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Sowing dates and potash levels influences on yield of chickpea

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ABSTRACT : Experiment was laid out in a split plot design with three replications and twelve treatment combinations formed due to (A) three sowing dates *viz*.,(i) 49th MSW(D_1),(ii) 50th MSW(D_2),(iii) 51st MSW (D_3), (B) four potash levels (i) 0 kg K_2O ha^{-1} (K_1), (ii) 25 kg K_2O ha^{-1}(K_2) , (iii) 50 kg K_2O ha^{-1} (K_3) and (iv) 75 kg K_2O ha^{-1} (K_4). The chickpea was sown on various sowing dates *viz*., 10th, 17th and 24th December 2009. The treatments of potassium levels along with recommended dose of fertilizer (25:50:00 kg NPK ha^{-1}) was given at the time of sowing. The seeds were treated with rhizobium culture @ 25 g per kg seeds. Chickpea sown on 10th December produced significantly higher grain and straw yield over rest of the treatments. Growth attributes measured in terms of plant height (59.05 cm) and plant spread (58.63 cm). The interaction effect between sowing dates and potash levels on growth, yield and quality of chickpea were non- significant. Thus, from the results of the present investigation it is concluded that for *Rabi* chickpea (cv. DIGVIJAY) on deep black soil under irrigated conditions, 10th December sown crop along with application of 50 kg K_2O ha^{-1} through Muriate of potash at the time of sowing would be the best proportion for higher productivity.

Key Words : Potassium level, Chickpea, Sowing date

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Pulses are important not only for their value as human food but also the important source of high protein content for livestock. It has been important component of Indian agriculture enabling the land to restore fertility by fixing the atmospheric nitrogen. It helps in producing reasonable yield of succeeding crops by restoring the fertility of soil. It also meets the demand of human dietary requirement *viz*. proteins, carbohydrates, fat and other nutrient sources.Recently, Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri (MS) has released new variety of Chickpea cv. 'DIGVIJAY' (Phule G 91028 x Bheema) for the Maharashtra. Digvijay, a yellowish brown bold seeded variety is suitable for rainfed, irrigated and late sown conditions, high yield potential, good milling quality, high protein, methionine content and resistant to wilt disease.It is, therefore, necessary to study the various Agronomic techniques to exploit potential of chickpea cv. 'DIGVIJAY'. The fertilizers are the most critical inputs for realizing the yield potential of improved varieties. Unfortunately, most of farmers are not in a position to apply the recommended dose of fertilizers.

Therefore, the present investigation entitled was studied with the following objectives.To study the performance of chickpea in relation to sowing dates under changing climatic scenario.

RESEARCH PROCEDURE

The soil of the experimental field was well drained with good water holding capacity, deep black having a depth more than 1.5 m. In order to know the physical and chemical properties of soil, samples were collected before sowing at 0-30 cm. depth at 15 locations from the experimental field and composite sample was prepared and analyzed for physical and chemical properties. The soil of the experimental field was clayey in texture, low in available nitrogen (148.25 kg ha^{-1}), medium in available phosphorus (16.64 kg ha^{-1}) and very high in available potassium (432.58 kg ha^{-1}) content. The pH value indicated that the soil was slightly alkaline in reaction. The field experiment was laid out in a split plot designwith 12 treatment combinations with 3 replications. The treatments consisted of three sowing dates relegated into main plot as main plot treatments and four potassium levels relegated into sub plot as sub-plot treatments.

For recording various observations five plants were selected randomly from the net plot. These five plants were marked by fixing bamboo pegs at the north side of each plant

in a row in the net plot. All the biometric observations were recorded at 28, 42, 56, 70, 84 DAS and at the harvest. The details of observations recorded during the period of investigation are presented in Table given below The statistical analysis was carried out as per Panse and Sukhatme (1967).

RESEARCH ANALYSIS AND REASONING

The experimental findings regarding the response of chickpea cv. 'DIGVIJAY' to various sowing dates in respect of growth and yield under *Rabi* conditions are presented and discussed as under .

Plant height:

Data on mean plant height as influenced periodically by different treatments are presented in Table 1. The mean plant height increased with the advancement of age of the crop but there was slight reduction in the rate of increase in plant height at harvest. The plant height was maximum at 84 days after sowing. The mean plant height was minimum (18.13 cm) at 28 days and it was maximum (58.87 cm) at harvest.

Effect of sowing dates:

The data presented in table 1 revealed that there was significantly superior effect of sowing dates on the height of plant was influenced significantly due to sowing dates at all the crop growth stages. It was significantly superior in the 49th MSW throughout the crop growing period, except 28 DAS. While the lowest plant height was recorded in 51st MSW. This might be attributed to increased day length coupled with increased temperature in late sown crop. Similar results were obtained by Sharma *et al.* (1984) and Knowing *et al.* (2005).

Effect of potassium levels:

Pursuant of the data in Table 1 revealed that the plant height was significantly influenced by different potassium levels throughout crop growth. There was gradual increase in plant height with increasing levels of potassium. The mean plant height was significantly higher throughout the growing period of chickpea in treatment allocated with recommended dose of fertilizers (25 kg N + 50 kg P_2O_5 ha^{-1}) along with 50 kg K_2O ha^{-1} than other potassium levels, except at 28 DAS. The application of recommended dose of fertilizer with 25 kg K_2O haha^{-1} level was statistically at par where 75 kg K_2O ha^{-1} was applied. The lowest plant height was recorded by treatment allocated without potassium. These might be explained as potassium influences crop growth through its effect on root growth, maintenance of turgor, transpiration and stomatal regulation (Nelson 1980). Similar results were obtained by Saxena *et al.* (1986), Mathan *et al.* (1996) and Reddy (1998).

Effect of interaction:

The interaction effect between sowing dates and potassium levels on plant height was found non-significant at all growth stages.

Table 1 : Mean plant height (cm) as influenced periodically by various treatments

Treatments	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	At harvest
Sowing dates						
D_1:49th MSW	19.30	29.75	37.82	49.47	59.05	59.05
D_2:50th MSW	18.22	27.75	35.80	46.75	56.75	56.80
D_3: 51thMSW	16.88	26.50	33.77	44.75	54.75	54.76
S.E.±	0.50	0.28	0.51	0.11	0.34	0.30
C.D. (P=0.05)	1.49	0.83	1.53	0.33	1.05	0.91
CV %	9.52	7.68	8.23	11.82	9.32	8.43
Potash levels kg ha^{-1}						
K_1:(0)	16.51	27.33	34.03	44.14	54.02	54.04
K_2: (25)	18.02	28.42	35.06	46.34	56.11	56.16
K_3: (50)	19.63	30.00	38.04	50.34	60.12	60.15
K_4: (75)	18.37	27.76	36.06	47.13	57.12	57.12
S.E.±	0.42	0.35	0.44	0.66	0.10	0.10
C.D. (P=0.05)	1.25	1.04	1.30	1.95	0.31	0.31
Interaction (DxK)						
S.E.±	0.19	0.71	0.86	0.72	0.78	1.47
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
General Mean	18.13	28.00	35.80	46.99	56.85	58.87
CV %	8.42	6.65	9.45	10.12	8.48	9.34

NS = Non-significant

Plant spread:

Data on mean plant spread as influenced periodically by different treatments are presented in Table 2 . The data in the Table 2 revealed that the mean plant spread per plant increased with advancement in the age of the crop up to harvest. The growth rate of plant spread was maximum during grand growth period.

Effect of sowing dates:

The plant spread was influenced significantly due to different sowing dates at all the stages of observations. The plant spread was higher in sowing date D_1 (49th MSW) which was significantly superior over other sowing dates. The minimum plant spread was recorded in late sown crop (51st MSW). This may be explained as favorable climatic conditions available during the early sown crop might have resulted into profuse growth.Similr results are in conformity with Tiwari and Tripathi (1995) and Oweis *et al.* (2004).

Effect of potassium levels:

The plant spread was influenced significantly due to different potassium levels at all the stages of observations.The plant spread increased with increasing levels of potassium being maximum up to 50 kg K_2O ha^{-1} and declined thereafter which was significantly higher than other potassium levels. The minimum plant spread was recorded under control. This might be attributed to the influence of potassium through its effects on water uptake and transpiration regulation. The present results are found to be in conformity with the results obtained by Malik *et al.* (1986), Rawal and Yadav (1986).

Effect of interaction:

The interaction effect between sowing dates and potassium levels on plant spread were found to be non-significant.

Number of nodules and their weight per plant:

Data on mean number of nodules and their weight per plant as influenced periodically by different treatments are presented in Table 3.From the data, it was observed that the number of root nodules per plant and their weight per plant was maximum at 45 DAS. The mean number of nodules was 24.31 with 288.32 mg weight per plant at 45 DAS.

Effect of sowing dates:

The sowing dates influenced significantly the number of root nodules and their weight. The highest number of nodules and their weight per plant (25.65 and 289.65 mg, respectively) was observed when sowing was done at 49th MSW (D_1) which was superior over other sowing dates.Similar results are found by Boulbaba *et al.* (2005) Shamsi (2010).

Effect of potassium levels:

The mean number of nodules and their weight per plant was significantly influenced by various potassium levels. There was gradual increase in number of nodules and their weight

Table 2 : Mean plant spread (cm) as influenced periodically by various treatments

Treatments	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	At harvest
Sowing dates						
D_1:49th MSW	14.41	28.67	37.43	45.80	56.30	58.63
D_2:50th MSW	12.97	26.85	33.29	43.62	53.29	53.54
D_3: 51thMSW	11.52	24.23	29.55	41.63	50.17	48.07
S.E.±	0.27	0.43	0.10	0.68	0.75	0.84
C.D. (P=0.05)	0.82	1.29	0.32	2.02	2.23	2.50
CV %	7.17	6.23	8.15	9.17	7.68	6.67
Potash levels kg ha^{-1}						
K_1:(0)	11.51	24.89	30.60	41.04	50.36	48.90
K_2: (25)	12.72	26.32	33.29	43.38	53.15	53.49
K_3: (50)	14.52	28.41	36.36	46.61	56.20	58.20
K_4: (75)	13.11	26.72	33.44	43.71	53.29	53.63
S.E.±	0.28	0.51	0.93	0.10	0.80	0.12
C.D. (P=0.05)	0.85	1.52	2.76	0.31	2.28	0.35
Interaction (DxK)						
S.E.±	0.60	0.63	0.82	0.72	0.81	080
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
General Mean	12.97	26.58	33.42	43.65	53.25	53.56
CV %	7.51	7.92	9.25	8.48	6.94	6.38

NS = Non-significant

per plant due to increase in levels of potassium up to 50 kg K_2O ha^{-1}. Maximum number of nodules and there weight per plant (25.55 and 289.67 mg, respectively) was recorded with application of 50 kg K_2O ha^{-1}. The optimum availability of potassium might have developed good root system resulting into development of root nodules.Similar results are in conformity with Singh and Kumari (1990) and Ali *et al.* (2007).

Effect of interaction:

The interaction effect between sowing dates and potassium levels on number of nodules and their weight per plant were found to be non-significant.

Yield of grain and straw:

Data pertaining to the yield of grain and straw in q ha^{-1} as influenced by different treatments are presented in Table 4. The grain and straw yield of chickpea were significantly affected by different treatments. The data presented in Table 15 revealed that mean grain and straw yield were 22.67 and 25.08 q ha^{-1}.

Grain yield:

Effect of sowing dates:

The early sown crop (49th MSW) registered maximum grain yield (26.11 q ha^{-1}) which was significantly superior over crop sown in 50th MSW (22.26 q ha^{-1}) and 51st MSW (19.25 q ha^{-1}). The increase in yield due to early sowing (49th MSW) was 35.64 per cent and 15.64 per cent in 50th MSW over the delayed sowing in 51st MSW. This might be due to early sown crop get benefit of better moisture conditions that resulted in greater vegetative and reproductive development. On other hand late sown crop faced increasing day length and temperature.Similar results are in conformity with Munirathnam and Sangita (2009) and Mansur *et al*. (2010).

Effect of potassium levels:

Grain yield of chickpea was significantly influenced due to potassium levels, there was gradual increase in grain yield with increase in potassium levels. The mean grain yield was significantly the highest (24.07 q ha^{-1}) with application of 50 kg K_2O ha^{-1} and the increase in yield over control was to the tune of 11.60 per cent. The lowest grain yield was recorded in control. This might be due to activation of various enzymes, adjustment of stomatal movement, water relation and carbohydrate metabolism by potassium. Similar results are in conformity with Yahiya *et al.* (1995) and Govindan (2002).

Effect of interaction:

The interaction effect between sowing dates and potassium levels on grain yield were found to be non-significant.

Straw yield:

Effect of sowing dates:

Data in Table 4 showed the significant differences in straw yield per hectare due to sowing dates. Crop sown on 49th MSW

Table 3 : Mean number of nodules and their weight per plant (mg) as influenced periodically by various treatments

Treatments	No. of nodules per plant at 45 DAS	Wt. of nodules per plant (mg)	Number of nodules per plant at pod development	Weight of nodules per plant at pod development (mg)
Sowing dates				
D_1:49th MSW	25.65	289.65	22.34	190.32
D_2:50th MSW	24.39	288.55	20.02	189.16
D_3: 51thMSW	22.89	286.07	18.26	188.45
S.E.±	0.18	0.27	0.20	0.33
C.D. (P=0.05)	0.72	0.84	0.60	NS
CV %	7.31	8.12	9.15	8.76
Potash levels kg ha^{-1}				
K_1:(0)	23.88	287.13	18.41	187.56
K_2: (25)	24.07	288.01	20.22	189.07
K_3: (50)	25.55	289.67	22.18	190.91
K_4: (75)	23.75	288.45	20.31	188.80
S.E.±	0.21	0.30	0.51	0.34
C.D. (P=0.05)	0.63	0.91	1.52	NS
Interaction (DxK)				
S.E.±	1.06	0.66	0.77	2.51
C.D. (P=0.05)	NS	NS	NS	NS
General Mean	24.31	288.32	20.86	189.08
CV %	8.84	9.12	8.76	7.90

NS = Non-significant

produced significantly higher straw yield (28.38 q ha^{-1}) which was 30.18 per cent higher than the late sown crop in 51 MSW, where the straw yield recorded 21.80 q ha^{-1}. This might be explained as favourable climatic conditions available during the early sown crop might have resulted into profuse growth, which consequently reflected into more accumulation of dry matter. Similar results are in conformity with Deore (1989) and Mansur *et al.* (2010)

Effect of potassium levels:

Straw yield of chickpea was significantly influenced due to various potassium levels. The straw yield increased gradually up to 50 kg K_2O ha^{-1} and declined thereafter. The mean straw yield was significantly the highest (26.72 q ha^{-1}) at 50 kg K_2O ha^{-1}, which was 12.60 per cent higher over control. However the application of 75 kg K_2O ha^{-1} recorded statistically identical straw yield (26.72 q ha^{-1}) with that of 50 kg K_2O ha^{-1}. This might be due to high water uptake, osmoregulation and root growth of the plant reflected into more vegetative growth.Similar results are in conformity with Verma (1994) and Yahiya *et al.* (1995).

Effect of interaction:

The interaction effect between sowing dates and potassium levels on straw yield were found to be non-significant.

Weight of bhusa per plant :

Data pertaining to the weight of bhusa per plant of chickpea are presented in Table 4. It could be seen that the mean weight of bhusa per plant was 30.93 g.

Effect of sowing dates:

Early sowing of chickpea on 49th MSW produced significantly higher bhusa per plant (34.83g) than rest of sowing dates, while late sown crop in 51st MSW recorded significantly the lowest weight of bhusa per plant (27.24g). The early sown crop get favorable climatic conditions which might have resulted into profuse growth consequently reflected into more accumulation of dry matter.Similar results are in conformity with Sambasiva Reddy (1983) and Kobraee *et al.* (2010).

Effect of potassium levels:

Thebhusa weight per plant increased with increase in potassium levels up to 50kg K_2O ha^{-1}. The lowest weight of bhusa per plant was recorded with control (27.86 g). The optimum availability of potassium have developed good root system resulting into adequate growth of the crop which might have reflected into more accumulation of dry matter.

Interaction effect:

The interaction effect between sowing dates and potassium levels on seed weight per plant were found to be non-significant.

Conclusion :

From the results it is concluded that for *Rabi* chickpea

Table 4 : Mean straw, grain yield and weight of bhusa per plant as influenced by various treatments

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Weight of bhussa per plant (g)
Sowing dates			
D_1:49th MSW	26.11	28.38	34.83
D_2:50th MSW	22.26	25.06	30.72
D_3: 51thMSW	19.25	21.80	27.24
S.E.±	0.23	0.38	0.75
C.D. (P=0.05)	0.69	1.13	2.23
CV %	11.29	10.12	9.24
Potash levels kg ha^{-1}			
K_1:(0)	21.57	23.73	27.86
K_2: (25)	22.41	24.49	30.83
K_3: (50)	24.07	26.72	34.01
K_4: (75)	22.72	25.39	31.02
S.E.±	0.44	0.66	0.11
C.D. (P=0.05)	1.31	1.98	0.34
Interaction (DxK)			
S.E.±	2.07	1.15	0.42
C.D. (P=0.05)	NS	NS	NS
General Mean	22.67	25.08	30.93
CV %	10.54	9.76	8.24

N.S. = Non-significant

(cv. DIGVIJAY) on deep black soil under irrigated conditions, 10th December sown crop along with application of 50 kg K_2O ha^{-1} through Muriate of potash at the time of sowing would be the best proportion for higher productivity

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