3 **F_2**	18.13	9.40	10.40	10.96
S_3 **F_3**	16.33	8.23	9.80	9.18
S_4 **F_1**	21.27	10.25	12.10	12.89
S_4 **F_2**	18.83	9.70	11.70	12.14
S_4 **F_3**	16.87	8.20	9.80	9.62
S.Em ±	0.30	0.10	0.21	0.22
C.D.(0.05)	0.88	0.30	0.62	0.65

Soil amendments (S)

S_1 : RDF (25:50:00 kg N: P_2O_5: K_2O/ha) + FYM 5 t ha^{-1} (Control/ RPP).

S_2 : FYM 1/2 (12.5 t ha^{-1}) + Vermicompost 1/2 (2.5 t ha^{-1})

S_3 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Neem cake 1/3 (1.66 t ha^{-1})

S_4 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Glyricidia green manure 1/3 (4.62 t ha^{-1})

Organic foliar spray (F)

F_1 : 3 % Panchagavya

F_2 : 10 % Vermiwash.

F_3 : Water spray (Control)

translocation of photosynthates to the sink which in turn resulted in better development of yield attributes and finally higher seed yield (Ravikumar *et al.* ,2012). Similar results were also reported by Yadav and Vijayakumari (2003) in chilli, Patil *et al*. (2012) in chickpea, Ravusaheb (2008) in sesame and Shwetha (2008) in soybean.

Foliar spraying of 3 % panchagavya at flower initiation and 15 days after flowering(F_1) has recorded significantly more number of pods/plant (18.85), pod length (9.49 cm), number of seeds per pod (11.15), seed yield per plant (11.44g/plant) (Table 1) seed yield per hectare (1135.58 kg/ha) followed by 10 % vermiwash as compared to absolute control water spray. The data presented in Table.2.This might be due to fact that cow dung in panchagavya act as a medium for the growth of beneficial microbes and cow urine provides nitrogen which is essential for crop growth (De Britto and Girija, 2006). These findings are in agreement with Patil *et al*., (2012) in chickpea, Ravusaheb (2008) in sesame and Shwetha (2008) in soybean.

Among the interactions of soil amendments and organic foliar sprays, spraying of 3% panchagavya in combination with FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 has recorded significantly higher number of pods/plant (21.27), pod length (10.25 cm), number of seeds per pod (12.10), seed yield per plant (12.89 g/plant) and seed yield per hectare (1263.68 kg/ha) over control S_1F_3 (RDF + FYM 5 t ha^{-1} + water spray). The seed yield of green gram is the product of various yield attributing characters like number of pods, pod length, number of seeds per pod and test weight and these are differed significantly due to application of soil amendments, organic foliar spray and their combined applications. This might be due to availability and optimum supply of nutrients to plants that favorably influenced the flowering and seed formation which ultimately

Table 2: Effect of organics on seed yield per hectare (kg/ha), 100 seed weight (g), Germination (%) and Root length (cm) in green gram variety DGGV-1

Treatments Soil amendments (S)	Seed yield per hectare (kg/ha)	100 seed weight (g)	Germination percentage	Root length (cm)
S_1	**952.92**	**4.92**	**92.22 (73.70)***	**16.83**
S_2	**1029.10**	**5.07**	**93.21 (75.04)**	**17.11**
S_3	**1057.83**	**5.00**	**92.55 (74.28)**	**16.94**
S_4	**1145.05**	**5.42**	**93.78 (75.69)**	**17.36**
S.Em ±	**6.87**	0.06	0.48	0.06
C.D.(0.05)	20.15	0.18	1.41	0.17
		Foliar sprays (F)		
F_1	1135.58	5.29	**94.91 (77.00)**	17.78
F_2	1084.03	5.11	**93.16 (74.89)**	17.13
F_3	919.07	4.89	**91.75 (72.15)**	16.28
S.Em ±	5.95	0.05	0.42	0.05
C.D.(0.05)	17.45	0.16	1.22	0.15
		SxF		
S_1 F_1	1014.68	5.02	94.33 (76.21)*	17.42
S_1 F_2	1012.34	5.01	92.33 (73.95)	17.10
S_1 F_3	831.75	4.73	90.00 (71.54)	15.97
S_2 F_1	1094.38	5.21	95.00 (77.09)	17.90
S_2 F_2	1064.32	5.04	93.67 (75.46)	17.17
S_2 F_3	928.60	4.95	91.00 (72.58)	16.27
S_3 F_1	1169.56	5.07	94.67 (76.67)	17.57
S_3 F_2	1074.26	5.03	92.67 (74.31)	16.90
S_3 F_3	929.66	4.91	90.33 (71.86)	16.37
S_4 F_1	1263.68	5.86	95.67 (78.03)	18.25
S_4 F_2	1185.18	5.37	94.00 (75.82)	17.33
S_4 F_3	986.28	4.98	91.67 (73.22)	16.50
S.Em ±	11.90	0.11	0.84	0.10
C.D.(0.05)	34.90	0.34	2.49	0.31

Soil amendments (S)

S_1 : RDF (25:50:00 kg N: P_2O_5: K_2O/ha) + FYM 5 t ha^{-1} (Control/ RPP).
S_2 : FYM 1/2 (12.5 t ha^{-1}) + Vermicompost 1/2 (2.5 t ha^{-1})
S_3 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Neem cake 1/3 (1.66 t ha^{-1})
S_4 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Glyricidia green manure 1/3 (4.62 t ha^{-1})

Organic foliar spray (F)

F_1 : 3 % Panchagavya
F_2 : 10 % Vermiwash.
F_3 : Water spray (Control)

increased the pods/plant, seeds/pod and test weight. Higher yield attributing characters in aforesaid treatments is a consequence of increased rate of photosynthesis coupled with efficient translocation of photosynthates from source (leaf and stem) to sink (pods) and it might be also due to significant improvement in the sink size (number of pods) could be due to increase in number of branches per plant, which might have resulted in the development of more number of reproductive parts and thereby increasing the sink size to obtain higher seed yield as already observed in chickpea (Patel *et al* , 2012 , Ravusaheb, 2008) and Shwetha, 2008).

When organics are applied, nutrients will be released slowly and also the nutrient losses will be minimized due to increased absorption of nutrients as a result of increased cation exchange capacity that increased with organic matter application. Thus plant nutrients will be available for a long period in adequate quantity thereby plant can absorb the required nutrients as per its demand resulting in better growth, development and yield components. Addition of organic matter improves soil structure, porosity, water holding capacity and decreases bulk density and chemical properties such as soil organic carbon and available nutrients will also be improved. All these promote soil health, crop growth and yield on sustained basis.

Application of soil amendments, organic foliar sprays and their interactions not only influenced the crop growth and seed yield of green gram but also helped in enhancing the seed quality parameters (Table.3). The application of soil amendments of FYM (1/3) + Vermicompost (1/3) + Glyricidia green leaf manure (1/3) recorded highest 100 seed weight (5.42 g), seed germination percentage (93.78 %), root length (17.36 cm), shoot length (15.17 cm), seedling vigour index (3,035) and protein content (22.64 %) attributes due to better nutrient status in the soil and better assimilation of nutrients by plants was reflected by their reproductive health and seed quality of seed. The increased the seed quality

Table 3. Effect of organics on shoot length (cm), seedling vigour index and protein content (%) in green gram variety DGGV-1

Treatments(S) Soil amendments	Shoot length (cm)	Seedling vigour index	Protein content (%)
S_1	**14.47**	**2890**	**21.97**
S_2	**14.74**	**2957**	**22.29**
S_3	**14.65**	**2932**	**22.08**
S_4	**15.17**	**3035**	**22.64**
S.Em ±	**0.08**	3089	0.15
C.D.(0.05)	0.23	2902	0.45
		Foliar sprays (F)	
F_1	15.74	3174	23.11
F_2	14.15	2910	22.18
F_3	14.08	2776	21.45
S.Em ±	0.07	3170	0.13
C.D.(0.05)	0.20	2918	0.39
		SxF	
S_1 F_1	15.33	3089	22.63
S_1 F_2	14.30	2902	22.17
S_1 F_3	13.77	2678	21.11
S_2 F_1	15.57	3170	23.22
S_2 F_2	14.40	2918	22.30
S_2 F_3	14.27	2783	21.37
S_3 F_1	15.52	3129	22.82
S_3 F_2	14.33	2844	21.86
S_3 F_3	14.10	2825	21.56
S_4 F_1	16.53	3308	23.79
S_4 F_2	14.78	2976	22.38
S_4 F_3	14.20	2821	21.76
S.Em ±	0.13	3129	0.27
C.D.(0.05)	0.20	2844	NS

Soil amendments (S)

S_1 : RDF (25:50:00 kg N: P_2O_5: K_2O/ha) + FYM 5 t ha^{-1} (Control/ RPP).
S_2 : FYM 1/2 (12.5 t ha^{-1}) + Vermicompost 1/2 (2.5 t ha^{-1})
S_3 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Neem cake 1/3 (1.66 t ha^{-1})
S_4 : FYM 1/3 (8.33 t ha^{-1}) + Vermicompost 1/3 (1.66 t ha^{-1}) + Glyricidia green manure 1/3 (4.62 t ha^{-1})

Organic foliar spray (F)

F_1 : 3 % Panchagavya
F_2 : 10 % Vermiwash.
F_3 : Water spray (Control)

obtained with application of soil amendments may also be due to better nutrient availability and its uptake by mother plant. This might have lead to accumulation of higher quantities of seed components like calcium carbonate and increased lipid metabolism which helps in increasing the protein content in seed. These results are in confirmation with findings of Patil (2008) in capsicum.

Organic foliar spray of 3 % panchagavya recorded significantly highest 100 seed weight (5.86 g), germination percentage (94.91 %), root length (17.78 cm), shoot length (15.74 cm), seedling vigour index (3,179) and protein content (23.11 %). The data depicted in Table.3.This may be due to the action of growth promoters such as kinetin, GA and beneficial microbes present in panchagavya. These results are in agreement with findings of Ramaswamy and Vijaykumar (2009) in senna, Kumaravelu and Kadambian (2009) in green gram, Saritha *et al.*(2013) in cluster bean. The organic foliar spray of 3% panchagavya recorded significant difference in protein content percentage (23.11 %) attributed to the enzymatic activity of nitrate reductase and glutamate synthase results in higher protein content percentage. These results are in agreement with the finding of Vijayakumari *et al*. (2012) in soybean.

The interactions of soil amendments and organic foliar spray were found to be significant with respect to seed quality parameters such as germination per cent, shoot length, root length and seedling vigour index(Table.3). Among the interactions S_4F_1 (FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 coupled with 3 % panchagavya as foliar spray) were found to be significant with respect to 100 seed weight (5.86 g), seed germination percentage (95.67 %), shoot length (16.53 cm), root length (18.25 cm) and seedling vigour index (3,308). This may be due to action of growth promoters such as kinetin and GA and beneficial microbes present in panchagavya and also due to enhanced carbohydrate synthesis and effective translocation of these photosynthates from source to sink relationship. These results are in agreement with the findings of Saritha *et al*. (2013) in cluster bean.

Soil application of P equivalent to 100 per cent recommended dose with FYM 1/3 + Vermicompost 1/3 + glyricidia leaf manure 1/3 and foliar spray of 3% panchagavya at flower initiation and 15 days after flowering improved the crop growth, seed yield and seed quality parameters of green gram. This will also helps in accomplishing the nutrient demand of green gram through various organic nutrient sources and reduce the dependence to chemical fertilizers. Thus this study clearly brought out that application of organic manures and an organic foliar spray play a crucial role in increasing the seed yield and seed quality attributes.

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