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RESPONSE OF GREEN GRAM TO ORGANIC MANURE AND BIO-PESTICIDE DURING SUMMER IN LOWER GANGETIC PLAINS

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ABSTRACT

A field trial was conducted during pre-*kharif* season of 2019 and 2020 at 'C' Block Farm, Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani, Nadia, West Bengal, India to find out suitable organic manure and bio-pesticide for better yield and quality of green gram (*cv*. Samrat). The experiment replicated thrice was laid out in a split-plot design, where 3 organic manures *viz*. O_1, Cow dung manure, O_2, FYM and O_3, Vermicompost were allocated in main plots, while 3 bio-pesticides *viz*. P_1, Control, P_2, *Neemastra* and P_3, *Dashparni* in sub-plots. The crop nourished with cow dung manure @ 20 kg/ha (O_1) recorded greater dry matter (DM) production throughout the cropping period (259.0 and 473.4 g/m^2 at 40 DAS and harvest, respectively), number of pods/plant (25.6) and seeds/pod (12.2), which led to the highest pooled grain yield (740 kg/ha) and protein content (21.6%) compared to other two organic nutrient sources. Two bio-pesticides (*Neemastra* and *Dashparni*) applied on foliage of green gram plants could have indirect positive effect on vegetative growth over the untreated control (P_1), but their efficacy could not properly be judged because the crop was not infested by insect-diseases in both the years.

Keywords **:** Bio-pesticide, Green gram, Organic manure and Yield.

Introduction

Green gram (*Vigna radiata* L.), the third most important pulse crop after chickpea and pigeonpea, is cultivated throughout India mainly in the states of Rajasthan, Madhya Pradesh, Punjab, Haryana, Uttar Pradesh, Maharashtra, Karnataka Andhra Pradesh and Tamil Nadu. Green gram contains 21-26% protein, 60-65% carbohydrate, 1-1.5% fat and 3.5-4.5% fibre (Lal *et al*., 2025), and it has versatile uses as vegetable, pulse, fodder and green manure. As it provides a cheaper source of protein, it is known as 'poor man's meat' (Potter and Hotchkiss, 1997).

In recent times, the demand for organic products of vegetables and pulses is increasing in high value markets. Organic farming is a system that avoids the use of synthetic chemical fertilizers and pesticides, and that raises the crop with the use of organic manures, green manure and biological pest control. Organic sources *like* FYM, vermicompost, oil cakes and bio-fertilizers are gaining importance day-*by*-day because they help to sustain the crop productivity, and improve crop quality and soil health (Lal *et al*., 2019). On the other hand, indiscriminate use of plant protection chemicals increase cultivation cost, pollute environment, and that may induce resistance against several pest-diseases. Bio-pesticides, derived from natural plant and animal materials, offer sustainable approach for controlling pest-diseases in pulse crops. So, the present experiment was carried out to study the effect of organic manures and bio-pesticides on growth, yield and quality of green gram in lower *gangetic* plains of West Bengal.

Materials and Methods

A field experiment was carried out during pre-*kharif* season of 2018–19 and 2019–20 at 'C' Block Farm (22º57 'N latitude, 88º20 'E longitude and 9.75 m

altitude) of Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani, Nadia, within New Alluvial Zone West Bengal, India. The soil was clay-loam (order Entisol), neutral in reaction (pH 6.9), medium in organic C (0.67%), available N (326.8 kg/ha), P (42.5 kg/ha) and K (229.6 kg/ha). The experiment replicated thrice was laid out in a split-plot design comprising three organic manures (O_1, Cow dung manure @ 20 kg N/ha as basal, O_2, Farm yard manure @ 20 kg N/ha as basal and O_3, Vermicompost @ 20 kg N/ha as basal) in main plots, and three botanical pesticides (P_1, control, P_2, *Neemastra*, P_3, *Dashparni*) in sub-plots. Seeds of green gram *var*. Samrat (PDM 84-139) were mixed with *Rhizobium* culture, and those were sown @ 25 kg/ha in furrows at a spacing of 30 cm × 10 cm. Thinning and hand weeding was done at 25 DAS to maintain optimum plant population and to keep the field weed-free, and two irrigations were given during the cropping period. *Neemastra* and *Dashparni* prepared at the farm were sprayed @ 2.5 ml/litre of water at 2 weeks interval from 3 WAS as per treatment schedule to control insect-pests in the field. Hand picking of pods was done twice at an interval of 7 days, and threshing was done manually.

Growth attributes like plant height, number of branches/plant, dry matter accumulation, number of nodules/plant and nodule dry weight were noted at different stages, while yield attributing characters, seed yield and stover yield were recorded at harvest. The crude protein content of green gram was estimated based on total nitrogen (N) content in grain determined by Kjeldahl method (Jackson, 1973) using Automatic Nitrogen Estimation System (Kel Plus, Pelican make, India), multiplied by 6.25. The data recorded in the study were analysed using the Analysis of Variance technique following procedures described by Gomez and Gomez (1984), and the treatment means were compared at 5% level of significance.

Results and Discussion

The organic manures and bio-pesticides had significant influence on various growth attributes such as number of branches/plant, dry matter production, number of nodules/plant, nodule dry weight/plant of green gram during the cropping period (Table 1). Vermicompost applied @ 20 kg N/ha as basal resulted in maximum plant plant height (61.0 cm) at maturity, but that was at par with cow dung manure and FYM in *gangetic* alluvial soil. Similarly, the foliar spray of bio-pesticides could not influence the plant height of green gram at maturity. Rao *et al.* (2019) recorded maximum plant height of green gram under residual effects of 75% N + Vermicompost in rice–greengram cropping system in Tamil Nadu.

The primary branching in green gram plants was initiated at or after 30 DAS, and reached to 1.5-2.0 branches/plant at 40 DAS, and that was similar or slightly less at maturity. The maximum branching was recorded with FYM (2.5/plant) at 40 DAS (Table 1). Patel and Gangwar (2023) found maximum branches/ plant of green gram (*cv*. Shikha) with application of FYM @ 16.66 q/ha + Poultry manure @ 2.77 q/ha + Vermicompost @ 8.33 q/ha + *Rhizobium* + PSB at Jhansi, Uttar Pradesh. The number of root nodules/plant of green gram was not significantly influenced by different organic nutrient sources at 40 DAS, but the plots treated with *Dashparni* (P_3) recorded maximum root nodules (48.8/plant) and dry weight (68.5 mg/plant) at 40 DAS. The basal application of vermicompost (O_3) resulted in the highest nodule dry weight/plant at 40 DAS (67.1 mg), which might be probably due to greater size of nodules produced on roots of green gram compared to cow dung manure and FYM.

Mean pooled dry matter production in aerial parts of green gram over different treatment combinations was noted as 30.5, 252.1 and 452.0 g/m^2 at 20, 40 DAS and harvest, respectively. It may be noted that high day temperature (±35°C) during late vegetative and early reproductive stage in both the years promoted the height, branching habit and foliage growth that led to higher DM accumulation at 40 DAS and harvest during pre-*kharif* season. The basal application of cow dung manure (O_1) resulted in the highest pooled DM yield at 40 DAS (259.0 g/m^2) and maturity (473.4 g/m^2) due to slow and consistent release of nutrients from cow dung manure (O_1). The lowest value of dry matter production was recorded with basal application of vermicompost (233.5 g/m^2) and basal application of FYM (438.7 g/m^2) at 40 DAS and at harvest, respectively. The botanical pesticides applied on foliage had favourable effect on DM production of green gram at 40 DAS and harvest over untreated control (P_1). The plots received the spray of *Dashparni* (P_3) recorded the highest DM production (261.5 and 466.7 g/m^2) at 40 DAS and harvest, respectively followed by *Neemastra* probably due to no or least infestation of insect-disease during the cropping period.

Although the number of pods/plant was not varied significantly by different organic manures and bio-pesticides for pooled over two years (Table 2), but the maximum pods/plant (24.2) was recorded in plots received basally applied vermicompost (O_3) in second year (data not shown) probably due to profuse branching habit. The plants received cow dung manure (O_1) as basal produced maximum seeds/pod (12.2), but

that was (11.5 seeds/pod) closely followed by both FYM (O_2) and vermicompost (O_3). However, Bhadu *et al*. (2018) found better effect of combined use of FYM + Vermicompost + *Rhizobium* + PSB on greater number of seeds/pod in green gram than sole application of FYM or Vermicompost or control at Jabalpur, Madhya Pradesh. Surprisingly, the maximum number of seeds/pod (12.1) was found in untreated control (P_1) plots, which was followed by *Neemastra* (11.7/pod) and *Dashparni* (11.5/pod) in pooled study. The finding can be supported by field observation for non-infestation of diseases on green gram plants throughout the cropping period during pre-*kharif* season of both the years. Test weight of green gram was significantly influenced by varied organic nutrient sources, where FYM (O_2) recorded the highest pooled test weight (32.8 g). Similarly, Jat *et al.* (2012) found that application of 5 t/ha FYM resulted in highest 1000 grain weight (4.7 gm) over no FYM application.

The effect of organic manure and bio-pesticide on grain yield of summer green gram during 2019 and 2020 is presented graphically in Fig. 1, where the grain yield was higher in first year than second year irrespective of main and sub-plot treatments in the investigation. The crop received cow dung manure (O_1) as basal produced the maximum pooled grain yield (740 kg/ha) due to significant improvement in number of pods/plant and number of seeds/pod. Patel and Gangwar (2023) reported that the grain yield of green gram (*cv.* Shikha) was significantly higher (10.50 q/ha) with application of FYM @ 16.66 q/ha + Poultry manure @ 2.77 q/ha + Vermicompost @ 8.33 q/ha + *Rhizobium* + PSB at Jhansi, Uttar Pradesh. Similarly, Tyagi and Upadhyay (2015) observed that application of 100% RDF + Vermicompost 1.0 t/ha + *Rhizobium* resulted in significantly higher seed yield being 57.3% greater over control at Tikamgarh, Madhya Pradesh. The foliar spray of bio-pesticides (*Neemastra* and *Dashaprni*) had no significant influence on grain yield of green gram compared to untreated control (P_1). The application of FYM (O_2) resulted in the highest pooled stover yield (2930 kg/ha) due to greater foliage production, being followed by cow dung manure (2800 kg/ha) during pre-*kharif* season.

The basal application of cow dung manure resulted in maximum protein content in grain (21.6%), but it remained unaffected due to varied bio-pesticides used in the study, and mean protein content of the variety Samrat was estimated as ±21% during pre-*kharif* season.

Conclusion

Based on these, it can be concluded that cow dung manure could be advised for basal application to green gram, while the efficacy of bio-pesticides (*Neemastra* and *Dashaparni*) could not properly be judged for economic yield and protein content during pre-*kharif* season.

Table 1 : Effect of organic manure and bio-pesticide on growth attributes of summer green gram (pooled over 2 years)

Treatment	Plant height (cm) at harvest	No. of branches/ plant at 40 DAS	No. of root nodules/plant at 40 DAS	Dry weight of root nodule (mg/plant) at 40 DAS	Dry matter accumulation (g/m^2)	
					40 DAS	Harvest
Organic manure						
O_1, Cowdung manure @ 20 kg N/ha	60.9	2.1	49.9	63.7	259.0	473.4
O_2, FYM @ 20 kg N/ha	58.6	2.5	41.5	62.4	243.9	438.7
O_3, Vermicompost @ 20 Kg N/ha	61.0	2.4	43.0	67.1	233.5	443.8
SEm ±	0.70	0.07	2.60	1.26	6.76	7.89
CD (P=0.05)	2.30	0.25	NS	4.23	20.52	23.75
Botanical pesticide						
P_1, Control	60.8	2.1	40.7	59.6	242.4	434.2
P_2, *Neemastra*	60.0	2.3	44.9	65.0	252.5	455.0
P_3, *Dashparni*	59.6	2.5	48.8	68.5	261.5	466.7
SEm ±	0.69	0.05	0.65	0.57	1.85	2.00
CD (P=0.05)	NS	0.18	2.12	1.87	6.04	6.53

DAS = Days after sowing, NS = Not significant

Table 2 : Effect of organic manure and bio-pesticide on yield and quality of summer green gram (pooled over 2 years)

Treatment	No. of pods/plant	No. of seeds/pod	Test weight (g)	Grain yield (kg/ha)	Stover yield (kg/ha)	Protein content (%)
Organic manure						
O_1, Cowdung manure @ 20 kg N/ha	25.6	12.2	32.6	740	2800	21.6
O_2, FYM @ 20 kg N/ha	23.3	11.5	32.8	596	2930	21.1
O_3, Vermicompost @ 20 Kg N/ha	24.4	11.5	32.1	639	2410	21.0
SEm ±	0.58	0.14	0.06	42.1	124.0	0.19
CD (P=0.05)	1.86	0.46	0.22	128.3	406.2	0.58
Botanical pesticide						
P_1, Control	24.5	12.1	32.6	656	2670	21.0
P_2, *Neemastra*	24.1	11.7	32.6	644	2650	21.3
P_3, *Dashparni*	24.6	11.5	32.4	647	2820	21.3
SEm ±	0.73	0.11	0.11	17.5	680.7	0.25
CD (P=0.05)	NS	0.35	NS	NS	NS	NS

NS = Not significant

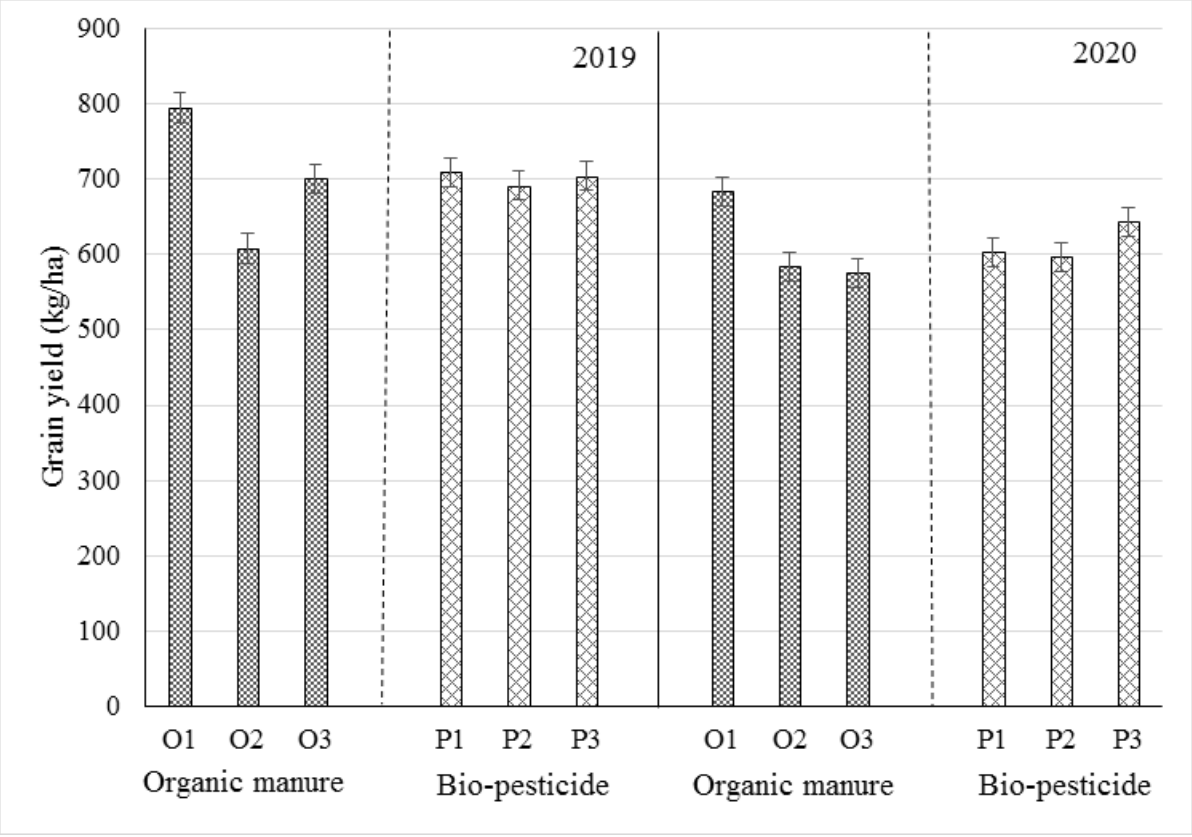

Fig. 1 : Effect of organic manure and bio-pesticide on grain yield of summer green gram during 2019 and 2020

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