

Measurement of interaction between different phosphorus levels and date of sowing on various agronomic parameters viz., growth, yield and quality of green gram (*Vigna Radiata* L.)

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The present investigation was carried out during the kharif season of 2019-20 at the Student instructional Farm, Department of Agronomy, AKS University, Satna, Madhya Pradesh (24°34'N, 80°47'E). The total of 144.98mm of rainfall was received during the experimental crop growth period. Maximum temperature 33.39°C and minimum 17.95°C was observed during experimental year 2019-20. The soil was sandy loam, having pH (7.5), organic carbon (0.43%) available N (176.6 kg/ha), P (12.5 kg/ha) and K (200 kg/ha) during the experimental year 2019-20. The experiment was laid out in Factorial Randomized Block Design (FRBD). The treatments comprise of 4 levels of phosphorus viz. P₀- 0 kg/ha, P₁- 20 kg/ha, P₂- 40 kg/ha and P₃- 60 kg/ha, , 3 sowing dates 8th July(D₁), 18th July (D₂) and 28th July (D₃) and their interaction i.e. P₀D₁(Phosphorous @ 0 kg/ha + 8th July), P₀D₂(Phosphorous @ 0 kg/ha + 18th July), P₀D₃ (Phosphorous @ 0 kg/ha + 28th July), P₁D₁ (Phosphorous @ 20 kg/ha + 8th July), P₁D₂ (Phosphorous @ 20 kg/ha +18th July), P₁D₃ (Phosphorous @ 20 kg/ha + 28th July), P₂D₁ (Phosphorous @ 40 kg/ha + 8th July), P₂D₂ (Phosphorous @ 40 kg/ha + 18th July), P₂D₃ (Phosphorous @ 40 kg/ha + 28th July), P₃D₁ (Phosphorous@ 60 kg/ha + 8th July), P₃D₂ (Phosphorous @ 60 kg/ha+18th July) and P₃D₃ (Phosphorous @ 60 kg/ha+28th July). Full recommended dose of fertilizer N: P: K @ 25:50:25(recommended by TNAU) was applied as a basal dose with Urea, Murate of Potash and Single Super Phosphate. Data were recorded for 5 randomly tagged plants on plant height (cm), number of leaves, number of primary branches at 30, 45 and 60 DAS. Root length (cm) and number of root nodules per plant were observed at harvest. Yield Parameters such as number of pods per plant, pod length (cm), number of seed

per pod, grain yield (q/ha), test weight (g), harvest index (%) were observed at harvesting time.

Protein content (%) as quality attribute was also estimated. Statistical analysis was done for determining the significance between the treatment means and to draw valid conclusion. Data was statistically analyzed by adopting appropriate method of Analysis of Variance (Gomez and Gomez, 1976). Regarding the effects of sowing date on various parameters, maximum plant height (cm), number of leaves, number of primary branches at 30, 45 and 60 DAS; root length (cm), number of root nodules per plant were observed in the plants sown on 8th of July among the sowing dates and the lowest plant height (cm), number of leaves, number of primary branches, root length (cm), number of root nodules per plant were observed in plants sown on 28th July (Table 1). Furthermore, the maximum number of pods per plant (34.25), pod length (9.31cm), number of seeds per pod (8.22), test weight (43.14g), protein content (24.74%) and harvest index (28.81%) were recorded in the crop sown on 8th of July whereas the minimum in the crop sown on 28th July (Table 2). As a result of which the maximum grain yield (8.40q/ha) and B: C ratio (2.50) were recorded in the crop sown on 8th July (Table 2). However, the second sowing 18 July and last sowing 28 July of Green gram resulted lesser days to maturity. Hence the crop could not utilize the available resources and environmental condition properly. While the late-sown crop (18th July and 28th July) experienced sub-optimal weather regime, during the later growth period, which retarded their growth compared to early sown crop (8th July). The maximum benefit cost ratio (B: C) ratio were recorded on 8th July-sown crop (Table 2).

Also, growth attributes of green gram were significantly influenced by various levels of

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Table No.1 Effect of Phosphorous Levels and Date of Sowing on Growth parameters of Green Gram

Treatments	Plant height (cm)			Number of leaves			Number of primary branches			Root length (cm)	Number of root nodules per plant
	30DAS	45DAS	60DAS	30DAS	45DAS	60DAS	30DAS	45DAS	60DAS		
Effect of phosphorous levels											
P ₀	20.25	28.68	36.96	8.33	22.84	31.49	1.42	2.62	3.82	9.21	16.98
P ₁	22.45	31.44	40.47	9.60	25.89	35.18	1.64	2.84	4.02	10.55	19.69
P ₂	22.36	33.95	43.73	11.02	30.71	39.00	2.02	3.22	4.42	12.25	22.73
P ₃	27.22	37.65	48.44	12.58	35.73	46.33	2.38	3.62	4.84	14.00	26.33
S.Em±	0.31	0.30	0.42	0.16	0.26	0.12	0.03	0.03	0.05	0.18	0.20
C.D.	0.84	0.88	1.22	0.47	0.75	0.36	0.09	0.09	0.13	0.52	0.59
Effect of date of sowing											
D ₁	22.85	34.58	44.55	11.00	30.92	39.88	2.03	3.25	4.42	12.27	22.87
D ₂	21.36	32.47	41.77	10.27	28.12	37.87	1.85	3.07	4.28	11.26	21.10
D ₃	22.54	31.75	40.88	9.88	27.35	36.70	1.72	2.92	4.13	10.98	20.33
S.Em±	0.25	0.26	0.36	0.14	0.22	0.11	0.03	0.03	0.04	0.15	0.17
C.D.	0.74	0.76	1.06	0.41	0.65	0.31	0.08	0.08	0.12	0.45	0.51
Interaction effect between phosphorous and date of sowing											
P ₀ D ₁	24.22	30.00	38.67	8.80	23.93	32.73	1.60	2.80	4.00	9.76	18.27
P ₀ D ₂	19.41	28.13	36.24	8.27	21.60	30.33	1.40	2.60	3.80	8.96	16.73
P ₀ D ₃	20.85	27.90	35.97	7.93	23.00	31.40	1.27	2.47	3.67	8.93	15.93
P ₁ D ₁	22.90	32.53	41.97	10.13	27.93	37.53	1.80	3.00	4.13	11.07	20.73
P ₁ D ₂	21.23	31.13	40.03	9.47	25.20	34.67	1.67	2.87	4.07	10.40	19.40
P ₁ D ₃	20.42	30.67	39.43	9.20	24.53	33.33	1.47	2.67	3.87	10.20	18.93
P ₂ D ₁	25.12	37.33	48.07	12.13	34.27	41.33	2.20	3.40	4.60	13.90	25.07
P ₂ D ₂	24.50	32.65	42.43	10.67	30.00	39.93	2.00	3.20	4.40	11.69	22.00
P ₂ D ₃	22.41	31.59	40.70	10.27	27.87	37.53	1.87	3.07	4.27	11.17	21.13
P ₃ D ₁	27.89	38.47	49.51	12.93	37.53	47.93	2.53	3.80	4.93	14.38	27.40
P ₃ D ₂	26.54	37.65	48.37	12.67	35.67	46.53	2.33	3.60	4.87	13.98	26.47
P ₃ D ₃	25.99	36.83	47.44	12.13	34.00	44.53	2.27	3.47	4.73	13.64	25.33
S.Em±	0.51	0.52	0.72	0.28	0.44	0.21	0.05	0.05	0.08	0.31	0.34
C.D.	1.23	1.52	2.12	NS	1.31	0.63	NS	0.59	NS	0.90	NS

phosphorus. Significantly the maximum plant height (cm), number of leaves, number of primary branches at 30, 45 and 60 DAS; root length (cm), number of root nodules per plant were observed with the application of phosphorous@60kg/ha as compared to other concentrations (Table 1). Furthermore the maximum number of pods per plant (38.71cm), pod length (10.21cm), number of seeds per pod (9.09), test weight (46.04g), protein content (25.95) and harvest index (29.91%) were recorded in the crop applied with phosphorous@60kg/ha (Table 2). As a result of which the maximum grain yield (9.61q/ha) and Benefit cost ratio (2.76) were recorded in the crop with phosphorous@60kg/ha (Table 2).

The interaction among variety, date of planting and phosphorus level had no significant effect on plant height at 30 DAS, number of leaves at 30 DAS, number of primary branches 30 DAS and 60 DAS, number of root nodules per plant, number of pods per plant and number of

seeds per pod. But the interaction had significant influence on plant height at 45 DAS and 60 DAS, number of leaves at 45 DAS and 60 DAS, number of primary branches at 45 DAS, root length, number of pods per plant, pod length (cm), Number of seed per pod, grain yield (q/ha), test weight (g), harvest index (%), benefit cost ratio (B:C), protein content (%). It was found that the maximum plant height at 30,45 and 60 DAS(27.89, 38.47 and 49.51cm), number of leaves at 30,45 and 60 DAS (12.93, 37.53 and 47.93), number of primary branches at 30, 45and 60 DAS (2.53, 3.80 and 4.93); root length (14.38cm), number of root nodules per plant (27.40) were observed in the crop sown on 8th July with the application of phosphorous @ 60kg/ha as compared to other treatment combinations (Table 1). Furthermore the maximum number of pods per plant (39.60), pod length (10.53cm), number of seeds per pod (9.40), test weight (46.91g) and protein content (25.96%) were recorded in the crop sown on 8th

July with the application of phosphorous @ 60 kg/ha (Table 2). As a result of which the maximum grain yield (9.61q/ha) and B:C ratio (2.76) were recorded in the crop with phosphorous @ 60kg/ha (Table 2). Maximum harvest index was observed in crop sown on 28th July with the application of phosphorous @ 60kg/ha.

Table 2: Effect of Phosphorous Levels and Date of Sowing on yield parameters of Green Gram

Treatments	Number of pods plant ⁻¹	Pod length (cm)	Number of seed pod ⁻¹	Grain yield (q/ha)	Test weight (g)	Harvest index (%)	Benefit cost ratio (B:C)	Protein content (%)
Effect of phosphorous levels								
P ₀	28.27	7.35	6.47	6.29	37.30	27.33	1.84	22.97
P ₁	31.27	8.31	7.31	7.22	40.13	28.02	2.10	23.82
P ₂	33.80	8.91	7.93	8.32	42.20	29.44	2.41	25.38
P ₃	38.71	10.21	9.09	9.61	46.04	29.91	2.76	25.95
S.Em±	0.60	0.11	0.08	0.09	0.33	0.08	0.03	0.06
C.D.	1.76	0.34	0.25	0.26	0.97	0.23	0.09	0.18
Effect of date of sowing								
D ₁	34.25	9.31	8.22	8.40	43.14	28.81	2.50	24.74
D ₂	32.88	8.52	7.53	7.68	40.96	28.53	2.20	24.42
D ₃	31.90	8.25	7.35	7.51	40.14	28.67	2.13	24.43
S.Em±	0.52	0.10	0.07	0.08	0.28	0.07	0.03	0.05
C.D.	1.52	0.29	0.22	0.23	0.84	0.20	0.08	0.16
Interaction effect between phosphorous and date of sowing								
P ₀ D ₁	29.20	7.85	6.93	6.67	38.75	27.40	2.01	23.14
P ₀ D ₂	28.13	7.13	6.27	6.13	36.72	27.30	1.77	22.91
P ₀ D ₃	27.47	7.05	6.20	6.07	36.43	27.28	1.74	22.86
P ₁ D ₁	32.53	8.74	7.73	7.53	41.28	28.04	2.23	23.91
P ₁ D ₂	31.00	8.19	7.20	7.13	39.80	28.01	2.06	23.80
P ₁ D ₃	30.27	8.01	7.00	7.00	39.29	28.00	2.01	23.76
P ₂ D ₁	35.67	10.10	8.80	9.47	45.63	29.93	2.87	25.93
P ₂ D ₂	33.67	8.57	7.67	7.87	41.27	28.93	2.22	25.03
P ₂ D ₃	32.07	8.04	7.33	7.63	39.70	29.45	2.12	25.17
P ₃ D ₁	39.60	10.53	9.40	9.93	46.91	29.88	2.89	25.96
P ₃ D ₂	38.73	10.20	9.00	9.57	46.05	29.91	2.75	25.95
P ₃ D ₃	37.80	9.91	8.78	9.33	45.15	29.95	2.65	25.93
S.Em±	1.03	0.20	0.15	0.16	0.57	0.14	0.05	0.11
C.D.	NS	0.58	NS	0.46	1.67	0.41	0.15	0.32

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