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Growth and Yield of Blackgram (*Vigna mungo* L.) as influenced by Sowing Windows and varieties in North Coastal Zone of Andhra Pradesh

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ABSTRACT: A field experiment was carried out at Agricultural Research Station, Ragolu, Srikakulam district, Andhra Pradesh during the period from November 2022 to March 2023 to assess the performance of blackgram (*Vigna mungo* L.) varieties under different sowing windows in rice-based cropping system in North Coastal Zone of Andhra Pradesh. Blackgram production in the North Coastal Zone of Andhra Pradesh is low due to delayed sowings and the late-sown crop faces terminal stress which ultimately resulting in poor yields. So, the following experiment has been taken up to standardize the optimum date of sowing and to assess high yielding variety for this zone. The experiment was laid out in split plot design with three replications. The results showed that, November second fortnight recorded significantly taller plants (27.7 cm, 46.6 cm and 47.2 cm) and dry matter accumulation (353 kg ha^{-1}, 1985 kg ha^{-1} and 2867 kg ha^{-1}) at 30, 60 DAS and at harvest respectively. Yield attributes like number of pods plant^{-1} (23.7), pod length (5.4 cm), test weight (42.7 g) and seed yield (1270 kg ha^{-1}) were significantly influenced by the sowing windows and found to be significantly highest in November second fortnight. With regard to varieties, LBG 752 recorded significantly tallest plants (26.2 cm, 46.6 cm and 47.2 cm) and maximum dry matter accumulation (295 kg ha^{-1}, 1730 kg ha^{-1} and 2482 kg ha^{-1}) at 30, 60 DAS and at harvest, respectively, which was statistically on par with LBG 787. The yield attributing characters like number of pods plant^{-1} (22.0), pod length (5.2 cm), test weight (42.7g) and seed yield (1244 kg ha^{-1}) were found significantly highest in the variety TBG104. Overall, the results showed that sowing of TBG104 variety in November second fortnight seems to be the appropriate for getting higher seed yield in rice based cropping system of North Coastal Zone of Andhra Pradesh.

Keywords: Blackgram, Growth, Sowing windows, Varieties, Yield attributes and Yield.

INTRODUCTION

India is the world's largest producer and consumer of blackgram by contributing 70 per cent to the global production. The pulse blackgram plays an important role in Indian diet, which serves as a supplement to cereal-based diet. In terms of nutritional value, blackgram is a powerhouse of nutrients as it contains approximately 26% protein, three times more than that of cereals and it is also a good source of vitamins and minerals.

Rice-pulse system is the dominant cropping system in North Coastal Zone of Andhra Pradesh. But the blackgram production in the North Coastal Zone of Andhra Pradesh faces various challenges, leading to low productivity. One of the main challenges in blackgram production in the North Coastal Zone of Andhra Pradesh is the delayed sowings. The delay in south west monsoon hampers the timely sowing of rice crop and growing of long duration rice varieties during the *kharif* season also results in delayed sowing of rice fallow blackgram. As a result, the late-sown crop faces terminal stress, ultimately resulting in poor yields. In addition to the delayed sowing, poor management practices further contribute to the low productivity of blackgram in this zone. These poor management practices include poor selection of varieties, lack of nutrient management, and ineffective weed management practices. To address these challenges and improve blackgram productivity in the North Coastal Zone of Andhra Pradesh, it is necessary to focus on targeted production techniques and management strategies. One of the key factors that can significantly increase blackgram productivity in this zone is the manipulation of sowing time. The optimum time of sowing is mainly dependent on prevailing agro-climatic conditions of an area besides the variety grown. Planting during the optimum period, therefore, ensures better harmony between the plant and weather which ultimately results in higher crop yields (Venkateswarulu and Soundara Rajan 1991). By ensuring timely sowing, farmers can influence the time of flowering, seed set

and ultimately seed yield. High yielding cultivars also plays an important role in boosting crop production due to their genetic potential that promote higher productivity, disease resistance and adaptability to adverse environmental conditions of varied pressures. Hence, this research work has been taken up to standardise the optimum date of sowing and to assess the high yielding variety for this zone.

MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Station, Ragolu, Srikakulam, North Coastal Zone of Andhra Pradesh during *rabi* 2022 to 2023 in rice fallow situation. It is geographically situated at 18.24° North latitude, 83.24° East longitude with an altitude of 27 meters above the mean sea level. The experimental soil was found to be sandy clay loam, slightly acidic in reaction, low in organic carbon (0.3%), low in available N (234 Kg ha^{-1}), low in available P_2O_5 (24 Kg ha^{-1}) and medium in available K_2O (269 Kg ha^{-1}). The experiment was laid out in split plot design with three replications. Main plots include three sowing windows *viz.,* November second fortnight, December first fortnight, December second fortnight and subplots include five varieties *viz.* LB 752, LBG 787, LBG 884, TBG 104 and GBG 1. Pre sowing irrigation was given in order to attain optimum plant population followed by spraying of paraquat to control weeds. Dibbling method of sowing was followed with a spacing of 30 cm × 10 cm with a gross plot size of 4.8 m × 3.6 m. As the previous crop was rice fertilizers were not applied but 2 foliar sprays of nutrients (N:P:K) @ 2 ml L^{-1} were given at 30 DAS and further one more spray at 40 DAS. Early post emergence herbicide imazethapyr @ 2 ml L^{-1} was applied at 25 DAS in order to control broad spectrum of weeds. Plant height of 10 tagged plants from net plot area was measured in centimeters from the base of stem to the top most leaf with the help of meter scale. Drymatter was recorded by clearing square meter area with the help of quadrat. The total number of pods from the ten tagged plants were counted at harvest and then average number of pods $plant^{-1}$ was calculated. Pod length of 10 pods was measured from the base of the pod to the tip of the pod with the help of scale and expressed in centimeters. Grain yield from square meter area was recorded and expressed in kg ha^{-1}. For test weight, thousand seeds were counted from the sample, weighed and was expressed in grams (g).

RESULTS AND DISCUSSION

A. Effect of sowing dates on growth parameters

Among the different sowing windows, significantly tallest plants (27.7 cm, 46.6 cm and 47.2 cm) were recorded under November second fortnight at 30 DAS, 60 DAS and at harvest, respectively. The shortest plants (22.6 cm, 29.9 cm and 30.8 cm) were recorded in December second fortnight (Table 1). This might be due to the prevalence of optimum weather conditions *viz.,* optimum temperature during early sowing dates that contributed to longer vegetative growth and higher GDD accumulation during the entire crop growth period, hence, rapid cell elongation and cell division in meristematic tissues took place which ultimately led to the establishment of taller plants as reported by Shamsi (2010).

The data in Table 2 showed that significantly highest drymatter accumulation was recorded in November second fortnight at 30 DAS, 60 DAS and at harvest *i.e.,* 353 kg ha^{-1}, 1985 kg ha^{-1} and 2867 kg ha^{-1} respectively. The higher drymatter production could be attributed to the cumulative effect of more plant height and optimum weather conditions like higher bright sunshine hours coupled with optimum day length, which might have increased photosynthesis and in turn dry matter production.

B. Effect of sowing dates on yield attributes and yield

The analysed data in Table 3 revealed that significantly highest number of pods $plant^{-1}$ (23.7) were found in November second fortnight. While significantly lowest number of pods $plant^{-1}$ (14.31) were obtained in December second fortnight. Similar results were reported by Mane *et al.* (2017); Reddemma *et al.* (2019); Ambore *et al.* (2020). This might be due to high mean day temperature associated with cool night temperatures favouring effective pollination and fertilization resulting in increased number of pods $plant^{-1}$.

Significantly maximum pod length (5.4 cm) was recorded under November second fortnight which was statistically on par with December first fortnight *i.e.*,5.1 cm, while significantly shortest pod length of 4.8 cm was observed in December second fortnight. The increased pod length might be due to inherent capacity of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthates to the sink. Similar results were reported by Kumar and Kumar (2022).

Higher test weight was recorded in November second fortnight (42.1g), which was statistically on par with December first fortnight (41.2 g) and the significantly lowest test weight was obtained with December second fortnight (39.6g). Similar results were reported by Mane *et al.* (2017); Patidar and Singh (2018); Reddemma *et al.* (2019). This was due to moderate temperature regime during the seed filling stage and due to the utilization of more solar radiation which resulted in the development of seed as reported by Kambale *et al.* (2012).

The seed yield of blackgram varied significantly due to different sowing windows and varieties. Significantly highest seed yield (1270 kg ha^{-1}) was recorded with the crop sown on November second fortnight, followed by December first fortnight (960 kg ha^{-1}) and significantly lowest seed yield was observed in December second fortnight (633 kg ha^{-1}). The increase in seed yield might be due to lower maximum temperature coupled with higher relative humidity that helped the plant to keep the stomata open for longer period that might have resulted in higher photosynthesis and more dry matter production as reported by Calvino and Sadras (1999). Similar results were reported by Jadhav *et al.* (2014);

Panotra *et al.* (2016); Mane *et al.* (2017); Patidar and Singh (2018); Reddemma *et al.* (2019).

C. Effect of varieties on growth parameters

Concerning varieties, LBG 752 recorded significantly tallest plants (26.2 cm, 41.9 cm and 42.1 cm) at 30, 60 DAS and at harvest respectively, which was statistically on par with LBG 787 at 30, 60 DAS and at harvest. While the shortest plants were recorded with TBG 104 (23.7 cm, 34.2 cm and 35.0 cm) at 30, 60 DAS and at harvest, respectively, which remained on par with GBG 1. This may be attributed due to the genetic makeup of the variety.

Among the varieties tested, LBG 752 (295 kg ha^{-1}, 1730 kg ha^{-1} and 2482 kg ha^{-1}) recorded significantly higher dry matter accumulation over all other varieties at all the three stages of 30 DAS, 60 DAS and at harvest, respectively, which was on par with LBG 787and LBG 884 at 60 DAS and at harvest. While less drymatter was recorded with TBG 104 followed by GBG 1 varieties. This might be due to higher biomass potential of the variety that helped in producing more dry matter. These findings are in conformity with those of Kumar *et al.* (2006); Singh *et al.* (2012); Ragavendra *et al.* (2017).

D. Effect of varieties on yield attributes and yield

Among the varieties, TBG 104 recorded significantly highest number of pods $plant^{-1}$ (22.06) followed by GBG 1 (20.5), while significantly lower number of pods $plant^{-1}$ (15.9) were obtained with LBG752 which was on par with LBG787 (17.3).

The variety TBG 104 recorded significantly maximum pod length (5.2 cm), followed by GBG 1 (5.1 cm), LBG 787 (5.1 cm) and LBG 884 (5.1 cm). Significantly minimum pod length was observed with LBG 752 (4.9 cm). The increased pod length might be due to inherent capacity of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthates to the sink. These results were in accordance with Mane *et al.* (2017); Patidar and Singh (2018); Kumar and Kumar (2022).

The highest test weight was found in TBG 104 (42.7 g), which was statistically on par with LBG 752 (42.4g), while the lowest test weight was recorded in GBG 1 (39.6 g) which was on par with LBG787 (39.7 g) and LBG 884 (39.6 g). This might be due to short vegetative period of growth and comparatively long reproductive and grain filling period that significantly raised the test weight of blackgram. Similar results were reported by Jadhav *et al.* (2014); Patidar and Singh (2018); Reddemma *et al.* (2019).

Among the varieties, significantly highest seed yield was obtained in TBG-104 with 1244 kg ha^{-1}, it was superior over the rest of the varieties and it gave 18.16 %, 32.23%, 32.71 % and 33.44 % higher grain yield over other varieties GBG-1 (1018 kg ha^{-1}), LBG-884 (843 kg ha^{-1}), LBG-787(837 kg ha^{-1}) and LBG 752 (828 kg ha^{-1}) respectively. This might be due to more number of pods $plant^{-1}$, number of seeds pod^{-1} and test weight as reported by Choudhary and Haque (2010). Similar results were reported by Panotra *et al.* (2016); Mane *et al.* (2017); Reddemma *et al.* (2019); Sunil *et al.* (2020). The interaction between the sowing windows and varieties showed statistically significant difference for seed yield might be due to the superior performance in terms of growth and yield in November second fortnight.

Table 1: Plant height (cm) of blackgram at 30, 60 DAS and at harvest as influenced by sowing windows and varieties.

Treatments	Plant height (cm)		
	30 DAS	60 DAS	At harvest
Sowing windows			
S_1- November second fortnight	27.7	46.6	47.2
S_2- December first fortnight	24.3	38.5	39.1
S_3- December second fortnight	22.6	29.9	30.8
SEm±	0.5	1.1	1.0
CD (p=0.05)	2.1	4.4	4.1
CV (%)	8.3	11.2	10.3
Varieties			
V_1-LBG 752	26.2	41.9	42.1
V_2-LBG 787	25.2	39.4	40.4
V_3-LBG 884	24.9	38.9	39.2
V_4-TBG 104	23.7	34.2	35.0
V_5-GBG 1	24.4	37.1	38.3
SEm±	0.6	1.1	0.9
CD (p=0.05)	1.6	3.3	2.7
CV (%)	6.7	8.9	7.2
Interaction (S × V)	NS	NS	NS
Interaction (V × S)	NS	NS	NS

Table 2: Drymatter accumulation (kg ha^{-1}) of blackgram as influenced by sowing windows and varieties.

Treatments	Drymatter accumulation (kg ha^{-1})		
	30 DAS	60 DAS	At harvest
Sowing windows			
S_1- November second fortnight	353	1985	2867
S_2- December first fortnight	254	1686	2328
S_3- December second fortnight	183	1162	1773
SEm±	8.0	47.2	63.5
CD (p=0.05)	31.4	185.2	249.4
CV (%)	11.8	11.3	10.6
Varieties			
V_1-LBG 752	295	1730	2482
V_2-LBG 787	270	1644	2392
V_3-LBG 884	258	1610	2312
V_4-TBG 104	239	1472	2175
V_5-GBG 1	253	1599	2251
SEm±	10.4	54.3	65.6
CD (p=0.05)	30.5	158.6	191.5
CV (%)	11.9	10.1	8.5
Interaction (S × V)	NS	NS	NS
Interaction (V × S)	NS	NS	NS

Table 3: Yield attributes of blackgram as influenced by sowing windows and varieties.

Treatments	Yield attributes and yield			
	Pods plant^{-1}	Pod length (cm)	Test weight (g)	seed yield (kg ha^{-1})
Sowing windows				
S_1- November second fortnight	24	5.4	42.1	1270
S_2- December first fortnight	19	5.1	41.2	960
S_3- December second fortnight	14	4.8	39.6	633
SEm±	0.3	0.1	0.5	28.1
CD (p=0.05)	1.2	0.5	1.8	110.4
CV (%)	6.4	9.0	4.5	11.4
Varieties				
V_1-LBG 752	16	4.9	42.4	828
V_2-LBG 787	17	5.1	39.7	837
V_3-LBG 884	19	5.1	40.4	843
V_4-TBG 104	22	5.2	42.7	1244
V_5-GBG 1	21	5.1	39.6	1018
SEm±	0.5	0.1	0.5	25.2
CD (p=0.05)	1.4	0.3	1.5	73.7
CV (%)	7.5	5.3	3.6	7.9
Interaction (S × V)	NS	NS	NS	S
SEm±	-	NS	-	43.7
CD (p=0.05)	-	4.9	-	127.6
Interaction (V × S)	NS	5.1	NS	S
SEm±	-	5.1	-	48.2
CD (p=0.05)	-	5.2	-	157.1

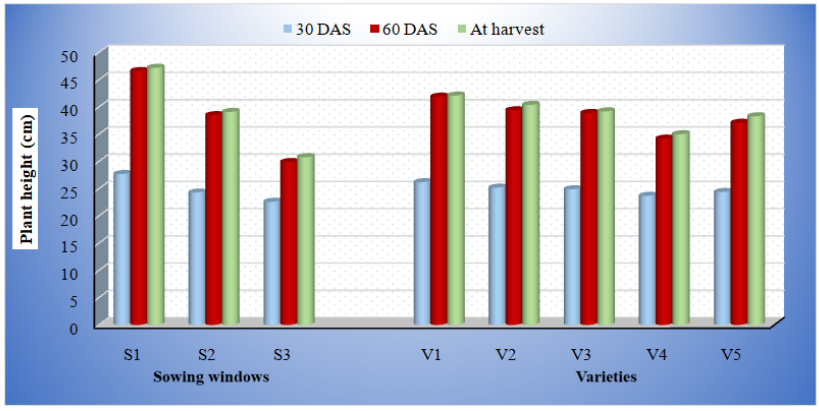

Fig. 1. Plant height (cm) of blackgram at 30, 60 DAS and at harvest as influenced by sowing windows and varieties.

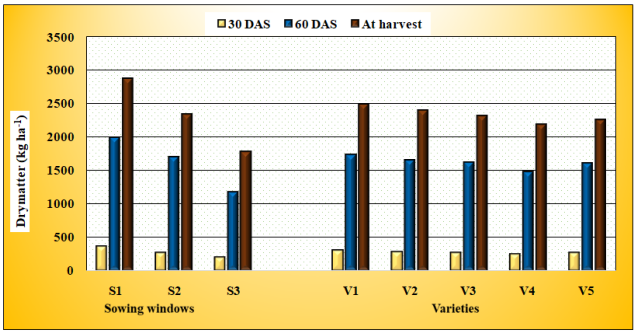

Fig. 2. Drymatter accumulation (kg ha^{-1}) of blackgram at 30, 60 DAS and at harvest as influenced by sowing windows and varieties.

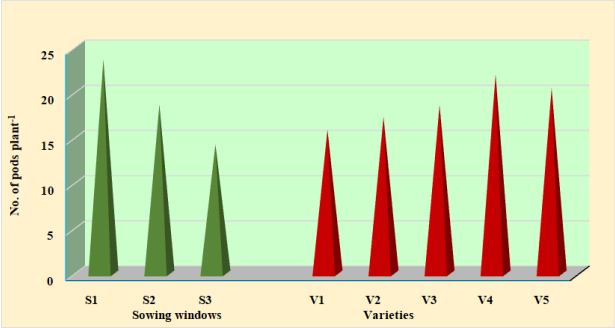

Fig. 3. Number of pods plant^{-1} of blackgram as influenced by sowing windows and varieties.

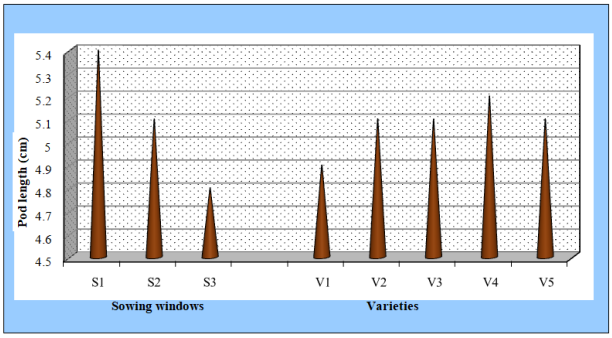

Fig. 4. Pod length (cm) of blackgram as influenced by sowing windows and varieties.

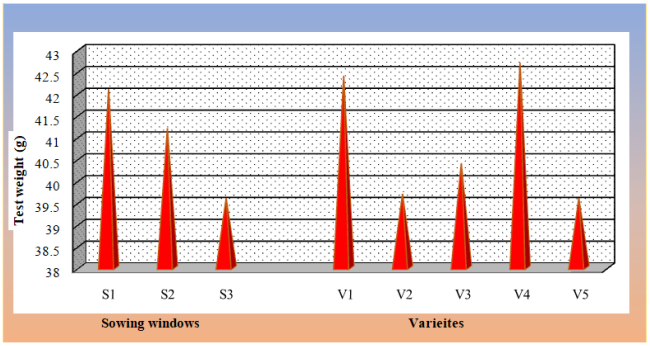

Fig. 5. Test weight (g) of blackgram as influenced by sowing windows and varieties.

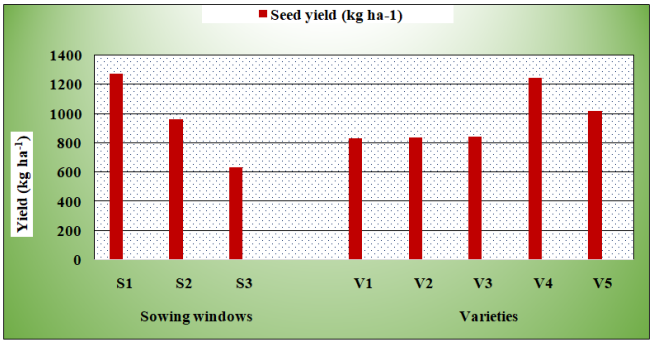

Fig. 6. Seed yield (kg ha^{-1}) of blackgram as influenced by sowing windows and varieties.

CONCLUSIONS

From the above study, it can be concluded that, November second fortnight is the optimum sowing window for blackgram under rice based cropping system for North Coastal Zone of Andhra Pradesh. The variety TBG 104 came out to be high yielder followed by GBG 1, LBG 884, LBG 787 and LBG 752 in rice based cropping system.

FUTURE SCOPE

Studies on rice fallow pulses of blackgram and greengram would probably be needed for improving the productivity particularly on weed and nutrient management in North Coastal Zone of Andhra Pradesh.

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Conflict of Interest. None.

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