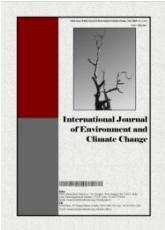

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Effect of Spacing and Panchagavya on Growth and Yield Attributes of Chickpea (*Cicer arietinum* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted during *rabi* season 2021-22 at the experimental field of the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India. The experiment was laid out in randomized block design with nine treatments replicated thrice. The treatments consisted of three levels of spacing (20 cm x 10 cm, 30 cm x 10 cm, 40 cm x10 cm) and three concentrations of panchagavya (2, 3 and 5%). The results revealed that significantly higher plant height (51.1 cm), maximum number of nodules/plant (11.7) and higher plant dry weight (25.7 g). Whereas the maximum number of pods/plant (62.0), higher seeds/pod (1.86), maximum seed index (22.9 g), higher seed yield (2.58 t/ha), higher stover yield (5.34 t/ha) and higher harvest index (36.6%) were recorded in the treatment-5 (30 cm x 10 cm + panchagavya 3%).

Keywords: Chickpea; spacing; panchagavya; growth and yield.

1. INTRODUCTION

Pulses are valuable source of dietary protein and have a specific ability to sustain and preserve soil fertility by adding biological nitrogen fixation. Pulses are restoratives crops and leaves quite enough as 30 kg/ha nitrogen in soil. Among the pulses, chickpea is an important

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Rabi season crop with high acceptability and wider use in nutritional food basket.

Chickpea contains 18-22% protein, 52-70% carbohydrate, 4-10% fat and sufficient quantity of minerals, calcium, phosphorus, iron and vitamins. In India pulses are grown nearly in 28.83 m ha with an annual production of 25.72 m t and productivity of 0.8 t/ha. Some of the states like uttar pradesh is about 8.24 m ha with an annual production of 9.97 m t and productivity of 1.08 t ha major producer of chickpea in India as advocated by Ministry of agriculture and Farmer Welfare [1]. Besides, "it is also important for sustainable agriculture as it improves the physio-chemical and biological properties of the soil. Its deep roots also open the soil, which ensure better aeration and heavy leaf drop increases the organic matter in the soil. It can fix about 25-30 kg N/ ha through symbiosis and these minimize dependency on chemical fertilizers. Thus, chickpea plays a vital role in improving the soil health" [2].

"Row spacing is one of the important characters which can be manipulated to attain the maximum production from per unit land area. The optimum row spacing with proper geometry of planting is dependent on variety, its growth habit and agro climatic condition. The seed yield of chickpea is highly dependent on plant population. Seed yield increases with decrease in row spacing up to an optimum limit which changes according to genotypes. Row spacing is also one of the important factor which ultimately effect nutrient uptake growth and yield of plant. Increase in spacing decreases the total population, but with more nutrition to the individual plants grows better and yield more and vice versa. The increases or decreases of plant population has definite pattern in relation to the yield" [3].

An organic product called panchagavya can be utilised as manure. Cow dung, cow urine, and cow milk are the three basic elements used in its preparation. Desi curd and animal ghee. In order to help plants grow and become more resistant to disease, panchagavya is utilised in organic farming. An organic compound called panchagavya has the ability to support plant growth and provide immunity. Panchagavya is made up of five ingredients: milk, curd, ghee, cow dung, and cow urine. When combined and applied properly, these have astonishing results. "Plants sprayed with Panchagava invariably produce bigger leaves and develop denser canopy. The photosynthetic system is activated for enhanced biological efficiency, enabling synthesis of maximum metabolites and photosynthates. The key feature of Panchagavya is its efficacy to restore the yield level of all crops when the land is converted from inorganic cultural system to organic culture from the very first year. The harvest is advanced by 15 days in all the crops. It not only enhances the shelf life of vegetables, fruits and grains, but also improves the taste" [4].

2. MATERIALS AND METHODS

The experiment was carried out during *Rabi* season of 2021-22 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). Which is located at 25^0 30' 42''N latitude, 81^0 60' 56" E longitude, and a height of 98 meters above sea level. The soil texture in the experimental plot was sandy loam, with a practically neutral soil (PH 7.1), low in organic carbon (0.44%) available N (171.48 kg/ha), available P (27.0 kg/ha) and K (291.2 kg/ha). The crop was sown on 13 December 2021 using variety NBeG-49. The experiment was set up in a Randomized Block Design with three replications and nine treatments in total *Viz.,* T1: 20cm x 10 cm + Panchagavya 2%, T2: 30 cm x 10 cm + Panchagavya 2%, T3: 40 cm x 10 cm + Panchagavya 2%, T4: 20 cm x 10 cm + Panchagavya 3%, T5: 30 cm x 10 cm + Panchagavya 3%, T6: 40 cm x 10 cm + Panchagavya 3%, T7: 20 cm x 10 cm + Panchagavya 5%, T8: 30 cm x 10 cm + Panchagavya 5% and T9: 40 cm x 10 cm + Panchagavya 5%. Panchagavya application is done through foliar spray. The growth Parameters and yield attributes were recorded at harvest form randomly selected plants in each plot. The data was computed and analyzed by following statistical method of [5].

3. RESULTS AND DISSCUSSION

3.1 Effect of Spacing and Panchagavya on Growth Attributes of Chickpea

3.1.1 Plant height (cm)

At harvest the significant and higher plant height (51.1 cm) was recorded in treatment 5 (Spacing 30 cm x 10 cm + Panchagavya 3%). However, treatment 6 (40cm x 10 cm+ Panchagavya 3%) and treatment 8 (30 cm x 10 cm + Panchagavya 5%) was found statistically at par with treatment 5

(Spacing 30 cm x 10 cm + Panchagavya 3%). The significantly higher plant height was under treatment of spacing 30 cm x 10 cm this might be due to plant get sufficient space under wider spacing for light, air and nutrition for better growth and development. Similar findings also reported by [6].

3.1.2 Number of nodules/plant

Significantly maximum number of nodules / plant (11.7) was recorded in treatment 5 (Spacing 30 cm x 10 cm + Panchagavya 3%). However, treatment 6 (40 cm x 10 cm + Panchagavya 3%) and treatment 8 (30 cm x 10 cm + Panchagavya 5%) were found statistically at par with treatment 5 (Spacing 30 cm x 10 cm + Panchagavya 3%). Significant and maximum number of root nodules / plant might be due to the better availability of nutrients from panchagavya which has many nutrients and effective conversion of nutrients from organics such as Fe, Mg and Zn available at the site of photosynthesis. When panchagavya 3% was used, it was seen that there were more nodules overall and more productive root nodules, which led to the expression of higher growth and yield-attributing characteristics and increased chickpea production. Similar findings also reported by [7].

3.1.3 Plant Dry weight (g)

Significantly maximum plant dry weight (25.7 g) was recorded in treatment 5 (Spacing 30cm x 10 cm + Panchagavya 3%). However, treatment 6 (40 cm x 10 cm + Panchagavya 3 %) and treatment 8 (30 cm x 10 cm + Panchagavya 5%) were found statistically at par with treatment 5 (Spacing 30 cm x 10 cm + Panchagavya 3%). Significant increases in plant dry weight may be attributed to Panchagavya foliar spray made improvements in dry matter accumulation, chlorophyll content, and nitrogen content discussed above may be attributed to higher yield and yield attributes with Panchagavya. Similar findings also reported by [8,9].

3.2 Effect of Spacing and Panchagavya on Yield and Yield Attributes of Chickpea

3.2.1 Number of pods/plant

Treatment-5 (30 cm x 10 cm + Panchagavya 3%) was recorded significantly maximum number of pods/plant (62.0) which was superior over all other treatments. However, treatment 6 (40 cm x 10 cm + Panchagavya 3%) and treatment 8 (30 cm x 10 cm + Panchagavya 5%) was found statistically at par with treatment 5 (30 cm x 10 cm + Panchagavya 3%).Significant increase number of pods/plant this might be due panchagavya which is an efficient plant growth stimulant that enhanced the biological efficiency of crops. Similar findings also reported by [10].

3.2.2 Number of seeds/pod

Treatment-5 (30 cm x 10 cm + Panchagavya 3%) was recorded significantly maximum number of seeds per pod (1.86) which was superior over all other treatments However, treatment 6 (40 cm x 10 cm +Panchagavya 3%) and treatment 8 (30 cm x 10 cm + Panchagavya 5 %) were found statistically at par with treatment 5 (30 cm x 10 cm + Panchagavya 3%).Significant increase in number of seeds/pod Probably may be due to favorable effect of panchagavya on reproductive growth viz., pods / plant which is one of the important yield attributes having significant positive correlation with seed & straw yield. Similar findings also reported by [11].

3.2.3 Seed index (g)

Treatment-5 (30 cm x 10 cm + Panchagavya 3%) was recorded significantly maximum seed index (22.9 g) which was superior over all other treatments. However, treatment 6 (40 cm x 10 cm + Panchagavya 3%) and treatment 8 (30 cm x 10 cm + Panchagavya 5%) were found statistically at par with treatment 5 (30 cm x 10 cm + Panchagavya 3%). “The higher seed index might be due to favorable effect of the cow dung present in the panchagavya acts as a medium for the growth of beneficial microbes and cow urine provides nitrogen which is essential for crop growth upon fermentation with other in gradients in panchagavya has beneficial effect on growth and yield” [12].

3.2.4 Seed yield (t/ha)

Treatment-5 (30 cm x 10 cm + Panchagavya 3%) was recorded significantly maximum Seed yield (2.58 t/ha) which was superior over all other treatments. However, treatment 6 (40 cm x 10 cm + Panchagavya 3%) was found statistically at par with treatment 5 (30 cm x 10 cm + Panchagavya 3%).The significant and maximum seed yield was recorded with 30 cm of row spacing which was significantly more over others row spacing followed in experiment. It might be due to sufficient plant population which caused for higher growth and development along

with proper utilization of production inputs and ultimate results was maximum yield. Similar findings also reported by [13].

3.2.5 Stover yield (t/ha)

Treatment-5 (30cm x 10 cm + Panchagavya 3%) was recorded significantly maximum Stover yield (5.34 t/ha) which was superior over all other treatments. However, treatment 6 (40 cm x 10 cm + Panchagavya 3%) was found statistically at par with treatment 5 (30 cm x 10 cm+ Panchagavya 3%).The maximum stover yield might be due to the IAA and GA present in panchagavya when applied as foliar spray could have created stimuli in the plant system and increased the production of growth regulators in cell system and the action of growth regulators in plant system ultimately stimulated the necessary growth and development This may be due to the positive impact on plant height and reproductive growth characteristics, which are both indicators of vegetative development. The similar findings were also reported by [14,15].

Table 1. Effect of Spacing and Panchagvya on growth and yield of Chickpea

S. No.	Treatments	Plant Height (cm)	Number of Nodules/plant	Plant Dry weight (g)
1	20 cm x 10 cm + Panchagavya 2%	45.4	6.5	19.2
2	30 cm x 10 cm + Panchagavya 2%	46.0	8.2	24.0
3	40 cm x 10 cm + Panchagavya 2%	44.6	7.3	23.0
4	20 cm x 10 cm + Panchagavya 3%	44.0	7.8	20.7
5	30 cm x 10 cm + Panchagavya 3%	51.1	11.7	25.7
6	40 cm x 10 cm + Panchagavya 3%	49.6	11.1	25.1
7	20 cm x 10 cm + Panchagavya 5%	43.5	9.0	20.1
8	30 cm x 10 cm + Panchagavya 5%	49.0	10.1	24.8
9	40 cm x 10 cm + Panchagavya 5%	45.6	9.2	22.3
	F test	S	S	S
	SEm (±)	0.76	0.56	0.55
	CD (P=0.05)	2.28	1.68	1.66

Table 2. Effect of Spacing and Panchagvya on yield attributes of chickpea

S. No.	Treatments	No. of Pods/ plant	No. of Seed s/pod	Seed Index (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1	20 cm x 10 cm + Panchagavya 2%	54.3	1.13	19.1	2.00	3.88	35.1
2	30 cm x 10 cm + Panchagavya 2%	59.0	1.46	21.3	2.46	4.48	34.0
3	40 cm x 10 cm + Panchagavya 2%	58.7	1.46	20.9	2.31	4.20	34.5
4	20 cm x 10 cm + Panchagavya 3%	57.8	1.20	20.0	2.20	4.14	36.0
5	30 cm x 10 cm + Panchagavya 3%	62.0	1.86	22.9	2.58	5.34	36.6
6	40 cm x 10 cm + Panchagavya 3%	61.0	1.79	22.3	2.52	5.23	36.3
7	20 cm x 10 cm + Panchagavya 5%	54.5	1.26	19.6	2.05	4.05	34.7
8	30 cm x 10 cm + Panchagavya 5%	60.9	1.73	22.2	2.43	4.84	35.5
9	40 cm x 10 cm + Panchagavya 5%	58.8	1.55	21.4	2.30	4.34	35.8
	F test	S	S	S	S	S	S
	SEm (±)	0.30	0.09	0.35	0.03	0.16	0.32
	CD (P=0.05)	2.51	0.29	1.07	0.11	0.50	1.07

3.2.6 Harvest Index (%)

Treatment-5 (30 cm x 10 cm + Panchagavya 3%) was recorded significantly maximum harvest index (36.6%) which was superior over all other treatments. The maximum harvest index suggests that individual plant under higher plant population performed better than plant under lower plant population the improvement in yield attributing parameters and yield per plant of individual plant under lower plant population was not sufficient enough to compensate the loss in density for higher seed yield. The similar findings also reported by [3].

4. CONCLUSION

Based on the research done in one season, it is concluded that for obtaining higher yield in chickpea, the treatment (T5) with Spacing 30cm x 10cm and Panchagavya 3% is advised as it is recorded higher in growth and yield. Hence, Spacing 30cm x 10cm and Panchagavya 3% may be more preferable and can be recommended to the farmers.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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