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Short Communication

Response of blackgram (*Phaseolus* mungo L.) to dates of sowing and nitrogen levels

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Blackgram (*Phaseolus mungo* L.) is a major rainy season pulse crop. It is popularly known as Urad bean. In Madhya Pradesh, the total area under blackgram is 4.72 lakh ha with a production of 1.66 lakh tonnes with lower productivity (352 kg ha^{-1}). The optimum time of sowing of blackgram may vary from variety to variety and season to season due to variation in agro-ecological conditions. Date of sowing determines the time of flowering and has great influence on dry matter accumulation seed set and seed yield. Time of sowing is the most important factor influencing the yield of blackgram. Too much delay in the time of sowing results in reduction of crop yield (Patidar, 2018). Therefore timely sowing of blackgram crop is important for better plant growth, development and grain yield. The optimum crop yield potential can not be realized without adequate N supply to the plant during the entire crop growth period. Sound N management practices need to be established and followed to improve N use efficiency leading to higher grain yield and minimum fertilizer N loss to the environment. Feeding crop N as per crop need is the most appropriate fertilizer N management strategy to improve N use efficiency (Tyagi and Singh, 2019). New varieties of black gram are coming forward to the different agro-climatic conditions which needs to be examined for their optimum time of sowing and nitrogen requirement. Therefore, keeping the above facts in view, the present investigation was taken up using black gram as test crop.

A field experiment was conducted at the experimental Farm, A.K.S. University, Satna (M.P.). The soil of the experimental field was silty clay-loam having pH 7.5 electrical conductivity 0.26 dSm^{-1}, organic carbon 48g kg^{-1}, available N, P_2O_5 and K_2O 187, 12.5 and 200 kg ha^{-1}, respectively. The rainfall received during the cropping season was 866.4 mm. The treatments comprised 3 sowing dates (20, 30 July and 9 August) and 4 N-levels (0, 15, 25 and 35 kg ha^{-1}). The twelve treatments combinations were laid out a randomized block design (factorial) keeping three replications. Blackgram var. Pant urad- 35 was sown in rows 30 cm apart on 10th July, 2018. Nitrogen levels were applied through urea as basal in the respective treatments in 30 cm apart open furrows just before sowing. A common dose of P_{40} and K_{20} was applied as basal through single superphosphate and muriate of potash in all the treatments. Before sowing, the seeds were first treated with thrium fungicide @ 3 g kg^{-1} seed. The blackgram was grown as per recommended package of practices. The crop was harvested during the last week of September in 2018. The seed protein was determined by following standard procedure (Jackson, 1973).

The highest nitrogen level (35 kg ha^{-1}) increased all the vegetative growth parameters significantly at every stage of observations. Accordingly, at harvest stage, the maximum plant height was 35.64 cm, branches 5.09 $plant^{-1}$ and leaves 44.06 $plant^{-1}$ (Table 1). The significant enhancement in growth parameters due to increased nitrogen levels may be due to the fact that the applied nitrogen promoted plant growth by ensuring higher number of green leaves with increased photosynthesis as a result of increased metabolism of the absorbed plant nutrients. In fact, leaf is the principal site of plant metabolism and the changes in nutrients supply are reflected in the composition of leaf. These results agree with the findings of Suresh *et al.*, (2010) and Singh *et al.*, (2015). The crop sown early on 20th July recorded maximum plant height (35.36 cm), branches (4.89 $plant^{-1}$) and leaves (42.80 $plant^{-1}$). This was on account of accumulation of more photosynthates under the available longer vegetative growth period. While the gradual decrease in these growth parameters was enumerated when the crop was

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sown on later dates on 30 July and 9 August. This might be due to the favourable conditions available during the longer growing period available when planted earlier than 20 July. Similar results were obtained by many workers (Gangwar *et al.*, 2013; Singh *et al.*, 2014 and Patidar, 2018).

Table 1: Growth, yield-attributes, economics and quality of blackgram as influenced by N-levels and dates of sowing

Treatments	Plant height (cm) at harvest	branches plant^{-1} at 40 DAS	No. of leaves plant^{-1} at 40 DAS	Pods plant^{-1}	Length of pod (cm)	Seeds pod^{-1}	Test weight (g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})	Harvest index (%)	Net income (Rs. Ha^{-1})	B:C ratio	Protein content (%)
Nitrogen (kg ha^{-1})													
0	30.30	2.68	31.41	10.84	4.32	5.42	41.26	3.39	19.21	15.00	21101	1.89	19.22
15	35.12	3.83	41.88	14.63	6.75	7.23	42.89	6.83	21.41	24.18	27122	2.14	20.10
25	35.64	4.60	43.18	15.75	6.83	7.45	43.61	6.94	23.21	23.02	33348	2.41	20.70
35	35.64	5.09	44.06	17.52	7.08	7.57	44.41	7.64	23.87	24.25	37849	2.59	21.70
S.Em±	0.20	0.09	0.22	0.14	0.07	0.12	0.28	0.12	0.07	0.15	3.84	0.07	0.07
CD (P = 0.05)	0.68	0.30	0.76	0.46	0.24	0.41	0.96	0.40	0.24	0.49	13.00	0.24	0.24
Dates of sowing													
20 July	35.36	4.89	42.80	16.54	6.77	7.41	44.14	7.02	23.80	22.78	34295	2.45	21.22
30 July	34.52	3.82	41.85	15.02	6.67	7.24	43.20	6.52	22.04	22.83	31579	2.33	20.60
9 August	32.86	3.45	35.74	12.50	5.29	6.09	41.79	5.06	19.94	20.24	23690	2.00	19.67
S.Em±	0.23	0.10	0.26	0.16	0.08	0.14	0.33	0.14	0.08	0.17	4.43	0.08	0.08
C.D. (P=0.05)	0.59	0.26	0.66	0.40	0.21	0.36	0.83	0..35	0.20	0.43	11.26	0.20	0.20

Application of 35 kg N ha^{-1} produced significantly maximum (17.52), pods plant^{-1}, pod length (7.08 cm), seeds pod^{-1}(7.57) and 44.41 g 1000-seed weight. Consequently, the blackgram yield was eventually highest (7.64 q ha^{-1}) under the highest level of nitrogen. The stover yield was also significantly higher (23.87q ha^{-1}) over the preceding N-levels. There was no any significant changes in the harvest index due to different nitrogen levels. The probable reason for such increment to yield-attributes and yield due to increased nitrogen level may be ascribed as a result of greater accumulation of carbohydrates, protein and their translocation to the reproductive organs, which in turn, increased the higher yield components (Singh *et al.* 2015). The yield-attributes and yield were found almost significantly higher when the crop was sown early on 20th July as compared to that when the crop was sown on the later dates (30 July and 9 August). Due to early sowing the maximum pods (16.57) plant^{-1}, pod length (6.77 cm), seeds pod^{-1} (7.41) and 44.14 g test weight were recorded. Consequently, seed and straw yields were also maximum. All these yield attributes and yields were decreased significantly with the delay in sowing upto 9 August. The rapid increase in yield and yield-attributes under early sowing was due to more period available vigorous growth resulting in more photosynthates from leaves to the reproductive parts.

The black gram yield was significantly affected by different dates of sowing. and 20th July sowing gave the highest seed yield (7.02 q ha^{-1}). The longer duration of crop in early sowing might have led to the development of better sink by better utilization of growth resources which were later on translocated to pods and seeds than its delayed sowing (*Gill et al.*, 2013). The seed yield was gradually decreased upto 5.06 q ha^{-1} in the later sowing dates which may be due to decrease in the yield-attributing characters as a result of decreased translocation of photosynthates from the vegetative parts towards the reproductive organs. These findings corroborate with those of Gangwar *et al.*, (2013),; Singh and Kumar (2014) and Patidar and Singh, (2018). Amongst the N-levels, N_{35} gave maximum net income upto Rs.37849 ha^{-1} with 2.59 B:C ratio. The second best N-level was N_{25} (Rs.33348 ha^{-1}) and then N_{15} (Rs.27122 ha^{-1}). Similarly the earliest 20th July sowing gave the maximum monetary gain (Rs.34295 ha^{-1} with 2.45 B:C ratio), whereas the late sowing 30 July and 9 August gave Rs.31579 and Rs.23690 ha^{-1}, respectively. Such variation in monetary gain under different varieties and their sowing dates was exactly in accordance with the grain and stover yield and the

consequently gross income obtained per hectare after the sale of the produce from these treatments.

The addition of increasing levels of nitrogen (N_{15} to N_{35}) augmented the seed protein significantly and maximum value (21.70%) was recorded with 350kg N ha^{-1} as against (19.22%) under without nitrogen. The response of blackgram to applied N levels towards improving seed quality may be attributed to its significant role in regulating the photosynthesis, root enlargement and better microbial activities and more synthesis of protein under N-metabolism. These results are in close agreement with those of Deshmukh and Jain (2014) and Saket *et al.* (2014).The earlier sowing of blackgram resulted in highest seed protein (21.22%). It was decreased with the delay in sowing. Ultimately 9th August sowing recorded the lowest seed protein (19.67%). The longer crop duration provided most favourable growth and development processes in the plant which ultimately encouraged more synthesis of protein through amino acids as a result of increased metabolism.

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