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Research Article

Evaluation of growth and yield parameters of green gram (*Vigna radiata* L.)

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SUMMARY : A farmers' participatory field trial was conducted to evaluate the growth and yield parameters of different high yielding varieties of green gram at Tainsi village of Angul block in Angul district of Odisha with the financial support from ATMA during *Kharif* season of 2012 and 2013. The treatments were consisted of five different high yielding green gram varieties *viz.*, OBGG 52, OUM 11-5, IPM 02-14, Pant M-5, TARM 1 and one local variety Kala mung. Among different varieties, OBGG 52 recorded maximum seed yield (13.6 q ha^{-1}), stover yield (55.65 q ha^{-1}), length of pod (7.9 cm), number of pods $plant^{-1}$ (30.6), number of seeds pod^{-1} (12.2) , number of nodules $plant^{-1}$ (3.85 to 13.2). The same variety also produced the maximum leaf area index(4.54), total dry weight (328.42 g m^{-2}), crop growth rate (7.41 g m^{-2} day^{-1}) with net return (Rs. 26050 ha^{-1}) and B:C ratio (2.21) and was found to be most suitable. HYV Pant M-5 produced maximum number of branches $plant^{-1}$ (10.2) and 100 seed weight (4.15 g) where as the local variety Kala mung produced the lowest no of pods $plant^{-1}$ (19), number of seeds pod^{-1} (8.4), leaf area index (3.12), crop growth rate (5.95 g m^{-2} day^{-1}), seed yield (7.8 q ha^{-1}) and net return (Rs.9450 ha^{-1}). Hence, the existing local variety (Kala mung) can be replaced by HYV OBGG 52 since it fits to the existing farming situation for higher productivity and income.

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BACKGROUND AND OBJECTIVES

Greengram is the major pulse crop of the state with a total coverage of 799680 hectare which is about 40 per cent of the total pulse cultivating area of the state. Area under green gram crop in Angul district is 32710 hectare with a productivity of 4.17 q ha^{-1} which is at par with that of state (Anonymus, 2011). One of the major constraints of decreasing in yield and spread of green gram , is the non-availability of high yielding resistant variety to replace the traditional varieties.

Green gram or mung bean (*Vigna radiata* L.) is the third most important food legumes grown and consumed in India and is a good source of proteins and minerals and its protein quality is similar to or better than other legumes (Kataria *et al.*, 1989).

Green gram (*V. radiata* L.) is one of the important short season grain legumes in the conventional farming system of tropical and temperate regions. It can be grown on a variety of soil and climatic conditions, as it is tolerant to drought (Malik *et al.*, 2006).

When mung bean is grown under rainfed condition, greater rooting depth helps to acquire stored water from various depths to improve stability in grain yield. Drought stressed plants diverted significantly higher dry matter to roots and stems, while well watered plants diverted to pods and grains (Kumar and Sharma, 2009).

Including mung bean in the rice rotation system has diversified and strengthened the cropping system, alleviated the disadvantage of the cereal–cereal cropping system and improved the productivity of the soil. Including mung bean in a rice rotation has increased the yield of paddy

and the income of farmers (Weinberger, 2003).

Addition of N and P fertilizer enhances root development, which improves the supply of other nutrients and water to the growing parts of the plants, resulting in an increased photosynthetic area and there by more dry matter accumulation. The application of phosphorus to mung bean has been reported to increase dry matter at harvest, number of pods per plant, seed per pod, 1000 grain weight, seed yield and total biomass (Mitra *et al*., 1999).

Therefore, it was considered important to evaluate growth and yield parameters of few selected high yielding varieties of green gram and to identify the most suitable one among those in the existing farming situation for higher productivity and income.

RESOURCES AND METHODS

A farmers' participatory field trial was conducted to evaluate the growth and yield parameters of different high yielding varieties of green gram at Tainsi village of Angul block in Angul district of Odisha with the financial support from ATMA during *Kharif* season of 2012 and 2013. The geographical location of the area has 84^0 16´ to 85^0 23´ E longitude and 20^0 31´ to 21^0 41´ N latitude and average elevation of 195 m above sea level. Climate of the region is fairly hot and humid monsoon and mild winter with average annual rainfall of 1401.9 mm. The mean maximum and mean minimum temperature vary from 39.6^0C in April to 23.5^0C in December and from 23.5^0 C in June to 11.3^0 C in January, respectively. The soil of the experimental site was slightly acidic in reaction (pH-5.4), sandy loam in texture with medium organic carbon content (0.54 %), low in nitrogen (279.0 kg ha^{-1}) and phosphorus (9.3 kg ha^{-1}) and medium in potassium (174.0 kg ha^{-1}) contents. The treatments were consisted of five different high yielding and one local green gram varieties *viz.*, T_1: OBGG 52, T_2: OUM 11-5, T_3: IPM 02-14, T_4: Pant M-5, T_5: TARM, T_6: Kala mung (Local) and were replicated five times in a Randomized Block Design. Five different high yielding varieties with one local variety (Kala Mung) were grown with recommended package of practices by each of the five farmers. They were supplied with input like seed and fertilizers. The plot size was (5 × 5) m. The recommended dose of fertilizer (RDF) for green gram was 20:40:40 kg ha^{-1} N, P_2O_5 and K_2O, respectively and all fertilizers were applied as basal. The crops were sown during 1st week of July and harvested during 1st week of September. Observations on different growth and yield parameters were taken and economic analysis was done. The dry weight of leaves was used for determining leaf area index (LAI) as suggested by Watson (1952). Leaf area index was obtained by multiplying the ratio of area/weight with dry weight of green leaves produced per square meter of ground surface. The total biomass at different stages of crops were taken by reaping the plants at ground level and the plant samples were separated and dried in a hot air oven at 70^OC for 48 hours and weight of dried samples were taken. The soil fertility status was analyzed by standard methods. Crop growth rate (CGR) was determined with the formula:

$$\frac{W_2 - W_1}{t_2 - t_1}$$

where,

W_1 and W_2 are dry weight of plants at time t_1 and t_2 respectively.

Final crop yields were recorded and the gross returns (Rs. ha^{-1}) were calculated on the basis of prevailing market price of the produce. The benefit: cost ratio for different varieties was calculated by dividing gross return by cost of cultivation. The data were statistically analyzed applying the techniques of analysis of variance and the significance of different sources of variations were tested by error mean square of Fisher Snedecor's 'F' test at probability level 0.05 (Cochran and Cox, 1977).

OBSERVATIONS AND ANALYSIS

The experimental findings obtained from the present study have been discussed in following heads:

Plant height and no of branches plant^{-1}

The tallest plants (50.6 cm) were recorded in local variety *i.e.* Kala mung followed by high yielding variety OBGG 52 and TARM 1 having height 46.6 cm and 44.4 cm, respectively (Fig. 1). The rest of the varieties had plant height at par. Pant M-5 produced the maximum numbers of branches plant^{-1} (10.2) which was significantly higher than rest of the varieties. This reason may be attributed to their genetic variability, varietal difference and environmental adaptability. Similar results were also reported by Lawrence and Gohain (2011) in rice crops.

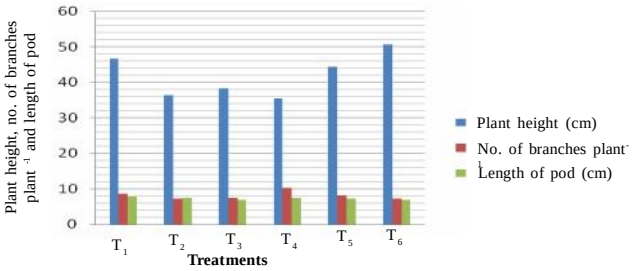

Fig. 1: Effect of treatments on plant height no. of branches plant^{-1} lenght of pod

Length of pod and no of pods plant^{-1}:

The longest pod (7.9 cm) produced in OBGG 52 followed by OUM 11-5, Pant M-5 and TARM 1 which were equivalent

(Fig.1). The shortest pod was produced in Kala mung (6.8 cm) which was followed by IPM 02-14. The maximum no of pod plant^{-1} (30.6) was recorded in OBGG 52 where as minimum no of pods was found in Kala mung (Table 1). The rest of the varieties had moderate no of pods. Similar result were obtained by Ali *et al.* (2010) and Singh and Sekhon (2010).

No. of seeds pod^{-1}and test weight:

OBGG 52 was the top ranker having maximum no. of seeds pod^{-1} (12.2) and minimum number of seeds per pod^{-1} was obtained in Kala mung (8.4). The rest of the varieties were equivalent. Pant M-5 recorded the maximum test weight (100 seed weight) of 4.15 g where as OBGG 52 recorded minimum test weight of 2.97g (Table 1). The rest of varieties had moderate range of test weight. This reason may be owing to their genetic variability. This finding is in corroborated with the findings of Kumar *et al*. (2013).

No. of nodules plant^{-1}and leaf area index:

The trend of producing nodules plant^{-1} in different varieties were almost similar at 20 and 40 DAS. Among the varieties OBGG 52 produced the maximum numbers of nodules plant^{-1} (13.2) at 40 DAS which was 61 per cent higher than that with Kala mung. The maximum leaf area index (4.54) was recorded in OBGG 52 which was at par with OUM 11-5 and lowest leaf area index (3.12) was found in Kala mung (Table 2). This is in agreement with Manivasagaperumal *et al.* (2011).

Total dry weight and crop growth rate:

Data on crop total weight clearly witnessed that the total dry weight increased continuously up to maturity stage. Among the different green gram varieties OBGG 52 achieved the maximum biomass (328.42 g m^{-2}) at 60 DAS which was at par OUM 11-5. Kala mung was the lower efficient in biomass production (281.52 g m^{-2}). The might be due to the increase of metabolically active tissue and as obtained less to plant growth. The crop growth rate was comparatively higher during 20-40 DAS in comparison to 40-60 DAS (Table 2). During 20-40 DAS, HYV green gram had CGR values between 6.60 to 7.77 g m^{-2} day^{-1} where as local Kala mung had growth rate 6.62 g m^{-2} day^{-1}. During 40-60 DAS, OBGG 52 had the top rank of CGR value (7.41 g m^{-2} day^{-1}) and was equivalent with OUM 11-5. Local check Kala mung had minimum growth rate (5.95 g m^{-2} day^{-1}). Similar kind of results were reported by Pramanik *et al.* (2013).

Seed yield and stover yield:

The seed yields of different HYV of green gram (Table 1) ranged from 10.6 to 13.6 q ha^{-1} which was 36-74 per cent higher yield than that with existing local variety (Kala mung).

Table 1: Effect of different treatments no. of pods plant^{-1}, no. of seeds pod^{-1}, 100 seed weight, seed yield and stover yield (Pooled data over 2 years)

Treatments	No. of pods plant^{-1}	No. of seeds pod^{-1}	100 seed weight (g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})
T_1: OBGG 52	30.6	12.2	2.97	13.6	55.65
T_2: OUM 11-5	26.2	11.8	3.62	12.5	48.55
T_3: IPM 02-14	24.1	11.2	3.71	12.2	45.14
T_4 : Pant M-5	23.2	10.6	4.15	10.6	38.56
T_5 : TARM 1	24.8	10.3	3.95	11.8	43.10
T_6 : Kala mung	19.0	8.4	3.20	7.8	32.14
S.E. $\pm$	0.088	0.025	0.02	0.010	0.476
C.D. at 5%	0.271	0.076	0.061	0.305	1.467
C.V. %	0.790	0.511	1.226	1.940	2.428

Table 2: Effect of different treatments on no. of nodules plant^{-1}, leaf area index, total dry matter accumulation and crop growth rate

(Pooled data over 2 years)

Treatments	No. of nodules plant^{-1}		LAI	Total dry matter accumulation(g m^{-2})			Crop growth rate (g m^{-2} day^{-1})	
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20-40 DAS	40-60 DAS
T_1: OBGG 52	3.85	13.2	4.54	29.38	180.15	328.42	7.54	7.41
T_2: OUM 11-5	2.54	11.3	4.32	27.84	183.25	327.38	7.77	7.21
T_3: IPM 02-14	2.32	11.0	3.86	29.09	173.45	301.64	7.22	6.41
T_4 : Pant M-5	1.85	9.80	3.64	30.34	166.25	290.26	6.80	6.20
T_5: TARM 1	3.62	12.4	3.22	25.54	157.52	280.45	6.60	6.15
T_6 : Kala mung	1.78	8.2	3.12	30.05	162.54	281.52	6.62	5.95
S.E. $\pm$	0.045	0.162	0.05	0.130	1.982	1.39	0.098	0.128
C.D. at 5%	0.140	0.45	0.153	0.40	6.109	4.289	0.302	0.395
C.V %	3.808	3.213	2.939	1.012	2.60	1.032	3.096	4.379

OBGG 52 produced the maximum seed yield of 13.6 q ha^{-1} due to higher number of pods per plant and longer pod with higher crop growth. OUM 11-5 and IPM 02-14 were equivalent producing the seed yield 12.5 and 12.2 q ha^{-1}, respectively. The lowest seed yield was obtained from Kala mung (7.8 q ha^{-1}). The trend of stover yields of different varieties were almost similar with seed yields. Maximum Stover yield was obtained from OBGG 52 (55.65 q ha^{-1}) owing to its higher dry matter accumulation where as Kala mung produced least stover yield (32.14 q ha^{-1}). These results are in agreement with the findings of Uddin *et al.* (2010).

Economics:

The HYV green gram OBGG 52 recorded the maximum gross return and net profit of Rs.47600 ha^{-1} and Rs.26050 ha^{-1}, respectively. The same variety had also maximum B.C ratio (2.21) due to its higher productivity which was followed by OUM 11-5, IPM 02-14 and Pant M-5 which were equivalent. Kala mung recorded lowest net return (Rs.9450 ha^{-1}) and B:C ratio (1.53) due to its less return (Fig. 2). These finding are similar with the findings of Patel *et al*. (2013).

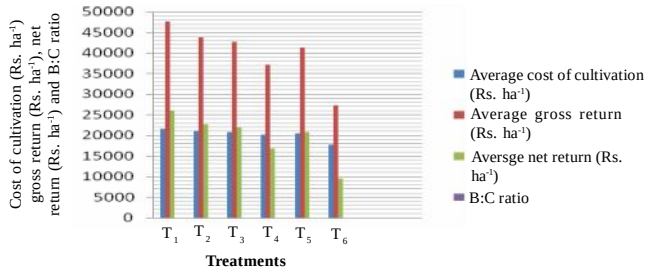

Fig. 2: Effect of treatments on cost of cultivation, gross return, net profit and B:C ratio

Thus, the existing local variety Kala mung can be replaced with high yielding variety OBGG 52 because of higher productivity and income. OBGG 52 was found most suitable since it fits well to the existing farming situation and also it had been appreciated by the farmers.

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