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Performance of black gram [*Vigna mungo* (L.) Hepper] varieties to different sowing dates

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ABSTRACT : The field investigation entitled performance of blackgram [*Vigna mungo* (L.) Hepper] varieties to different sowing dates will be conducted during *Kharif* season 2012-13 at experimental farm, AICRP on Water Management, MKV, Parbhani. The experiment conducted with four sowing dates in main plot *viz.*, D_1 : Onset of monsoon (20th June), D_2 : 10 days after onset of monsoon (30th June), D_3 : 20 days after onset of monsoon (10th July), D_4 : 30 days after onset of monsoon (20th July) and three varieties in sub plot *viz.*, V_1-TAU-1, V_2-BDU-1, V_3-TPU-4. Gross and net plot size *viz.*, 4.5 m x 4.4 m and 3.9 m x 4.0 m, respectively. The soil was medium black, clayey in texture, alkaline in reaction and higher in total soluble salt concentration, low in nitrogen and rich in phosphorus, potassium and lime, alkaline in reaction with high base saturation. Sowing was done by dibbling method. From the result of experiment it can be concluded that, among different sowing dates in black gram, the sowing at 20 days after onset of monsoon (10th July) was found optimum for achieving higher seed yield whenever the onset of monsoon delayed. The black gram variety BDU-1 was found highly productive as compared to TAU-1 and TPU-4.

Key **W**ords : Blackgram, Sowing date, different varieties

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Pulses have great importance in Indian agriculture as they are rich source of protein (17 to 25 %) as compared to that of cereals (6 to 10 %), their ability to fix atmospheric nitrogen and improve the soil fertility. Among pulses, black gram is one of the most important crop. Black gram has originated from Indian sub-continent (De Candolle, 1986; Vavlov, 1926; Zukovskiji, 1962). De and Krishanan (1966) found close resemblance between the chromosomes of Vigna mungo and Vigna radiata. The family leguminoceae includes about 18,000 species, which are characterized by their pods and alternate pinnate or trifoliate leaves (Cobley and Steele, 1976). Grain legumes, commonly known as pulse belong to sub-family 'papilioniace' as their flowers resemble the shape of butterfly. India accounting 22 per cent of worlds pulse production. The pulses are grown on 304 lakh ha area in India with production of 14.77 million tonnes and productivity is 617 kg ha^{-1}. The total area under pulses in Maharashtra is 32.69 lakh ha with total production of 21.44 lakh tonnes and productivity is 217 kg ha^{-1} (Indian economy 2011-2012). In India, Black gram is grown on 2.5 million ha area with total production of 1.5 million tonnes and productivity of 166 kg ha^{-1}. In Maharashtra it occupies an area of 3.65 lakh ha with total production of 1.22 lakh tonnes and the productivity of 299 kg ha^{-1} (Economic Survey of Maharashtra 20011-12).

The weather parameters play an important role in deciding the success or failure of the crop, because they strongly influence strongly the physiological expression and genetic potential of the crop. It is well known that yield from any given crop or variety depends on the availability of certain optimum rainfall, solar radiation, temperature, soil moisture, heat units etc. during different stages of crop growth. Among different management factors, sowing time plays a key role in obtaining higher yield. Time of sowing is known to influence the yield and growth of black gram. The optimum time 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 (Venkateshwarulu and Sounda Rajan, 1991). Therefore, the experiment is framed to find out the response of newly evolved varieties of black gram at different sowing dates in *Kharif* season. Since it is essential to enhance the productivity of crop by selection of suitable varieties and sowing dates with this preamble the present research entitled performance of black gram [*Vigna mungo* (L.) Hepper] varieties to different sowing dates was undertaken.

RESEARCH PROCEDURE

A field experiment was undertaken at research farm of all India co-ordinated research project on water management, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *Kharif* 2012 to study the performance of blackgram [*Vigna mungo* (L.) Hepper] varieties to different sowing dates on growth and yield of blackgram. The soil of experimental plot was clayey in texture, medium in organic carbon (0.26 %), poor in nitrogen (212 kg ha^{-1}), medium in available phosphorus (15.6 kg ha^{-1}), high in potash (578 kg ha^{-1}) and slightly alkaline in reaction (pH 8.7). The experiment was laid out in Split Plot Design where in the main plot were assigned to four sowing dates *viz.*, D_1 : Onset of monsoon (20th June), D_2 : 10 days after onset of monsoon (30th June), D_3 : 20 days after onset of monsoon (10th July) and D_4 : 30 days after onset of monsoon (20th July) and subplots to three varieties *viz.*, V_1 : TAU-1, V_2 : BDU-1 and V_3 : TPU-4 of black gram and the treatment combinations were randomly replicated thrice. The seeds of variety BDU-1, TAU-1 and TPU-4 were sown as per the treatments. The seeds were dibbled at 30 × 10 cm spacing. Before sowing the seed was treated with with thirum @ 4 g per kg of seed followed. by *Rhizobium* and PSB @ 2.5 g per kg of seed. The growth observations were recorded at 30 DAS, 60 DAS and at harvest whereas the yield attributing and yield observations were recorded at harvest. The experimental data were statistically analyzed as per the method described by Panse and Sukhatme (1985).

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Effect of sowing :

The sowing of 20 days after onset of monsoon (10th July) produced more vegetative growth in early period of crop growth. It was observed from the data that the height was increased progressively at every stage of crop growth. The increase in height was rapid during 30-50 DAS and, thereafter, it increases marginally till maturity. The effect of different sowing dates on plant height was found to be significant and the higher plant height was observed by the sowing date 20 days after onset of monsoon (10th July) was (48.31 cm) as compared to other dates of sowing. Similar results were obtained by Nisar Ahmad Soomro (2003).

From the data on mean number of branches, it was revealed that the number of branches increased up to 50 days and remained constant thereafter up to harvest. Mean number of branches were influenced significantly by various treatments under study. The sowing of 20 days after onset of monsoon. (10th July) found to be significantly superior over rest of all sowing dates. These findings are in conformity with the earlier findings by Choudhary *et al.* (1994).

Data on mean number of trifoliate functional leaves per plant revealed that the functional leaves increased rapidly up to 40 days and between 40-50 DAS, whereas moderately between 51-60 days and decreased there after towards maturity due to senescence of leaves. The sowing of 20 days after onset of monsoon (10th July) recorded higher mean number of functional leaves (13.06) and leaf area per plant (846.35cm^2) followed by the sowing at onset of monsoon (20th June) (812.50 cm^2) and 10 days after onset of monsoon (30th June) (785.99 cm^2), respectively at every stage of crop growth.

Total dry matter accumulation per plant was found to be increased continuously with advancement in age of the crop till maturity. The rate of increase in dry matter accumulation was slow up to 30 days and faster between 30 to 60 DAS. The sowing of 20 days after onset of monsoon (20th July) recorded higher dry matter accumulation $plant^{-1}$ (9.45g) followed by the sowing at onset of monsoon (20th July) (9.45g) $plant^{-1}$ followed by the sowing on onset of monsoon (20th June) (8.66g) $plant^{-1}$ and sowing of 10 days after onset of monsoon (8.55g) at all the crop growth stages. Similar result was reported by Vijaylaxmi (2012).

Effect of varieties on growth and development :

The varieties selected for the present investigation were TAU-1, BDU-1 and TPU-4. Black gram varieties *viz.*, BDU-1 and TAU-1 recorded more or less similar height in early stage which might be due to slow during seeding stage. During later stage comparatively taller plant height was observed in respect of variety BDU-1. These findings are in line with earlier findings by Choulwar *et al.* (1997) and Gangwar *et al.* (2012).

More number of leaves and higher leaf area per plant were noticed in variety BDU-1 as compared to TAU-1 and TPU-4 during all crop growth stages. The probable reason for this may be the genetical potential of the genotype that has helped in producing more number of leaves and ultimately higher leaf area.

The mean total dry matter per plant was influenced due to black gram varieties. Variety BDU-1 Produce significantly more dry matter as compared to TAU-1 and TPU-4 at all growth

stages. This might be due to higher biomass potential of the variety such differential dry matter production in different black gram variety BDU-1 produced significantly more dry matter as compared to TAU-1 and TPU-4 at all growth stages. This might be due to higher biomass potential of the variety such differential dry matter production in different black gram varieties were reported by Singh *et al.* (1992).

Effect of sowing date on yield and yield attributes :

The mean pod yield (g) per plant was significantly influenced by the various treatments. The sowing of 20 days after onset of monsoon (10th July) was recorded significantly higher pod yield per plant (8.45 g) followed by the sowing at onset of monsoon (20th June) (7.77 g) and 10 days after onset of monsoon (30th June) (7.07 g). These findings are in consonance with the earlier findings by Biswas *et al.* (2002).

The effect of different sowing dates on mean seed yield (g plant^{-1}) was found to be significant. The sowing on 20 days after onset of monsoon (10th July) was recorded significantly higher mean seed yield (3.86 g plant^{-1}) followed by the sowing at onset of monsoon (20th June) (3.57 g plant^{-1}) and sowing at 10days after onset of monsoon (30th June) (3.24 g plant^{-1}). Similar increase in seed yield due to different sowing date was noticed earlier by Rao and Suryawanshi (1983).

The different sowing dates showed significant differences in mean number of seed per pod. The sowing at 20 days after onset of monsoon (10th July) recorded significantly higher mean number of seeds per pod (6.75). The sowing date 20th June and 30th June found at par with each other. Same results were reported by Reddy *et al.* (1991).

The effect of different sowing dates on tests weight (1000 seeds) was found to be non - significant. But the highest test weight was observed due to the sowing of 20 days after onset of monsoon (10th July) (42.92 g) followed by sowing date 20th June (42.33 g) and 30th June (41.37 g). Similar trend was observed in respect of test weight reported by Rana *et al.* (2006).

Data on mean seed yield kg ha^{-1} as influenced by different sowing dates is presented in Table 1. The data showed that the sowing of 20 days after onset of monsoon (10th July) recorded significantly higher mean seed yield (1001 kg ha^{-1}) over rest of the sowing dates. The sowing at onset of monsoon (20th June) (889 kg ha^{-1}) ranked second followed by 10 days after onset of monsoon (813 kg ha^{-1}). These findings conformity with the findings of earlier research work carried out by Rathore *et al.* (2010).

Straw yield kg ha^{-1} as influenced by different sowing dates was found to be significant. The sowing of 20 days after onset of monsoon (10th July) recorded highest mean straw yield kg ha^{-1} (2078 kg ha^{-1}) which was significantly superior over rest of treatments. The sowing on onset of monsoon (20th June) (1895 kg ha^{-1}) ranked second which was followed by 10 days after onset of monsoon (30th June) (1810 kg ha^{-1}). Choudhary *et al.* (1989) reported similar results.

Data on biological yield kg ha^{-1} as influenced by different sowing dates was found to be significant. The sowing of 20 days after onset of monsoon (10th July) recorded higher mean biological yield (3080 kg ha^{-1}) which was significantly superior over rest of the treatments. Sowing on onset of monsoon (20th

Table 1: Periodical plant height (cm) and no. of leaves per plant as influenced by various treatments

Treatments	Plant height (cm)			No. of leaves per plant		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Sowing dates (D)						
D_1 : Onset of monsoon (20th June)	19.74	43.51	44.82	6.01	11.90	3.91
D_2 : 10 days after onset of monsoon (30th June)	18.37	39.44	39.89	5.78	11.18	3.66
D_3 : 20 days after onset of monsoon (10th July)	20.42	45.84	46.31	6.18	13.06	4.12
D_4 : 30 days after onset of monsoon (20th July)	15.61	35.75	36.06	5.58	10.64	3.38
S.E. ±	0.40	0.67	0.62	0.25	0.21	0.09
C.D. (P=0.05)	1.19	2.02	1.87	0.76	0.64	0.28
Varieties (V)						
V_1 : TAU-1	18.60	41.05	41.66	5.94	11.69	3.75
V_2 : BDU-1	20.08	46.26	47.42	5.96	12.34	3.97
V_3:TPU-4	17.04	38.09	39.53	5.77	11.06	3.58
S.E. ±	0.39	1.49	0.84	0.17	0.26	0.08
C.D. (P=0.05)	1.19	4.46	2.51	0.51	0.80	0.26
Interaction (D x V)						
S.E. ±	0.79	2.98	1.68	0.34	0.53	0.17
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
General Mean	18.57	41.13	41.77	5.89	11.70	3.77

NS = Non–significant

June) (2777 kg ha^{-1}) ranked second and followed by 10 days after onset of monsoon (30th June) (2626 kg ha^{-1}). Same results were reported by Dhoble *et al.* (1990).

Data on harvest index showed that there was no any significant effect of sowing dates on harvest index. The highest harvest index was observed (32.50) by the sowing at 20 days after onset of monsoon (10th July). Same result was reported by Rana *et al.* (2006).

Effect of varieties on yield and yield attributes :

The performance of variety BDU-1 as regard to yield attributing characters *viz.*, number of pods plant, number of

Table 2 : Leaf area (cm^2) plant^{-1} and dry matter (g) as influenced by various treatments

Treatments	Leaf area (cm^2) plant^{-1}			Dry matter (g)		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Sowing dates (D)						
D_1 : Onset of monsoon (20th June)	148.54	812.50	60.35	1.43	5.54	8.66
D_2 : 10 days after onset of monsoon (30th June)	143.97	785.99	56.67	1.33	5.46	8.55
D_3 : 20 days after onset of monsoon (10th July)	161.10	846.35	65.55	1.58	6.06	9.45
D_4 : 30 days after onset of monsoon (20th July)	134.52	768.50	46.10	1.28	5.00	7.67
S.E. ±	2.58	12.48	1.10	0.05	0.15	0.26
C.D. (P=0.05)	7.72	37.36	3.30	0.15	0.47	0.79
Varieties (V)						
V_1 : TAU-1	147.75	800.13	57.43	1.42	5.52	8.59
V_2 : BDU-1	153.91	846.90	59.51	1.54	6.35	8.97
V_3:TPU-4	139.43	762.98	54.57	1.26	4.68	8.20
S.E. ±	2.41	19.41	0.94	0.04	0.20	0.14
C.D. (P=0.05)	7.24	58.12	2.83	0.13	0.61	0.44
Interaction (D x V)						
S.E. ±	4.83	38.83	1.89	0.08	0.41	0.29
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
General Mean	147.03	803.34	57.17	1.41	5.52	8.58

NS = Non–significant

Table 3 : Periodical yield and yield attributes as influenced by various treatments

Treatments	No.of pods plant^{-1}	Pod length (cm)	No. of seeds pod	Pod weight plant^{-1} (g)	Grain weight plant^{-1} (g)	Test weight (g)
Sowing dates (D)						
D_1 : Onset of monsoon (20th June)	20.12	4.64	6.50	7.77	3.57	42.33
D_2 : 10 days after onset of monsoon (30th June)	18.65	4.51	6.32	7.07	3.24	41.37
D_3 : 20 days after onset of monsoon (10th July)	21.88	4.85	6.75	8.45	3.86	42.92
D_4 : 30 days after onset of monsoon (20th July)	15.57	4.33	6.03	6.14	2.85	40.63
S.E. ±	0.47	0.02	0.04	0.08	0.03	0.71
C.D. (P=0.05)	1.42	0.07	0.13	0.25	0.10	2.14
Varieties (V)						
V_1 : TAU-1	18.90	4.56	6.39	7.35	3.40	41.85
V_2 : BDU-1	20.07	4.99	6.85	8.02	3.51	42.07
V_3:TPU-4	18.20	4.20	5.96	6.70	3.22	41.53
S.E. ±	0.44	0.16	0.17	0.18	0.05	0.70
C.D. (P=0.05)	1.32	0.48	0.51	0.54	0.16	2.11
Interaction (D x V)						
S.E. ±	0.88	0.32	0.34	0.36	0.10	1.41
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
General Mean	19.06	4.58	6.40	7.36	3.38	41.82

NS = Non–significant

seeds per pod, pod weight per plant seed yield per plant and test weight was significantly superior as compared to TAU-1 and TPU-4. The probable reason for this may be the genetic makeup of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthates to the sink (seed). Yadaballi *et al.* (2006) and Patra *et al.* (2001) observed improvement in black gram varieties having different genetic makeup.

Pod formation started 50 DAS, and development of pod was continued up to maturity. Genotype BDU-1 produced significantly more number of pods per plant and seed yield per plant as compared to TAU-1 and TPU-4 indicating its higher yield potential. Similar trends were reported by Eswari and Rao (2007).

The performance of black gram varieties in respect of seed yield was very encouraging and followed a similar trend that of yield attributes. The black gram variety BDU-1 recorded higher seed yield of (930 kg ha^{-1}) which was significantly superior over varieties TAU-1 and TPU-4. This increase in seed yield of BDU-1 genotype might be due to the higher production efficiency that has been reflected through improvement in different yield attributing characters. Similar findings were reported by Patra *et al.* (2001). Black gram genotype BDU-1 produced biological yield of (2912 kg ha^{-1}) which was found significantly superior over TPU-4 and found at par with variety TAU-1. The higher biological yield of BDU-1 as compared to TAU-1 might be due to accumulation of more dry matter and higher biomass potential. These findings are in conformity with the findings of Choudhary *et al.* (1989) and Revanappa *et al.* (2012).

Black gram varieties differed significantly in harvest index. The genotype BDU-1 recorded higher harvest index as compared to TAU-1 and TPU-4 which might be due to its higher production efficiency similar trend was observed by Kandasamy and Kuppusamy (2007).

Effect of sowing date on economics :

The data on gross monetary returns it was revealed that the sowing of 20 days after onset of monsoon (10th July) gave highest gross monetary returns (36105 Rs. ha^{-1}) followed by sowing date 20th June (31339 Rs. ha^{-1}) and 30th June 29868 (Rs. ha^{-1}).

The data on net monetary returns/ha revealed that the sowing of 20 days after onset of monsoon (10th July) gave higher net monetary returns (21764 Rs. ha^{-1}) followed by 20th June sowing date (16377 Rs. ha^{-1}) and 30th June sowing date (14906 Rs. ha^{-1}).

Data on benefit : cost ratio it was seen that the sowing of 20 days after onset of monsoon (10th July) gave higher benefit : cost ratio (2.51) followed by the sowing date 20th June (2.09) and 30th June (1.99).

Effect of varieties on economics :

The data on gross monetary returns it was revealed that the variety BDU-1 gave highest gross monetary returns (33126 Rs. ha^{-1}) which was significantly superior over TAU-1 (31043 Rs. ha^{-1}) and TPU-4 (30274 Rs. ha^{-1}).The data on net monetary returns/ha revealed that the variety BDU-1 gave higher net monetary returns (18458 kg ha^{-1}) which was significantly

Table 4 : Periodical yield and economics as influenced by various treatments

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)	GMR (Rs. ha^{-1})	NMR (Rs. ha^{-1})	B:C ratio
Sowing dates (D)							
D_1 : Onset of monsoon (20th June)	889	1895	2777	32.01	31339	16377	2.09
D_2 : 10 days after onset of monsoon (30th June)	813	1810	2626	30.95	29868	14906	1.99
D_3 : 20 days after onset of monsoon (10th July)	1001	2078	3080	32.5	36105	21764	2.51
D_4 : 30 days after onset of monsoon (20th July)	785	1781	2571	30.53	28613	14272	1.99
S.E. ±	15.09	27.25	46.6	--	292.26	292.26	-
C.D. (P=0.05)	45.17	81.57	139.51	--	874.88	874.88	-
Varieties (V)							
V_1 : TAU-1	871	19.04	2776	31.37	31043	16375	2.07
V_2 : BDU-1	930	1982	2912	31.93	33126	18458	2.21
V_3:TPU-4	816	1786	2603	31.34	30274	15656	2.02
S.E. ±	19.58	28.6	55.05	--	222.39	222.39	-
C.D. (P=0.05)	58.63	85.63	164.81	--	665.7	665.7	-
Interaction (D x V)							
S.E. ±	39.17	57.21	110.12	--	444.77	444.77	-
C.D. (P=0.05)	NS	NS	NS	--	NS	NS	-
General Mean	872	1891	2764	31.51	31481	16830	2.12

NS = Non–significant

superior over TAU-1 (16375 Rs. ha^{-1}) and TPU-4 (15656 Rs. ha^{-1}). Data on benefit : cost ratio it was seen that variety BDU-1 gave higher benefit : cost ratio (2.21) followed by TAU-1 and TPU-4.

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