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Effect of Nipping and Planting Geometry on the Growth and Yield of Chickpea (*Cicer arietinum* L.) in Bundelkhand Region of U.P., India

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Abstract **– Chickpea is an important crop in the cropping pattern supplying cheap protein diet especially for poor people and flourish the soil with nitrogen supply. Over the years, however, low yields are more prominent declining acceptability of this crop. Apart from other production enhancement indicators, nipping appeared to be a factor increasing yield and yield contributing parameters. To investigate the appropriate nipping technique as well as to sort out combination of spacing and nipping, an experiment was conducted during 2019-20 with chickpea variety Pusa-256. Nipping was done on four different crop growth stages viz. ground level, at 10 cm plant height, at 15 cm plant height and control (no nipping) with planting geometry 30×10 cm, 40×13 cm, 50×16 and 60×20 cm. Among the parameters studied, number of number of primary, secondary and tertiary branches plant-1, dry biomass plant-1 and number of nodules plant-1 were found maximum with the nipping at 15 cm plant height with planting geometry of 60×20 cm. Number of pods plant-1, weight of pods plant-1, number of seeds pod-1 were found significantly more with nipping at 15 cm height of plant in the combination of 60×20 cm planting geometry. Significantly highest seed yield was calculated with nipping at 15 cm plant height, while in relation to planting geometry the 50×16 and 60×20 cm were calculated statistically at par, but highest seed yield was calculated with 50×16 cm of planting geometry. The research concluded that nipping is a profitable practice for chickpea growers.**

Keywords **– Chickpea, Growth, Yield, Nipping, Plant Geometry.**

I. INTRODUCTION

Pulses historically have been one of the most important constituent of the Indian cropping and consumption patterns and long considered “the poor man's meat” as it is one of the less expensive sources of protein (Mohanty and Satyasai 2015). Among pulses, chick pea (*Cicer arietinum* L.) is preferred to food legumes because of its multiple uses for growing population across the world. During 2017-18, globally it was grown on 149.66 lakh ha area, with the total production of 162.25 lakh tonnes (FAOSTAT, 2019) and average productivity of 1252 kg/ha. Out of which, 71 per cent of global area with 70 per cent of global production of chick pea is contributed by India as it ranks 1st in area and production but lags behind several countries in terms of productivity because of poor adoption of improved varieties and production technologies by farmers. Apart from India, Australia (12.35%), Myanmar (3.25%) and Ethiopia (2.92%) are the major chick pea producing countries of the world. The chick pea production in India has gone up from 38.55 to 112.29 lakh tonnes during 2000-01 to 2017-18, while the area has also gone up from 51.85 to 105.61 lakh ha, whereas, the yield has steadily increased from 744 kg ha-1 to 1063kg ha-1 during the same period.

Madhya Pradesh is leading state in terms of area and production as it contributes around 34 and 40 per cent share to the total area and production of gram in the country. Madhya Pradesh stood first among all the states in both area (3.59 mha) and production (4.60 mt) of chickpea but productivity (1280 kg ha $^{-1}$) is far below its yield potential, chickpea is grown under rainfed as well as irrigated condition in India.

System of chickpea intensification has been reported to produce higher seed yield of chickpea compared to conventional sowing method recently (Sonboir and Tripathi, 2017) which is attributed with wider spacing and nipping practice. Row spacing is also considered an important variable influencing yield of crops. Appropriate adjustment between the rows facilitates easy handling of crops which leads to increased potential for protein synthesis through better nutrition, more air and light penetration, resulting in higher yields. Agronomic practices like nipping in chickpea is one of the important parameter for the enhancement of yield and yield contributing parameters (Reddy et al, 2003). The foliage nipping at early stages of crop could increase number of branches while restricting profuse vegetative growth thereby promoting crop yield. Nipping at various stages tended to enhance number of branches and number of pods that in turn boost chickpea yield. Nipping practice in the research area has twofold advantage. On the one hand nipping at prescribed growth stages could improve yield of the crop while on the other band during time the chickpea in the field is usually a shortage of fodder and poor farmers could not afford to buy forage at distant locations, so chickpea may provide them an opportunity to fetch green fodder for their livestock (Sonboir *et al*., 2017).

In light of important of chickpea and its yield losses owing to improved agronomic practices, a field experiment entitled "Effect of nipping and planting geometry on the growth and yield of Chickpea (*Cicer arietinum* L.) in Bundelkhand region of U. P." during autumn season of 2019-20 at the agricultural research farm of Brahmanand Post Graduate College, Rath (Hamirpur) U.P. was conducted.

II. Materials and Methods

The field experiment was conducted at research farm of Brahmanand Post Graduate College, Rath (Hamirpur) U.P. during winter season of 2019-20 in the subtropical zone at latitude and longitudinal range of 79.7^0 East and 25.5^0 North. It is located at an elevation range of 526 feet's from the mean sea level. The annual rainfall ranges between 875-975 mm, which is received mostly from last week of June to last of September with occasional shower in winter. The soil of the experimental field was Parwa in texture having soil pH 7.6, organic carbon 0.53%, field capacity 17.33 %, permanent wilting point 6.8% and bulk density 1.48 gm/cm^3 respectively. The available nitrogen, phosphorous and potassium were 108.8, 24.55 and 123.0 kg per ha^{-1}, respectively. Sixteen combinations of four nipping stages i.e. No nipping, nipping at ground level, nipping at 10 cm height and nipping at 15 cm height and four spacing i.e. 30×10 cm, 40×13 cm, 50×16 and 60×20 cm were used for the experiment.

Sowing of seeds of chickpea variety Pusa-256 was undertaken in the field at crop spacing of as per the treatments on 25thOctober 2019. The fertilizer dose of N, P_2O_5 and K_2O was applied at rate of 20:40:20 $kgha^{-1}$. Observation dry biomass $plant^{-1}$ (g), No. of primary, secondary and tertiary $branchesplant^{-1}$, number of nodules $plant^{-1}$, No of pods $plant^{-1}$, weight of pods $plant^{-1}$ and number of seeds $plant^{-1}$ and seed yield (q ha^{-1}) were recorded. The data collected from the experiment was analysed statistically using the analysis of variance procedure, appropriate for the factorial randomized block design. The test of significance was carried out at 5 per cent level.

III. Results and Discussion

Growth Characters:

Table 1 shows that plant height was significantly differed with different nipping methods. Significantly high-

-est plant height (46.23) at 90 DAS was measured in the plot which was not applied with nipping process followed by nipping at 10 cm height, 15 cm height and the least height of plant was measured with the nipping at ground level i.e. 45.56 cm, 42.24 cm and 39.25 cm. The highest plant height was due to the continuous growth of apical portion of plant. Significantly highest dry biomass (29.45 g) was weighed with the no nipping plot due to excessive growth of plant which was significantly more over nipping at 10 cm height, 15 cm height and the nipping at ground level respectively. Dry biomass was found statistically at par between nipping at 10 cm of plant height and nipping at 15 cm of plant height, both these treatment could not differed significantly amongst each other in this regards. The minimum biomass (20.12 g) at 90 DAS was weighted with the nipping at ground level these findings were also produced by Yadav *et al.* (2017).

Table 1. Growth parameters and yield attributes influenced by weed control methods and mulching source.

Treatment	Plant height (cm) at 90 DAS	Dry weight plant^{-1} at 90 DAS	Number of primary branches plant^{-1} at 90 DAS	Number of Secondary branches plant^{-1} at 90 DAS	Number of Tertiary branches plant^{-1} at 90 DAS	Number of nodules plant^{-1} at 90 DAS	Number of pods plant^{-1}	Weight of pods plant^{-1} (g)	Number of seeds pod^{-1}	Seed yield (qha^{-1})	B:C Ratio
Nipping Stages											
No nipping	46.23	29.45	5.25	5.33	1.44	18.01	21.12	5.54	2.26	9.66	1.5
Nipping at ground level	39.25	20.12	5.36	5.40	1.62	24.53	24.10	7.15	2.32	13.47	1.6
Nipping at 10 cm height	45.56	25.32	5.01	5.45	2.15	26.70	29.86	7.58	2.34	18.52	1.7
Nipping at 15 cm height	42.24	26.65	5.52	6.65	2.45	30.07	32.83	7.88	2.65	25.60	1.6
S.E. (d) ±	0.929	1.601	0.168	0.335	0.37	0.05	0.03	0.10	0.05	0.171	
C.D. at 5%	2.681	4.623	0.486	0.968	.223	2.110	0.810	0.200	0.220	0.494	
Spacing (cm)											
30×10	39.63	24.22	4.52	5.65	1.25	18.69	25.41	7.57	2.24	11.25	1.2
40×13	41.36	25.33	5.22	6.69	2.00	25.15	27.85	8.28	2.28	20.23	1.6
50×16	42.04	26.45	5.25	6.87	2.02	26.20	28.58	8.38	2.29	19.49	1.3
60×20	44.86	28.65	6.66	8.44	2.99	30.51	30.06	9.41	2.35	13.44	1.2
S.E. (d) ±	0.929	1.601	0.168	0.335	0.374	0.05	0.39	0.10	0.05	0.171	
C.D. at 5%	2.481	1.623	0.486	0.968	0.81	2.05	0.81	0.20	0.223	0.494	

Growth pattern was found changed when the number of primary, secondary and tertiary branches plant^{-1} were counted at 90 DAS. Significantly highest number of primary, secondary and tertiary branches plant^{-1} (5.52, 6.65, 2.45) were counted with the nipping at 15 cm of plant height followed by the nipping at 10 cm plant height, nipping at ground level and the control (no nipping).

Number of nodules are the important parameter in the chickpea plant which helps in fixing the free nitrogen from the environment within the plant, which were counted at 90 DAS in this trial. Significantly highest number of nodules plant^{-1} (30.07) were counted with the nipping at 15 cm of plant height which were significantly more over nipping at 10 cm of plant height (26.70), nipping at ground level (24.53) and the lowest with no nipping plot i.e. 18.01.

Plant spacing significantly differed with increasing of space between plants. Significantly highest value for plant height (44.86), dry weight plant^{-1} (28.65 g), number of primary branches plant^{-1} (6.66), secondary branches plant^{-1} (8.44) and tertiary branches plant^{-1} (2.99) and number of nodules plant^{-1} (30.51) were observed in 60×20 cm (83333 plants ha^{-1}) followed by 50×16 cm (125000 plants ha^{-1}), 40×13 cm (192307 plants ha^{-1}), 30×10 cm (333333 plants ha^{-1}), respectively, due to optimum availability of sunlight, plant nutrients and water to the particular plant. The plant spacing 40×13 cm (192307 plants ha^{-1}) and 50×16 cm (125000 plants ha^{-1}) were found statistically at par among each other in this regards. Aziz M.A. (2000) was also found similar results.

Yield Attributes and Yield

Yield attributes are the results of their particular enhanced growth parameters. Highest number of pods plant^{-1} (32.83) were counted with the nipping at 15 cm of plant height which was statistically over the nipping at nipping at ground level (24.10) and the no nipping, respectively. Significantly lowest number of pods plant^{-1} were counted with (21.12) the plot with no nipping in this regards. Similar trend was scene in the weight of pods plant^{-1} which was found significantly maximum with the nipping at 15 cm of plant height (7.88 g) followed by nipping at 10 cm of plant height, ground level and no nipping, respectively. Number of seeds pod^{-1} were counted and found that the nipping at 15 cm of plant height was recorded highest number of pods^{-1} which was significantly over nipping at ground level and no nipping plot, respectively similar results were also produced by Khan *et al.* (2003). All these yield contributing characters viz. number of pods plant^{-1}, weight of pods plant^{-1} and number of seeds pod^{-1} were counted significantly at par with the nipping at 10 cm of plant height. Sujatha et al. (2017) was also agree with similar findings.

Seed yield is the important factor which determines the suitability of any input in the crop. Highest seed yield (25.60 qha^{-1}) was calculated with the nipping at 15 cm of plant height which was significantly more over the nipping at 10 cm of plant height, nipping at ground level and the no nipping respectively. The nipping at 10 cm of plant height was significantly more over the nipping at ground level and the ground level nipping was significantly crossed to the control plot. The results are supported with Baloch M.S. and Zubair, M. (2010).

Significantly highest growth attributing characters viz. number of pods plant^{-1}, weight of pods plant^{-1} and number of seeds pod^{-1} were counted with 60×20 cm (83333 plants ha^{-1}) followed by 50×16 cm (125000 plants ha^{-1}), 40×13 cm (192307 plants ha^{-1}), 30×10 cm (333333 plants ha^{-1}), respectively, due to their enhanced growth characters. While the minimum values were recorded with 30×10 cm (333333 plants ha^{-1}). Seed yield q ha^{-1} significantly increased with 40×13 cm (192307 plants ha^{-1}) and it was calculated 20.43 q ha^{-1} on net plot basis which was 3.79%, 33.56% and 44.38% more over 50×16 cm (125000 plants ha^{-1}), 60×20 cm (83333 plants ha^{-1}) and 30×10 cm (192307 plants ha^{-1}), respectively. The seed yield with 40×13 cm (192307 plants ha^{-1}) was increased due to optimum utilization of light, nutrients and water by the plants, Abd el (2012).

Benefit cost ration is the key to find out actual potentiality of any input in the crop so the B:C ratio was work-

-out per hectare on the net plot basis. The highest B:C ratio was calculated with nipping at 10 cm of plant height and 40×13 cm (192307 plants ha^{-1}). The results are in consonance with Patel *et al.* (2013).

Meteorological Observations:

Chickpea is sensitive to light and temperatures and it requires long days and cool temperatures. Average around 20°C with warm days (20°- 25°C) and cool (5°-10°C) and chickpea uses 100 to 450 mm of water.

Date presented in table (2) indicated that during the year (2019-20) the total rainfall was above normal and during cropping period, the rainfall from September to February was as high as 16.00 mm which was much lower from normal of 125.50 mm. However proper irrigation facilities were available at research farm and the crop was irrigated as per schedule. During the crop growth period in 2019-20 the lowest and highest mean temperature recorded 5.1^0C and 35.6^0C but during the peak growth stage of crop it was not exceeded beyond 28^0C which is quite favourable for chickpea growth. Relative humidity is one of the most important constraints for chickpea growth which must be in the range of 80-90 percent. Highest humidity was recorded in the month of January and February 2020 which was in the range of 88-90 and it is most favourable humidity for the chickpea growth. Similar findings were presented by Patil and Halikatti (2013).

Table 2. Meteorological study.

Standard Meteorological Week		40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13
Temperat-ure (^{0}C)	**Max**	35.8	34.6	34.8	33.6	32.1	29.4	3.9	3.2	26.5	25.7	22.9	22.8	21.9	23.6	21.2	22.9	21.4	21.5	22	23.5	27.3	23.3	26.4	28	32.2	35.6
	Min	20	18.3	15.9	14.9	14.5	11.1	11.9	11.4	9.8	8.1	7.0	4.8	4.8	5.8	5.1	4.8	8.2	5.9	7.7	9.5	11	9.4	11.7	12.3	14.1	16.4
Relative Humidity (%)	**I**	80	79	76	75	78	79	83	81	81	78	87	90	91	88	88	90	90	89	89	90	83	89	82	80	75	63
	II	36	36	36	38	43	47	46	44	44	43	46	49	56	48	52	45	55	58	57	45	47	52	44	43	38	33
Rainfall (mm)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.4	0.4	0	3.2	0	0	0	0
Evaporation (mm)		5.3	5.3	5.3	5.1	4.4	4.4	3.9	3.6	3.6	3.3	0.7	2.7	2.3	2.6	2.4	2.5	2.4	2.5	2.7	2.8	3.8	4	4.4	5	6	7.6

IV. CONCLUSION

The present investigations were carried out with a purpose to assess the adoption of nipping and proper plant population in chickpea crop in terms of technical feasibility and yield. The findings of the study are encouraging to adopt nipping at 10 cm height of plant and plant geometry 40×13 cm (192307 plants ha^{-1}) in chickpea crop for obtaining higher seed yield.

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