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Influence of weather parameters at different sowing dates on growth and yield of varieties of chick pea (*Cicer arietinum* L.) Under Prayagraj agro-climatic condition

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Abstract

The field experiment was conducted to study the performance of chickpea varieties (C-205, C-206 and C-208) under different date of sowing viz., 10th November, 20th November and 30th November in Rabi season at Prayagraj. There were 9 treatment combinations formed due to 3 sowing dates. The varieties showed significant difference in plant height, No of branches, (primary and secondary branches), 50% flowering, number of seed/pod, number of seeds/plant, grain yield kg/ha, straw yield kg/ha, test weight g/100 seeds, harvest index %. Sowing time C-206 sown on 10th NOV (D1V2) has produced highest grain yield 18.833 qt/ha than other two varieties. This sowing time has showed the significant difference in plant height, no of branches, 50% flowering, primary and secondary branches, number of seeds/plant, grain yield kg/ha, test weight g/100seeds, straw yield kg/ha however seed yield was reduced consequently as the delayed date of sowing. The 1st date of sowing and variety C-206 shows the highest test weight and grain yield. The study further revealed that early date of sowing gives satisfactory yield compare to other date of sowing therefore suggested that C-206 could be sown up to early November (20th Nov) under the Prayagraj agro climatic conditions for better yield.

Keywords: Chick pea, growth, sowing time, varieties, yield

1. Introduction

India ranks first in the production and consumption of chickpea (*Cicer arietinum*. L.) in the world. Chickpea is a most important pulse crop of India which is mostly grown under dry land condition with heavy cloudy soil. It is a rich source of nutritional values in the diet of Indian people because of containing 21.5 percent protein, 64.5% carbohydrates and 4.5% fat (Ahlawat and Omprakash, 1996) which is comparatively deficient in the cereals and oilseeds. Among the states Madhya Pradesh is the largest producer of chickpea in India. In M.P. chickpea is cultivated in 3.13 million ha with the production of 3.81 million tones with an annual productivity of 1220 kg/ha (Commissioner Land Records, M.P. Gwalior, 2012-13).

Chickpea is cool season crop. It's yield and quality is mostly depend on climatic parameters and time of sowing. It is a short durational crop and requires relatively low temperature for its optimum growth. Date of sowing plays an important role in yield and yield attributes of chickpea. Delayed sowing reduces growing period, hastens maturity and ultimately reduces yield. Soil moisture plays a critical role in chickpea production influencing the plant growth right from the seedling establishment to maturity.

Temperature is an important weather parameter that affects plant growth, development and yield. Winter crops are vulnerable to high temperature during reproductive stages and differential response of temperature change (rise) to various crops has been noticed under different production environments. Temperature based indices like growing degree days (GDD), Helio thermal units (HTU), Pheno-thermal index (PTI), and Heat use efficiency (HUE) can successfully be used for describing phenological behavior and other growth parameters like leaf area development, biomass production and yield.

In the view of recent climate change situation, the weather parameters are highly influencing the crop productivity simultaneously due to global warming wherein there is an increase in day temperature and drastic reduction in the night temperature. Among pulses, chickpea is more sensitive to temperature. Hence, the present investigation was carried out to understand the influence of weather parameters and effect of different sowing

dates on growth and yield of varieties of chickpea under Prayagraj agro climatic conditions.

2. Material and Methods

A field experiment was conducted at Research farm of College of Forestry SHUATS, Prayagraj during the Rabi season of year 2018-2019. Prayagraj has a sub-tropical climate prevailing in the south east of U.P. With both the extremes in temperature winter and summer. In cold winters the mercury sometimes falls to 4-5 °C in January and during summer the temperature rises up to 46-48 °C during the month of may and June. The average annual rainfall is 1013 mm, which is mainly received during the middle of July to end of August. Prayagraj experiences three seasons. Hot and dry summer, cool and dry winter and warm humid monsoon. The soil of experimental field was sandy loam deep in texture, low in organic carbon (0.28%), available nitrogen (100 kg/ha), and medium in available phosphorus (17 kg/ha) and high in available potassium (264 kg/ha).

The experiment consists of nine treatment combinations (T1 to T9) with three dates of sowing viz., 10th November (D1), 20th November (D2) and 30th November (D3) and three varieties viz., C-205 (V1), C-206 (V2), and C-208 (V3). The experiment set up at 3x3 factorial randomized complete block design (RBD) in split plot arrangement with three replications. Sowing dates were randomized in the main plots while varieties were randomized in subplots.

Treatment combination

T1 (C-205 + 10 NOV), T2 (C-205+ 20 NOV), T3 (C-205+ 30 NOV)
 T4 (C-206+ 10 NOV), T5(C-206+ 20 NOV), T6(C-206+30NOV)
 T7(C-208+10NOV), T8(C-208+ 20NOV) and T9(C-208+ 30 NOV)

3. Result and Discussion

In the present study, plant height (cm), number of branches per plant, primary and secondary branches, Days taken for 50% flowering, number of seeds per pod, number of pods per plant, seed index (g/100), grain yield (q/h), straw yield (q/h), harvest index (%) were computed and average weather parameters like maximum and minimum temperatures, morning, evening relative humidity, sunshine hours were computed at different phenophases. Accumulated heat indices such as growing degree days, heliothermal units and photo thermal units were computed for different cultivars of chick pea.

The plant height was Non-significantly influenced on sowing dates and varieties of chick pea. The maximum 58.12cm was recorded in D₁V₂ (10th NOV + C-206).The minimum plant height 50.93 was recorded in D₃V₃ (30th NOV+ C-208).The number of branches per plant was significantly influenced on sowing dates and varieties of chick pea. The maximum 13.50 was recorded in D₁V₂ (10th NOV + C- 206) the minimum number of branches per plant 10.03 was recorded in D₃V₃ (30th NOV + C- 208). The number of Primary and secondary branches was significantly influenced on sowing dates and varieties of chick pea. The maximum primary and secondary branches 3.60 and 7.40 was recorded in D₁V₂.The minimum Number of Primary and secondary Branches 2.85and 5.94 was recorded In D₃V₃The days to 50% flowering was

significantly influenced on sowing dates and varieties of chick pea. The maximum days to 50% flowering 77.13 was recorded in D₁V₂.The minimum Days to 50% Flowering 69.66 was recorded in D₃V₃. The number of Pods per Plant was significantly influenced on sowing dates and varieties of chick pea. The maximum number of pods per plant 43.00 was recorded in D₁V₂. The minimum Number of Pods per Plant 35.00 was recorded In D₃V₃.The number of seeds per pod was non-significantly influenced on sowing dates and varieties of chick pea. The maximum number of seeds per pod 3.66 was recorded inD₁V₂.The minimum number of seeds per pod 2.00 was recorded in D₃V₃The seed index was significantly influenced on sowing dates and varieties of chick pea. The maximum seed index 32.60 was recorded in D₁V₂. The minimum seed index 23.73 was recorded in D₃V₃The grain yield (qt/ha) was significantly influenced on sowing dates and varieties of chick pea. The maximum grain yield 18.83 (qt/ha) was recorded in D₁V₂. The minimum grain yield 14.40 (qt/ha) was recorded in D₃V₃. The straw yield (qt/ha) was significantly influenced on sowing dates and varieties of chick pea. The maximum straw yield 2.12(qt/ha) was recorded in D₁V₂. The minimum straw yield 1.51 (qt/ha) was recorded in D₃V₃The harvest Index % was non-significantly influenced on sowing dates and varieties of chick pea. The maximum 97.26 was recorded in D₂V₃. The minimum Harvest Index 87.56% was recorded in D₂V₂.

Table 1: Influence of sowing dates and varieties on plant height (cm) of chick pea.

Treatment Combination	D1	D2	D3	Mean
V ₁	54.46	53.85	52.96	53.7
V ₂	58.12	57.04	57.05	57.4
V ₃	52.10	51.01	50.90	51.3
Mean	54.8	53.9	53.6	
	F -TEST	C.D (5%)	S.Em.	
Due to date of sowing	0.4	0.71	0.33	
Due to variety	3.1	0.71	0.33	
Due to interaction	NS	NS	0.57	

Table 2: Influence of sowing dates and varieties on no. of branches per plant of chick pea

Treatment Combination	D1	D2	D3	Mean
V ₁	11.90	11.86	11.24	11.66
V ₂	13.50	12.63	12.50	12.87
V ₃	10.82	10.29	10.03	10.38
Mean	12.07	11.59	11.25	
	F -TEST	C.D (5%)	S.Em.	
Due to date of sowing	S	0.35	0.16	
Due to variety	S	0.35	0.16	
Due to interaction	NS	-	0.28	

Table 3: Influence of sowing dates and varieties on no. of primary branches

Treatment Combination	D1	D2	D3	Mean
V ₁	3.20	3.18	3.02	3.13
V ₂	3.60	3.46	3.34	3.47
V ₃	2.95	2.89	2.85	2.89
Mean	3.25	3.17	3.07	3.16
	F TEST	C.D (5%)	SEm	
Due to date of sowing	S	0.14	0.48	
Due to variety	S	0.14	0.48	
Due to interaction	NS	-	0.83	

Table 4: Secondary branches of chick pea.

Treatment Combination	D1	D2	D3	Mean
V ₁	7.08	6.94	6.91	6.98
V ₂	7.40	7.22	7.19	7.27
V ₃	6.48	6.10	5.94	6.17
Mean	6.98	6.75	6.68	6.80
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	0.16	0.05	
Due to variety	S	0.16	0.05	
Due to interaction	N/S	-	0.09	

Table 5: Influence of sowing dates and varieties on days to 50% flowering of Chick pea crop.

Treatment Combination	D1	D2	D3	Mean
V ₁	74.90	73.66	72.86	73.80
V ₂	77.13	76.23	75.86	76.40
V ₃	71.40	70.46	69.66	70.50
Mean	74.476	73.45	72.793	73.57
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	1.18	0.55	
Due to variety	S	1.18	0.55	
Due to interaction	NS	-	0.95	

Table 6: Influence of sowing dates and varieties on no. of pods per plant of chick pea crop.

Treatment Combination	D1	D2	D3	Mean
V ₁	40.00	39.00	38.00	39
V ₂	43.00	42.00	41.00	42
V ₃	37.00	36.00	35.00	36
Mean	40	39	38	39
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	0.95	0.31	
Due to variety	S	0.95	0.31	
Due to interaction	N/S	-	0.54	

Table 7: Influence of sowing dates and varieties on no. of seeds per pod of chick pea crop

Treatment Combination	D1	D2	D3	Mean
V ₁	2.66	2.66	2.66	2.66
V ₂	3.66	3.33	3.33	3.44
V ₃	2.00	2.00	2.00	2
Mean	2.77	2.66	2.66	2.70
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	N/S	-	0.16	
Due to variety	S	0.48	0.16	
Due to interaction	N/S	-	0.27	

Table 8: Influence of sowing dates and varieties on no. of seeds per pod of seed index (g) of chick pea crop

Treatment Combination	D1	D2	D3	Mean
V ₁	29.53	28.50	27.56	28.53
V ₂	32.60	31.40	30.90	31.63
V ₃	26.02	24.76	23.73	24.84
Mean	29.38	28.22	27.4	28.33
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	1.11	0.36	
Due to variety	S	1.11	0.36	
Due to interaction	N/S	-	0.63	

Table 9: Influence of sowing dates and varieties on grain yield (qt/ha) different varieties of chick pea crop.

Treatment Combination	D1	D2	D3	Mean
V ₁	17.40	16.66	15.90	16.65
V ₂	18.83	18.03	17.60	18.15
V ₃	15.53	15.36	14.40	15.1
Mean	17.25	16.68	15.96	16.63
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	0.71	0.23	
Due to variety	S	0.71	0.23	
Due to interaction	N/S	-	0.41	

Table 10: Influence of sowing dates and varieties on Straw yield (qt/ha) of chick pea crop

Treatment Combination	D1	D2	D3	Mean
V ₁	1.92	1.88	1.77	1.86
V ₂	2.12	2.06	2.00	2.06
V ₃	1.64	1.58	1.51	1.57
Mean	1.89	1.84	1.76	1.83
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	S	0.08	0.02	
Due to variety	S	0.08	0.02	
Due to interaction	N/S	-	0.04	

Table 11: Influence of sowing dates and varieties on Harvest index (%) of chick pea crop

Treatment Combination	D1	D2	D3	Mean
V ₁	90.65	88.31	89.66	89.54
V ₂	88.68	87.56	88.09	88.11
V ₃	94.75	97.26	95.89	95.96
Mean	91.36	91.04	91.21	91.20
	F TEST	C.D (5%)	S.Em	
Due to date of sowing	N/S	-	14.70	
Due to variety	S	44.45	14.70	
Due to interaction	N/S	-	25.46	

Conclusion

The results of experiment can be concluded as sowing dates and varieties showed significant effect on plant height, no. of branches, no. of primary and secondary branches, days to 50% flowering, number of seed/pod, number of seeds/plant, seed index g/100 seeds. The highest grain yield 18.833 Qt/ha and straw yield 2.123 Qt/ha was found in the variety C-206, harvest index 97.26% as per the growth parameters is concerned variety C-206 showed good result compare to other two varieties.

The weather parameter are temperature, relative humidity, wind and rainfall are significantly influenced on growth and yield of chick pea crop. The study revealed that early date of sowing and the variety C-206 gives satisfactory yield to compare the other. The date of sowing and the accumulation of GDD, PTU and HTU was significantly highest in this variety C-206 therefore, it is suggested that C-206 could be sown up to early November under the Prayagraj agro-climatic conditions for better yield.

The economics feasibility performance is concerned variety C-206 and 1st date of sowing (NOV 10th) showed the maximum benefit cost ratio (*i.e.* 1:6.6).

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