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Performance of Green Gram as Influenced by Sowing Time and Levels of Fertilizer

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ABSTRACT: *The field investigation entitled "Effect of sowing time and levels of fertilizer on growth and yield of green gram" was conducted during* kharif *2013 at experimental farm, Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was laid out in FRBD. There were twelve treatments combination with four sowing time i.e. S_1-25 MW, S_2-26 MW, S_3-27 MW, S_4-28 MW and three levels of fertilizer F_1-75% RDF, F_2-100% RDF and F_3-125% RDF were taken. The experimental soil was clayey in texture, low in organic carbon, more in nitrogen and medium in available phosphorous and high in potash and slightly alkaline. Sowing was done by dibbling method and application of fertilizer according to treatments through DAP and urea. From the result of experiment, it can be concluded that, the sowing time of 25 MW (18 June) & 26 MW (26 June) were found beneficial as compared to other sowing times. Among the different levels of fertilizer, the application of 100% RDF (25:50:00 NPK Kg ha^{-1}) was more profitable.*

INTRODUCTION

India is the largest producer of pulses accounting by 22 per cent of the world production of pulses (IIPR, Kanpur 2012). It has been important component of Indian agriculture enabling the land to restore fertility by fixing nitrogen, so as to produce reasonable yields of succeeding crops and to meet out the demand of dietary requirement regarding proteins, carbohydrates and other nutrient sources. On an average, pulses contain 22-24 per cent protein as against 8-10 per cent in cereals.

Green gram ranks third among all the pulses in India after chickpea and pigeon pea. In India, green gram occupies 34.4 lakh ha area and contribute to 14.0 lakh tones production with productivity 406.98 kg ha^{-1} in pulse production (Anonymous, 2011).

Fertilizer is one of the most important input for any crop, for utilizing the yield potential of improved high yielding crop. However, in recent days i.e. post green revolution era, due to indiscriminate nutrient mining, soil fertility is depleting at an alarming rate and to provide food for nearly 121 crores population there is need to add fertilizers to augment the sustainable crop production.

Generally availability of nitrogen, phosphorus and potassium in Indian as well as in Maharashtra soil is abundant but its availability to crop is very low. Nitrogen is a component of many important organic compounds ranging from protein to nucleic acids. It is an integral part of chlorophyll, which is the primary absorber of light energy needed for photosynthesis. It is the most useful for vegetative growth of plants. Phosphorous plays a central role in energy transfer and protein metabolism. It is an important structural component of many biochemical's including nucleic acids. It is also associated with root growth and early maturity of crops.

The weather parameters play important role in deciding success or failure of the crop. It is well known that yield from any given crop or variety depends on the availability of certain rainfall, solar radiation, temperature etc. during different stages of crop growth. Among different management factors, sowing time plays a very key role in obtaining higher yield. The optimum time of sowing is mainly dependent on prevailing Agroclimatic conditions of an area besides the variety grown. Planting during optimum period therefore, ensures better harmony between the plant and weather which ultimately results in higher yield.

In view of above consideration the present investigation entitled, "Effect of sowing time and levels of fertilizer on growth and yield of green gram", was planned and conducted during *kharif* season of 2013.

MATERIALS AND METHODS

The field investigation entitled "Effect of sowing time and levels of fertilizer on growth and yield of green

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gram" was conducted during *kharif* 2013 at experimental farm, Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

The aim of present experiment was to find out optimum sowing time for green gram and to study the effect of sowing time and levels of fertilizer on growth and yield of green gram and to study the interaction effect of sowing times and levels of fertilizers in green gram.

The soil of the experimental site was medium black, clayey in texture, slightly alkaline in reaction, moderate in available nitrogen, low in phosphorus and high in potassium content. This soil condition was optimum for normal growth and maturity of the crop.

The experiment was laid out in a Factorial Randomized Block Design where as combination of four sowing times and three levels of fertilizer, with twelve treatment combinations and three replications.

The gross and net plot size of the experiment was 5.4 x 4.5 m^2 and 4.5 x 3.6 m^2, respectively. Sowing was done by adopting dibbling method on 18th June (25 MW), 26th June (26 MW), 2th July (27 MW) and 10th July (28 MW) as S_1, S_2, S_3 and S_4, respectively at a spacing 30 x 10 cm^2 and the three levels of fertilizer F_1-75% RDF (18.75: 37.50 N, P_2O_5 kg ha^{-1}), F_2-100% RDF (25.00: 50.00 N, P_2O_5 kg ha^{-1}) and F_3-125% RDF (31.25: 62.50 N, P_2O_5 kg ha^{-1}) were applied at the time of sowing. The recommended cultural practices and plant protection measures were under taken as per requirement of crop.

RESULT AND DISCUSSION

Effect of sowing times on growth attributes

The effect of different sowing times on plant height was found to be significant and the higher plant height was observed by the sowing time i.e. 25 MW (18th June) as compared to other times of sowing. More plant height in S_1 sowing time i.e. 25 MW may be due to enjoying relatively more time by the plants and more rainfall during growing season. This result confirms the observations of Malik *et al*., (2003). From the data on mean number of branches, the sowing of green gram crop in 25 MW found to be significantly superior over rest of all sowing times. The higher mean number of functional leaves and leaf area per plant (cm^2) recorded by 25 MW it was followed by the sowing at 26 MW, 27 MW and 28 MW respectively. Maximum leaf area (cm^2) was produced due to long vegetative period, bright sunshine and high rainfall which favored more vegetative growth. These results agree to those of Malik *et al*., (2003). The sowing of 25 MW (18th June) recorded higher dry matter accumulation plant^{-1} (g) followed by the sowing at 26 MW (26th June), 27 MW (2th July) and 28 MW (10th July).

Higher total dry matter accumulation per plant was due to more cell elongation and vigorous growth of the crop plant due to the more rainfall and bright sunshine. The similar trend in case of growth characters was reported by Antony *et al*., (2006).

Effect of sowing times on yield attributes and yield

The mean number of pod and pod yield (g) per plant was significantly influenced by the various treatments. The sowing of 25 MW (18th June) was recorded significantly higher number of pods (9.63) and pod yield plant^{-1} (5.22 g) as compared to other sowing times.

Table 1
Growth parameters of blackgram

Treatments	*Plant Height (cm)*	*Functional leaves*	*Branches*	*Leaf area (cm^2)*	*Dry matter (gm.)*
Sowing time (S)					
S_1: 25 MW	53.12	3.93	5.91	439.92	12.60
S_2: 26 MW	51.40	3.74	5.81	414.07	12.46
S_3: 27 MW	48.18	3.46	5.25	367.29	12.12
S_4: 28 MW	45.05	3.18	4.58	335.38	11.78
SE ±	0.88	0.08	0.16	9.43	0.16
CD at 5 %	2.64	0.24	0.49	28.27	0.48
Levels of fertilizer (F)					
F_1: 75% RDF (18.75: 37.50 N, P_2O_5 kg ha^{-1})	47.03	3.22	5.06	354.38	11.79
F_2: 100% RDF (25.00: 50.00 N, P_2O_5 kg ha^{-1})	50.40	3.68	5.43	394.12	12.38
F_3: 125% RDF (31.25: 62.50 N, P_2O_5 kg ha^{-1})	52.37	3.83	5.67	419.00	12.55
SE ±	1.01	0.07	0.12	8.79	0.27
CD at 5 %	3.04	0.22	0.37	26.36	0.81
Interaction (S x F)					
SE ±	2.02	0.15	0.24	17.58	0.37
CD at 5 %	NS	NS	NS	NS	NS
General Mean	49.65	3.63	5.39	389.16	12.24

The sowing of 25 MW was recorded significantly higher number of seed pod^{-1} (10.96) and seed yield plant^{-1} (3.00 g) than other sowing times which was at par with sowing time 26 MW (10.80 & 2.86 g). The sowing times has non-significant effect on test weight (1000 seeds wt.). Higher yield attributes observed in first sowing time thus, due to the favorable climatic conditions to crop growth and minimum attack of pest and diseases.

The data showed that the sowing time 25 MW (18th June) recorded significantly higher mean seed

yield (955 kg ha^{-1}) over rest of the sowing times but at par with the 26 MW (26th June) (919 kg ha^{-1}) followed by 27 MW (2th July) (720 kg ha^{-1}), 28 MW (10th July) (522 kg ha^{-1}). The sowing time 25 MW (18th June) recorded higher mean straw yield (1993 kg ha^{-1}) which was significantly superior over rest of the treatments i.e. 27 MW (1654 kg ha^{-1}) and 28 MW (1258 kg ha^{-1}) but at par with 26 MW (1977 kg ha^{-1}). The sowing time 25 MW (18th June) recorded higher mean biological yield (2948 kg ha^{-1}) which was significantly superior over rest of the treatments but at par with sowing time 26 MW (26th June) (22897 kg ha^{-1}) and then followed by 27 MW (2th July) (2375 kg ha^{-1}) and 28 MW (10th July) (1770 kg ha^{-1}). A delay in sowing time results in yield loss. This yield loss was more a result of reduction in the number of pods per plant. This may be due to a shortened growth period and cloudy weather as planting time was delayed. Lower yield could also have been due to the attack of blister beetle contributed to the reduction of flowers and consequently number of pods. Similar trend in seed, straw and biological yield of green gram were observed by Taleei *et al.,* (1999).

Effect of fertilizers on growth attributes

The effect of different levels of fertilizers on plant height and number of branches was found to be significant. The application of 125 per cent RDF was found to be at par with 100 per cent RDF and significantly superior over 75 per cent RDF at all the crop growth stages in case of plant height and number of branches. The increase in plant height and number of branches can be reasonably attributed due to the increased cell division and their elongation stimulated by adequate nitrogenous and phosphatic fertilizer. Thus, it was clear that adequate fertilizer application had beneficial effect on production of high dry matter. The results are in conformity with the findings of earlier research work carried out by Ali *et al.* (2010). The application of 125 per cent RDF recorded higher mean number of functional leaves and leaf area per plant (cm^2) which was at par with the application of 100 per cent RDF followed by 75 per cent RDF respectively at every stages of the crop growth. Same result was recorded by Sadeghipour *et al.* (2010).

The application of 125 per cent RDF recorded the higher dry matter accumulation (g) which was at par with 100 per cent RDF followed by 75 per cent RDF at all the crop growth stages. The increase might have been on account of stimulation of root growth of crop as phosphorous plays an important role in various physiological processes including root development, nodulation and N fixation. Similar findings have also been reported by Owla *et al.*, (2007).

Table 2
Mean number of pod per plant, weight of pod per plant, number of seed per pod, weight seed per plant, and test weight as influenced by various treatments

Treatments	*No. of Pods plant^{-1}*	*Weight of pod plant^{-1} (g)*	*No. of seeds pod^{-1}*	*Weight of seed plant^{-1} (g)*	*Test weight (g)*
Sowing time (S)					
S_1: 25 MW	9.63	5.22	10.96	3.00	42.40
S_2: 26 MW	9.27	4.91	10.80	2.86	42.19
S_3: 27 MW	8.57	4.31	10.02	2.24	41.90
S_4: 28 MW	7.71	3.64	9.30	1.62	41.03
SE ±	0.16	0.17	0.18	0.10	0.32
CD at 5 %	0.48	0.51	0.54	0.30	NS
Levels of fertilizer (F)					
F_1: 75% RDF (18.75: 37.50 N, P_2O_5 kg ha^{-1})	8.23	4.08	9.80	1.86	41.41
F_2: 100% RDF (25.00: 50.00 N, P_2O_5 kg ha^{-1})	9.00	4.52	10.30	2.64	41.78
F_3: 125% RDF (31.25: 62.50 N, P_2O_5 kg ha^{-1})	9.16	4.96	10.70	2.78	42.45
SE ±	0.19	0.13	0.14	0.07	0.32
CD at 5 %	0.57	0.39	0.42	0.21	NS
Interaction (S x F)					
SE ±	0.38	0.25	0.28	0.13	0.64
CD at 5 %	NS	NS	NS	NS	NS
General Mean	8.79	4.52	10.27	2.43	41.38

Effect of fertilizers on yield attributes and yield

The application of 125 per cent RDF recorded significantly higher dry pod yield per plant (4.96 g) and mean seed yield (2.78 g plant^{-1}) than 75 per cent RDF (4.08 g, 1.86 g plant^{-1}) but at par with 100 per cent RDF (4.52 g & 2.64 g plant^{-1}). Significantly higher number of pods plant^{-1} was recorded by 125 percent RDF application (9.16) and it was at par with 100 percent RDF (9.00) which was followed by the application of 75 percent RDF (8.23). The yield attributes of the crop were higher due to the proper improvement in growth characteristics. These results are in the line of those findings of Owla *et al.* (2007) and Sadeghipour *et al.* (2010).

The application of 125 per cent RDF recorded significantly higher mean number of seed per pod (10.70) which was at par with the application of 100 per cent RDF (10.30) and then followed by 75 per cent RDF (9.80). The levels of fertilizer have non-significant effect on test weight (1000 seeds wt.).

These results collaborate to those reported by Owla *et al.,* (2007) and Sadeghipour *et al.* (2010). Data on mean seed yield (kg ha^{-1}) as influenced by different levels of fertilizers was found to be significant. The application of 125 per cent RDF recorded significantly higher mean seed yield (894 kg ha^{-1}) which was at par with the application of 100 per cent RDF (842 kg ha^{-1}) and then followed by 75 per cent RDF (601 kg ha^{-1}). This might to be due to increase in yield attributes by vital role of phosphorous in energy transformation and metabolic process of plant, photosynthesis, flowering and seed formation which ultimately enhanced seed yield. This result was in accordance with those of Sasode D.S. (2008) and Sathyamoorthi *et al.,* (2008).

Table 3
Seed, straw and biological yield (kg ha^{-1}) and harvest index of green gram as influenced by different sowing time and fertilizer levels

Treatments	*Seed Yield (kg ha^{-1})*	*Straw Yield (kg ha^{-1})*	*Biological Yield (kg ha^{-1})*	*H. I. (%)*
Sowing time (S)				
S_1 : 25 MW	955	1993	2948	32.33
S_2 : 26 MW	919	1977	2897	31.67
S_3 : 27 MW	720	1654	2375	30.29
S_4 : 28 MW	522	1258	1770	29.26
SE ±	14.91	36.61	51.03	-
CD at 5 %:	44.70	109.76	152.99	-
Fertilizer levels (F)				
F_1: 75% RDF (18.75: 37.50 N,P_2O_5 kg ha^{-1})	601	1375	1977	30.06
F_2: 100% RDF (25.00: 50.00 N, P_2O_5 kg ha^{-1})	842	1857	2700	31.01
F_3: 125% RDF (31.25: 62.50 N,P_2O_5 kg ha^{-1})	894	1929	2815	31.59
SE ±	17.64	34.97	49.69	-
CD at 5 %	52.89	104.83	148.98	-
Interaction (S x F)				
SE ±	35.28	69.93	99.38	-
CD at 5 %	NS	NS	NS	-
General Mean	779	1721	2497	30.88

The application of 125 per cent RDF recorded significantly higher mean straw yield (1929 kg ha^{-1}) and biological yield (2815 kg ha^{-1}) which was at par with 100 per cent RDF (1875 kg ha^{-1} and 2700 kg ha^{-1}) then rest of the 75 per cent RDF (1375 kg ha^{-1} and 1977 kg ha^{-1}). The increase in straw and biological yield with higher dose of fertilizer could be attributed to the higher photosynthetic activity leading to better supply of carbohydrate which might have resulted in more branches and dry matter production. The profound increase in straw and biological yield was the cumulative effect of improvement in growth characters like plant height, number of branches. These results are in the line of those findings of Sathyamoorthi *et al*., (2008) and Tickoo *et al.,* (2006).

Interaction effect

The interaction effect of sowing time and levels of fertilizer could not reach to the levels of significance in respect of growth, yield attributes, seed, straw and biological yields.

CONCLUSTION

The sowing time of 25 MW (18 June) and 26 MW (26 June) were found beneficial as compared to other sowing times. Among the different levels of fertilizer the application of 100% RDF (25: 50 N, P_2O_5 kg ha^{-1}) was more profitable.

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