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Impact of different Sowing Dates and Cultivars on Yield and Economics of Blackgram during *rabi* in North Western Plateau Zone of Odisha

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ABSTRACT: A Field experiment was carried out during *rabi* 2018-2020 at RRTTSS, Kirei, Sundargarh district of Odisha to assess "Impact of different sowing dates and cultivars on Yield and Economics of blackgram during *rabi* in North Western Plateau zone of Odisha". Three varieties (PU 31, IPU 0243 and OBG 41) were sown at spacing of 30 × 10 cm^2 under five sowing dates *viz.*, 8th November'19, 23rd November'19, 8th December'19, 23rd December'19 and 7th January'20. The experiment was laid out in FRBD with fifteen treatments and three replications. The treatment D_1 V_1 (8th November and variety PU-31) was found significantly superior with respect to yield over all other treatments. Among all varieties, PU-31 and among the sowing dates, 8th November'19 performed better followed by sowing date D_2 (23rd November) and variety V_3 (OBG-41). The variety IPU-0243 and sowing date D_4 (23rd December) recorded with least yield and yield attributes. It was observed that when all the 3 varieties were sown onfirst date (8th November), highest yield (677 kg/hectare) was obtained whereas when all varieties were sown on fourth date (23rd December), the least yield (487 kg/hectare) was attained by the crop. The maximum gross returns (Rs. 34426.33/ha), net returns (Rs. 19408.56/ha), Return per Rupee invested (2.28) was recorded in sowing date D_1 (8th November) and among all varieties, highest gross returns (Rs. 30612.84/ha), net returns (Rs. 15595.07/ha), Return per Rupee invested (2.03) was recorded in V_1(PU 31). The fundamental hypothesis underpinning this experiment aimed to ascertain the optimal sowing date and the optimal choice of varieties for cultivation in the specified area. The proposed hypothesis holds the potential to offer valuable insights to farmers within the Sundargarh district, fostering enhanced crop productivity and facilitating high revenue generation.

Keywords: Black gram, economics, sowing dates, yield, parameters.

INTRODUCTION

Pulses have great importance in Indian agriculture as they are rich in protein (17–25%), they fix atmospheric nitrogen and it helps in improving soil fertility. So, pulses are helpful in solving the protein malnutrition and are used as fodder and concentrates in cattle feeds. Because of this unique feature of pulses, they are used in different cropping system, as green manure crop and as protective ground cover to prevent erosion of soil. From various study it was observed that it helps to reduce different diseases like cardiovascular disorders, colon cancer and provides major nutritional and health benefits (Lukus *et al*., 2020). Pulses are also known as "the meat of the poor" (Jackson *et al*., 2021). It is main share of the protein requirement of the vegetarian (Shobanadevi *et al*., 2021).

Production of nutrient rich crops like pulses and oilseeds will boost nutritional food security. Among *Kharif* and *Rabi* seasons pulses, more than 60 per cent of total pulse production was contributed from *Rabi* season pulses.

Among various pulses, blackgram is one of the most important grown pulse crops in India. Blackgram is cultivated with area of 50.31 lakh ha^{-1} having production of 32.84 lakh tons and productivity of 652 kg ha^{-1} in India, (Anonymous, 2017). Pulses are grown in all the 30 districts of Odisha. Rusikulya plain is the most important agricultural region of Odisha and dominated by pulse crops. Blackgram is an important protein-rich food which contains about 26% protein, almost three times that of cereals. Dietary allowance recommended for adult male is 60 gm day-1 and for adult female it is 55 gm day^{-1} (Directorate of pulses Development, 2016). However, the per capita availability is only 42 gm day^{-1}. Hence, it is necessary to increase the per capita availability of pulses.

Productivity of blackgram is low in India as well as in Odisha due to lack of knowledge regarding various agronomic practices, among them, time of sowing and selection of suitable cultivar are one of the major limiting factors in production, especially during rabi season. Optimum time of sowing of blackgram may vary from variety to variety and season to season due to variation in conditions. It ensures the complete harmony between the vegetative and reproductive phases on one hand and climatic rhythm on the other and helps in realizing the potential yield. To achieve higher yield, crop must be sown at appropriate time (Ahmad *et al*., 2014). Varieties play important role in the success of crop production. When high yielding varieties are sown at suitable time, yield increases to a greater extent. The HYV's are of primary importance for potential yield production (Rehman *et al*., 2009). So, there must be specific sowing period during the season for different genotypes in order to get maximum yield, as opined by Kalra *et al*. (2008).

Favourable environment will be achieved only when crop is sown at correct time. Singh and Uttam (1999) reported that reduction in yield @ 39 kg ha^{-1} per day due to delay in sowing from apt time of sowing. Thus, keeping the above facts in view, the present experimentation was conducted to study the effect of different sowing dates and cultivars on yield and economics of black gram.

MATERIALS AND METHODS

Experimental Details. The Experiment was laid out in Factorial Randomized Block Design with fifteen treatments and three replications. The gross and net plot size was 4.80 × 3.40 m^2 and 4.20 × 3 m^2, respectively. Three varieties (PU 31, IPU 0243, OBG 41) i.e., V_1, V_2, V_3, respectively were sown by dibbling method on five sowing dates (8th November, 23rd November, 8th December, 23rd December and 7th January (i.e., D_1, D_2, D_3, D_4 and D_5 respectively) with 30 × 10 cm^2 spacings.

RESULTS AND DISCUSSION

The highest seed yield (677 kg/ha) was recorded from D_1 (8th November) and (601.2 kg/ha) from variety V_1 (PU-31) due to its inherited genetic makeup as evidence by higher vegetative growth, yield attributing characters. It may be the result of increased translocation of photosynthates towards grain formation. Moreover, sowing of crop early resulted in higher accumulation of photosynthates due to high temperatures than later dates of sowing and lowestseed yield (487 kg/ha) was obtained from D_4 and (557.4 kg/ha) from V_2 (IPU 02-43). These results are in line with the findings of Hossian *et al.* (2016); Imran *et al.* (2016).

Table 1: Average no. of pods $plant^{-1}$, Avg. no. of seeds pod^{-1}, pod length and test weight of blackgram as influenced by different dates of sowing and varieties.

Treatment	Avg no. of pods $plant^{-1}$	Avg. no. of seeds pod^{-1}	Avg. pod Length (cm)	Test weight (g)
SOWING DATES (D)				
D_1	24.5	7.6	5.9	42.1
D_2	21.7	6.5	5.3	40.2
D_3	19.2	5.7	4.6	38.1
D_4	18.6	5.7	4.6	37.9
D_5	20.9	6.4	5.1	39.1
SEm (±)	0.18	0.11	0.08	0.40
CD(p=0.05)	0.52	0.34	0.24	1.16
VARIETIES(V)				
V_1	21.4	6.9	5.4	40.6
V_2	20.4	5.8	4.7	37.7
V_3	21.1	6.4	5.2	40.2
SEm (±)	0.14	0.09	0.06	0.31
CD(p=0.05)	0.40	0.26	0.19	0.90
INTERACTION (D × V)				
SEm (±)	0.31	0.20	0.14	0.69
CD(p=0.05)	NS	NS	NS	NS

Yield attributes. Maximum number of pods $plant^{-1}$ were recorded when crop was sown on D_1 (8th November) i.e., 24.5 at harvest. Variety V_1 (PU-31) gave maximum no. of pods per plant (21.4) due to genetic makeup of variety that was beneficial in improving photosynthetic activity due to increased source capacity and efficient translocation of photosynthates to the sink. Palsaniya *et al*. (2016) revealed that maximum number of pods $plant^{-1}$ (16.6) were recorded with variety IPM 02-3.

Highest number of seeds pod^{-1} was recorded when sown on D_1 (8th November) *i.e*. 7.6. Variety V_1 (PU-31) produced highest number of seeds pod^{-1} (6.9). The feasible reason for this might be due to higher growth and physiological attributes. Similar results were found by Singh *et al*. (2012); Kumar *et al*. (2012).

Maximum pod length was recorded when crop was sown on D_1 (8th November) *i.e*. 5.9 cm at harvest followed by D_2 (23rd November) followed by D_5 (7th January) followed by D_3 sowing (8th December) and D_4 (23rd December). Variety V_1 (PU-31) gave maximum pod length (5.4 cm) followed by V_3 (OBG 41) followed by V_2 (IPU 0243).

The highest test weight (42.1 g) was recorded when sown on D_1 (8th November) by variety V_1 (PU-31) (40.6 g). Sharma *et al.* (2012) conducted field investigation

and found that higher test weight (30.84 g) was reported in variety Mash-1 in comparison with other blackgram variety Mash-338 in the study. The rapid increase in test weight under early sowing was due to more period of days available for growth resulting in more photosynthates from leaves to the reproductive parts.

Table 2: Seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvestindex of blackgram as influenced by different dates of sowing and varieties.

Treatment	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest Index
SOWING DATES (D)				
D_1	677	1152.6	1829.6	36.9
D_2	627.3	1134.6	1762	35.6
D_3	533.3	1018.3	1551.6	34.3
D_4	487	989	1476	32.9
D_5	579.3	1081.1	1660.4	34.8
SEm (±)	3.21	15.61	26.5	0.67
CD(p=0.05)	9.32	45.22	77.03	1.95
VARIETIES(V)				
V_1	601.2	1105.6	1706.8	35.1
V_2	557.4	1042.2	1599.6	34.7
V_3	583.8	1077.6	1661.4	35
SEm (±)	2.49	12.09	20.59	0.52
CD(p=0.05)	7.22	35.03	59.66	NS
INTERACTION (D × V)				
SEm (±)	5.57	27.04	46.05	1.16
CD(p=0.05)	NS	NS	NS	NS

Among 5 sowing dates, D_1 (8th November) produced significantly highest haulm yield i.e., 2518.33 kg/ha, whereas the lowest haulm yield was recorded (1997.66 kg/ha) by D_4 (23rd December), which was on par (2018.33 kg/ha) with D_3 (8th December). Among varieties, maximum haulm yield was found in variety PU-31 over all other varieties studied in field trial. The probable reason for this might be due to more dry matter accumulation, higher production efficiency and more biomass potential. These results are in line with findings Pantora *et al.* (2016); Khot *et al.* (2016).

Economic Studies. Data regarding economics parameters as influenced by different sowing dates and varieties in *rabi* blackgram is presented in Table 3.

Table 3: Economic parameters as influenced by different sowing dates and varieties of blackgram during *rabi* 2019-2020.

Treatment	Cost of Cultivation (Rs.)	Gross Returns (Rs.)	Net Returns (Rs.)	Return per Rupee invested (Rs.)
SOWING DATES (D)				
D_1	15,018	34426.33	19408.56	2.28
D_2	15,018	31934	16916.22	2.12
D_3	15,018	27175.83	12158.22	1.80
D_4	15,018	24844.5	9826.77	1.65
D_5	15,018	29507.23	14489.33	1.95
SEm (±)	-	159.63	159.64	0.010
CD(p=0.05)	-	462.44	462.47	0.031
VARIETIES(V)				
V_1	15,018	30612.84	15595.07	2.03
V_2	15,018	28391.1	13373.4	1.88
V_3	15,018	29728.8	14711	1.97
SEm (±)	-	123.65	123.66	0.008
CD(p=0.05)	-	358.20	358.23	0.024
INTERACTION (D × V)				
SEm (±)	-	276.49	276.51	0.018
CD(p=0.05)	-	NS	NS	NS

Among different sowing dates, highest gross returns (Rs. 34426.33/ha), net returns (Rs. 19408.56/ha), Return per Rupee invested (2.28) was recorded in sowing date D_1 (8th November) whereas lowest gross returns (Rs. 24844.5/ha), net returns (Rs. 9826.77/ha), benefit cost ratio (1.65) was recorded in D_4 (23 rd December). Among 3 varieties, highest gross returns (Rs. 30612.84/ha), net returns (Rs. 15595.07/ha), Return per Rupee invested (2.03) was recorded in V_1(PU 31) whereas lowest gross returns (Rs. 28391.1/ha), net returns (Rs. 13373.4/ha) and benefit cost ratio (1.88) was recorded in variety IPU 0243.

Biswas *et al.* (2002) observed that black gram economic valueswere higher on 28th March sowing and declines beyond late sowing dates.

CONCLUSIONS

On the basis of the field experimentation on Weather effects on yield of blackgram cultivars under different growing environment during *rabi* in North Western Plateau zone of Odisha, it could be concluded that the black gram variety PU 31 recorded with the highest yield over other two varieties, i.e., OBG 41 and IPU 0243 during the investigation under Treatment D_1 8th November.

FUTURE SCOPE

Further experiment can be carried at different location to find out location specific suitable cultivar. Research can be carried forward by incorporating different treatment combination including spacing, fertilizer application to test the yield quality of Bengal gram**.**

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