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Y Prem Kumar

M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Dr. Shikha Singh

Assistant Professor, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Dr. Pradeep Kumar Shukla

Assistant Professor, Department of Biological Sciences, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Boya Soma Shekar

M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:

Y Prem Kumar

M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Influence of spacing and organic nutrients spray on growth and yield of chickpea (*Cicer arietinum* L.)

Y Prem Kumar, Dr. Shikha Singh, Dr. Pradeep Kumar Shukla and Boya Soma Shekar

Abstract

The field experiment was conducted during *Rabi*, 2020 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). There were ten treatments which were replicated thrice along with control plot under Randomized Block Design. The experimental results revealed that significantly highest plant height (69.91 cm), number of nodules (4.63/plant), dry weight (25.31 g/plant), pods/plant (59.47), seeds per pod (1.87), test weight (232.66), seed yield (3053.02 kg/ha), stover yield (5142.53 kg/ha) and harvest index (37.25%) were recorded with 30 cm x 10 cm + panchagavya (4%). Maximum gross returns (Rs. 157593/ha), net returns (Rs. 125383/ha) and benefit: cost ratio (3.89) were obtained highest in the treatment combination of 30 cm x 10 cm + panchagavya (4%).

Keywords: Spacing, panchagavya, vermiwash, cow-urine, pods and yield

Introduction

Chickpea (*Cicer arietinum* L.) is the major pulse crop of India. At global level, it ranks third in terms of area and production under legumes. It is grown with less care and less manurial requirement. The earliest record of chickpea in India is from Atranji Khera in Uttar Pradesh and this dates back to 2000 BC. With an estimated global production of 13.1 million tons in 2013, chickpea is grown in about 50 countries around the world covering an area of 14 million ha with an average global productivity of 968 kg/ha. Chickpea is the fourth largest grain legume crop in the world, in India with a total production of 11.09 million tons from an area of 14.56 million ha and a productivity of 1.31 t/ha. Major producing countries include India, Pakistan and Iran (FAO, 2019).

Among all agronomic factors, adequate fertilization stands first and is considered one of the most productive input in agriculture. Chickpea does not require much nitrogen except a small quantity as starter dose in the beginning of the life cycle, because later it is being fixed by symbiosis with Rhizobium bacteria (85-100 kg N ha/yr). High fertilizers responsive new varieties with improved agronomic practices, can express their full yield potential only when adequate quantities of micronutrient containing fertilizers are also applied along with NPK fertilizers (Bag *et al.*, 2015) ^[1].

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 decreased 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 (Chang *et al.*, 2007) ^[2].

Application of organic manure builds up soil health and sustains crop production for longer time. However, single organic source of nutrient supplementation may not cope up with the nutrient demand of crops. Integration of different organic nutrient sources and/or liquid organic manures help to solve dual problem of supplementation of sufficient nutrient besides (Jitendra *et al.*, 2016) ^[3].

Materials and Methods

This experimental trial was carried out during *Rabi* 2020 at Crop Research Farm (CRF),

Department of Agronomy, Sam Higginbottom University of Agriculture, Technology & Sciences (SHUATS), Prayagraj (U. P) located at 25°39'42" North latitude, 81°67'56" East longitude and 98 m altitude above the mean sea level. The experiment laid was out in Randomized Block Design consisting of ten treatments which are T₁: Control plot, T₂: 30 cm x 10 cm +vermiwash (10%), T₃: 30 cm x 10 cm + panchagavya (4%), T₄: 30 cm x 10 cm + cow-urine (2%), T₅: 40 cm x 10 cm +vermiwash (10%), T₆:40 cm x 10 cm + panchagavya (4%), T₇: 40 cm x 10 cm + cow-urine (2%), T₈: 50 cm x 10 cm + vermiwash (10%), T₉:50 cm x 10 cm + panchagavya (4%), T₁₀: 50 cm x 10 cm + cow-urine (2%)replicated thrice to determine the Influence of spacing and organic nutrients spray on growth and yield of Chickpea (*Cicerarietinum* L.). The soil of the trial plot was sandy loam in texture nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), medium in available P and K (15.2 kg/ha and 232.5 kg/ha respectively). Fertilizers were applied at 4-5cm deep furrows were made along the seed rows with a hand hoe. The basal dose of manures FYM and Poultry Manure is applied. At 25 days of interval Vermicompost (10%), Panchagavya (4%) and Cow urine (2%) as foliar spray. Thinning and gap filling was done after 08 days of sowing and two irrigation was given just after sowing for ensuring proper germination and one more irrigation done before flowering stage. Between the period of germination to harvest several plant growth parameters were recorded at equal intervals and after harvest several yield parameters were recorded. In growth parameters plant height (cm), number of nodules per plant, no. of branches per plant and dry weight (g/plant) were recorded and yield parameters like pods/plant, seeds/pod, test weight (g), pod yield, seed yield, stover yield and harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez, K. A. and Gomez, A. A. 1984).

Plant height (cm)

Plant height (69.91 cm) was recorded with significantly highest spacing and application of 30 cm x 10 cm + panchagavya (4%), whereas application of 40 cm x 10 cm + cow-urine (2%), 30 cm x 10 cm +vermiwash (10%) were recorded on par to the highest. The plant height was increased with the application of panchagavya and spacing 30 cm x 10

cm, this is due to the enhanced growth rate of plant since it contains the favourable macro and micro nutrients, growth hormones and biofertilizers in liquid formation more over the presence of growth enzymes in it favours rapid cell division and elongation. Thus, it is essential for the general growth and vigor of the plants. These results are consistent with that achieved from (Khan *et al.*, 2021)^[4].

Number of nodules/plants

Highest nodules per plant (4.3) was recorded with significantly highest spacing and application of 30 cm x 10 cm + panchagavya (4%) were recorded on par to the highest whereas application of 40 cm x 10 cm + cow-urine (2%), 30 cm x 10 cm + vermiwash (10%).The increase in the nodulation might be due to the enhanced and established good rooting system with the application of organic manures favorable responses on nodulation have also been reported (Kumar *et al.*, 2011)^[6]. Foliar spray of panchagavya contains IAA and GA which create stimuli in the plant system and increase the production of growth regulators in cell system and the action of growth regulators in plants system ultimately stimulated the necessary growth and development which is involved in nodule formation. And row spacing was significantly impact on plant nodulation due to accumulation of plant nutrients at rooting zones. This is in accordance with earlier findings of (Khan *et al.*, 2010)^[5].

Dry weight (g)

At harvest, treatment with application of spacing 30 cm x 10 cm + panchagavya (4%) was recorded maximum plant dry weight (25.31g) which was superior over rest of all treatments and treatment with spacing and application of 30cmx10cm+cow-urine(2%),50cmx10cm + vermiwash (10%) and 50 cm x 10 cm + panchagavya (4%) were on par with highest treatment. Application of panchagavya will boost up the plant growth attributes will leads to accumulation of growth regulators which leads enhancement in the photosynthesis this is in accordance with earlier findings of (Kumawat *et al.* 2009)^[7]. Dry matter production increased steadily with advancing growth stages and reached the maximum at harvest. The DMP (kg/ha) was found to be more with spacing of 30 × 10 cm, which could be attributed to higher population and accumulation of nutrients/unit area compared to other spacing (Sathyamoorthi *et al.*, 2008)^[8].

Table 1: Effect of spacing and organic nutrients spray on growth parameters of chickpea at harvest

S. No	Treatments	Plant height (cm)	Nodules/plant	Dry weight (g/plant)
1	Control plot RDF (N: P: K)	65.98	2.23	18.15
2	30 cm x 10 cm +vermiwash (10%)	67.29	4.49	21.26
3	30 cm x 10 cm + panchagavya (4%)	69.91	4.63	25.31
4	30 cm x 10 cm + cow-urine (2%)	69.38	3.73	23.57
5	40 cm x 10 cm +vermiwash (10%)	68.94	3.37	21.65
6	40 cm x 10 cm + panchagavya (4%)	69.76	2.47	20.06
7	40 cm x 10 cm + cow-urine (2%)	66.70	2.60	19.17
8	50 cm x 10 cm + vermiwash (10%)	67.68	2.70	24.34
9	50 cm x 10 cm + panchagavya (4%)	69.14	2.73	23.55
10	50 cm x 10 cm + cow-urine (2%)	68.99	2.26	20.61
	S.Em+	0.67	0.32	1.03
	CD (P=0.05)	2.00	0.97	3.08

Effect on yield and yield attributes of chickpea

The statistical data representing yield and yield attributes is presented in Table 2.

Number of pods/plant

Number of pods/plant (59.47) was recorded significantly

highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments and treatment with spacing and application of 40 cm x 10 cm + panchagavya (4%) and 50 cm x 10 cm + panchagavya (4%) were on par with highest treatment.

Number of seeds/pods

Number of seeds/pods (1.87) was recorded significantly highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments and treatment with spacing and application of 30 cm x 10 cm + cow-urine (2%), 40 cm x 10 cm + cow-urine (2%), 50 cm x 10 cm + vermin wash (10%), 50 cm x 10 cm + panchagavya (4%) and 50 cm x 10 cm + cow-urine (2%) were on par with highest treatment.

Test weight (g)

Test weight (232.66 g) was recorded significantly highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments and treatment with spacing and application of 30 cm x 10 cm + cow-urine (2%), 40 cm x 10 cm + cow-urine (2%), 50 cm x 10 cm + vermiwash (10%), 50 cm x 10 cm + panchagavya (4%) and 50 cm x 10 cm + cow-urine (2%) were on par with highest treatment.

The beneficial effects of panchagavya addition were also related to improvement in soil physical properties. The beneficial response of panchagavya to yield attributes and yield of pods might also be attributed to the availability of sufficient amounts of readily usable form of plant nutrients throughout the growth period and specially at critical growth periods of crop resulting in better uptake, plant vigour and superior yield attributes (Somasundaram *et al.*, 2003)^[9]. Crop yield attributes in the complex function of physiological processes and biochemical activities, modify plant anatomy and morphology of the growing plant. No. of pods/plant and No. of seeds/pods of chick pea was significantly influenced by different treatments of panchagavya application. This might be attributed to the favourable effect on vegetative growth; plant height and reproductive growth. Row spacing was significantly highest impacted on yield attributes and were vary due to change in row spacing. These finding corroborates with the results of several other workers

(Verma *et al.*, 2008)^[10].

Seed yield (kg/ha)

Seed yield (3053.2 kg/ha) was recorded significantly highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments and treatment with spacing and application of 40 x 10 cm + vermiwash (10%), 40 cm x 10 cm + cow-urine (2%) and 50 cm x 10 cm + panchagavya (4%) were on par with highest treatment.

Stover yield (kg/ha)

Stover yield (5142.53 kg/ha) was recorded significantly highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments except treatment with spacing and application of 50 cm x 10 cm + cow-urine (2%) and Control plot.

Harvest index (%)

Harvest index (37.25%) was recorded significantly highest with application of spacing 30 cm x 10 cm + panchagavya (4%) which was superior over rest of all treatments except treatment with spacing and application of 50 cm x 10 cm + cow-urine (2%) and Control plot.

The significant increase in Seed yield, Stover yield and Harvest index was recorded with treatment with application of spacing 30 cm x 10 cm + panchagavya (4%) due to increase in yield attributes like number of pods per plant, number of seeds per pod which leads to increase in photosynthesis. Crop yield in the complex function of physiological processes and biochemical activities, modify plant anatomy and morphology of the growing plant. Seed and stover yield of chick pea was significantly influenced by different treatments of panchagavya application. This might be attributed to the favourable effect on vegetative growth; plant height and reproductive growth. These finding corroborates with the results of several other workers (Yadav *et al.*, 2017)^[11].

Table 2: Effect of spacing and organic nutrients spray on yield attributes on Chickpea

Treatments	No. of pods/plant	Number of Seeds/Pod	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
Control plot RDF (N: P: K)	47.25	1.20	134.68	2123.37	4866.30	30.38
30 cm x 10 cm +vermiwash (10%)	56.86	1.47	189.03	2611.42	4914.00	34.65
30 cm x 10 cm + panchagavya (4%)	59.47	1.87	232.66	3053.02	5142.53	37.25
30 cm x 10 cm + cow-urine (2%)	53.90	1.60	186.37	2584.67	4982.65	34.14
40 cm x 10 cm +vermiwash (10%)	55.73	1.53	207.20	2742.63	4921.48	35.65
40 cm x 10 cm + panchagavya (4%)	56.52	1.47	200.99	2503.87	4955.98	33.55
40 cm x 10 cm + cow-urine (2%)	51.62	1.60	215.58	2774.19	4993.49	35.70
50 cm x 10 cm + vermiwash (10%)	54.41	1.67	208.52	2567.98	5013.60	33.81
50 cm x 10 cm + panchagavya (4%)	58.48	1.80	221.32	2940.54	5052.77	36.78
50 cm x 10 cm + cow-urine (2%)	49.47	1.73	173.57	2410.33	4886.69	33.02
S.Em±	2.3470	0.1093	11.6472	130.5198	77.5589	1.2289
CD at 5%	6.9732	0.3248	34.6056	387.7943	230.4394	3.6512

Economics

Maximum gross return (157593.00 Rs.), Net return (125383.00 Rs.) and B:C Ratio (3.89) was observed with

treatment with application of 30 cm x 10 cm + panchagavya (4%) and the minimum return (112185.00 Rs.) was observed with treatment with control plot.

Table 3: Effect of spacing and organic nutrients spray on Economics of Chickpea

S. No.	Treatments	Cost of cultivation(Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
1.	Control plot RDF (N: P: K)	31810	112185	80375.2	2.53
2.	30 cm x 10 cm +vermiwash (10%)	32410	135829	103419	3.19
3.	30 cm x 10 cm + panchagavya (4%)	32210	157593	125383	3.89
4.	30 cm x 10 cm + cow-urine (2%)	32160	134676	102516	3.19
5.	40 cm x 10 cm +vermiwash (10%)	32104	142175	110071	3.43

6.	40 cm x 10 cm + panchagavya (4%)	31904	130724	98819.5	3.10
7.	40 cm x 10 cm + cow-urine (2%)	31854	143841	111987	3.52
8.	50 cm x 10 cm + vermiwash (10%)	31798	133932	102134	3.21
9.	50 cm x 10 cm + panchagavya (4%)	31598	151987	120389	3.81

Conclusion

On the basis of one year experimentation The treatment with spacing 30 cm x 10 cm + panchagavya (4%) respectively was found to be more productive with higher Seed yield (3053.2 kg/ha) as well as economic (3.89) B:C ratio also.

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