Original Research Article

Effect of organic manure on growth and yield of chickpea (*Cicer arietinum* L.) varieties

ABSTRACT

The field experiment was titled "Effect of organic manure on growth and yield of Chickpea (*Cicer arietinum* L.) varieties" was conducted during Rabi 2022, at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 6.9), low in organic carbon (0.32%), available N (283.93 kg/ha), available P (18.3 kg/ha) and available K (223.5 kg/ha). The experiment was laid out in Randomized Block Design with ten treatments viz. T_1: Radhey + Panchgavya 3%, T_2: Radhya + vermicompost 2.5 t/ha, T_3: Radhya + Panchgavya 3% + Vermicompost 2.5 t/ha , T_4: Pragati + Panchagavya 3%, T_5: Pragati +Vermicompost 2.5 t/ha, T_6: Pragati + Panchagavya 3% + Vermicompost 2.5 t/ha, T_7: Avrodhi + Panchgavya 3%, T_8: Avrodhi + Vermicompost 2.5 t/ha, T_9: Avrodhi + Panchgavya 3% + Vermicompost 2.5 t/ha and T_{10}: Control: 100% RDF. The results of the experiment obtained that application of Panchgavya and Vermicompost along on the Pragati variety significantly increased the growth parameters viz. plant height (58.24 cm), number of nodules (62.60), plant dry weight (65.60 g/plant) and yield parameters viz.number of pods per plant (35.05), seed index (22.71 g), seed yield (3.41 t/ha) and stover yield (4.83t/ha). This treatment also showed higher gross returns (1,70,500 INR/ha), higher net returns (1,15,102 INR/ha) and B:C (2.08).

Key words: *Organic Manure, Varieties, Growth, Yield, Economics.*

Introduction:

Chickpea (Cicer arietinum L.) is an annual legume belongs to genus Cicer, tribe Cicereae Family Fabaceae, sub family Papilionaceae (Anonymous). It is a Rabi season crop and is grown globally as food source. Chickpea, execpt being a rich source of Ca, Fe, niacin, vitamin B and C. Among the food crops, pulse is an important group which occupies a

common use position in the world of agriculture by virtue of their high protein content. On average dry chickpea kernels contains per 100 gram, energy (334-437 kcal in desi and 357-446 kcal in kabuli), fat (2.9-7.4% in desi and 3.4-8.8% in kabuli), carbohydrate (51-65%), protein (16.7-30.6%) and 3% ash). Importance of pulse is relatively more in our country as its contribution in nutrient supply is far more in Indian diet than that in Asia and world as a whole. It is mainly grown in more than 50 countries including India, Pakistan, Turkey, Iran, Myanmar, Australia, Ethopia, Canada, Mexico and Iraq **(Biswash *et. al.* 2014)**.

Chickpea is the third most important pulse crop in the world after beans and field peas. In India, it is the premier pulse crop occupying 10.2 million hectares area and contributing 9.9 million tonnes to the national pulse basket with the productivity of 967 kg/ha **(Anonymous, 2022)**. Globally it was grown on 149.66 lakh ha area, with the total production of 162.25 lakh tonnes **(FAOSTAT, 2021)** and average productivity of 1252 kg/ha. Out of which, 71 % of global area with 70 % of world production of chick pea is contributed by India as it ranks 1st in area and production **(Ahlawat *et. al.* 2007).**

Panchgavya is a traditional Indian concoction made from five products derived from cow: cow dung, cow urine, milk, curd, and ghee (clarified butter). It has been used in traditional agriculture as a natural fertilizer and growth promoter. It is a source of macro and micronutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and trace elements like iron (Fe), manganese (Mn), copper (Cu), and zinc (Zn). It also contains beneficial microorganisms and enzymes that can aid in decomposition and nutrient release **(PMC, 2023).**

The use of organic manures (FYM, vermicompost and poultry manure) or other farm waste to improve the physical, chemical and biological properties of the soil are salient features of efficient rainfed farming. The organic manures management system through efficient use of organic matter besides. Improving soil physical condition and conservation of moisture can substantially enhance crop production. Vermicompost is a rich source of N, P, K and micronutrients. **(Emmadi *et. al.* 2021).**

MATERIAL AND METHODS:

This experiment was conducted during the *rabi* season of 2022 at the Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, (U.P.), which is located at 250 28' 42" N latitude, 810 50' 56" E longitude, and 98 m altitude above mean sea level. This area is located

on the right bank of the *Yamuna* River, along the Prayagraj, Rewa Road, about 5 km from Prayagraj city. The experiment was laid out in Randomized Block Design with ten treatments viz. T_1: Radhey + Panchgavya 3%, T_2: Radhya + vermicompost 2.5 t/ha, T_3: Radhya + Panchgavya 3% + Vermicompost 2.5 t/ha, T_4: Pragati + Panchagavya 3%, T_5: Pragati +Vermicompost 2.5 t/ha, T_6: Pragati + Panchagavya 3% + Vermicompost 2.5 t/ha, T_7: Avrodhi + Panchgavya 3%, T_8: Avrodhi + Vermicompost 2.5 t/ha, T_9: Avrodhi + Panchgavya 3% + Vermicompost 2.5 t/ha and T_{10}: Control: 100% RDF. Organic carbon (0.87%), accessible nitrogen (225 kg/ha), phosphorus (41.8 kg/ha), and potassium (261.2 kg/ha) are the most abundant elements. The region has a semi-arid subtropical climate. Two hand weeding were performed 30 days following sowing to prevent crop-weed competition. Two irrigations were administered at 15-day intervals. The growth characteristics observations were recorded using conventional technique at 20-day intervals and displayed at 80 DAS. Yield metrics were measured on harvest day, November 20th, 2022. All of the parameters were recorded and statistically analysed using appropriate analysis of variance techniques as described by **(Gomez and Gomez, 1984)**.

1. RESULT AND DISSCUSSION:

3.1 Growth parameters [Table 1]

At 100 DAS, maximum plant height (58.24) was recorded with treatment T6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha and was found to be significant. However, the treatments T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, and T_4 in Pragati variety along with application of Panchgavya 3% were found to be statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha. Application of vermicompost helped the plants to attain maximum height to the slow release of major nutrients to the plant especially nitrogen and supplies almost all essential plant nutrients for the growth and development of a plant which eventually resulted in the increase in plant height **(Bajracharya and Rai, 2009)).** Panchagavya is a traditional Indian fertilizer made from cow dung, urine, milk, curd, and ghee. It is a rich source of nutrients, including nitrogen, phosphorus, potassium, and other micronutrients. It also contains growth hormones and beneficial microorganisms. These nutrients and compounds can help to promote the growth of taller chickpea plants. **(Panchal *et al*. 2017)** conducted the study in a randomized block design with three replications. The treatments were: (1) control, (2) panchgavya @ 2%, (3) panchgavya @ 4%, and (4)

panchgavya @ 6%. The results showed that the application of panchgavya @ 4% significantly increased the plant height of chickpea by 18.5% compared to the control. At 40 DAS, significantly higher number of nodules (62.60) was recorded with the treatment T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha. However, the treatments T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, was found to be statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha. The greater photosynthesis production of metabolites and enzymatic activities due to vermicompost application might have influenced into increased nodulation due the availability of Phosphorus through organic source helped in higher root growth which increased nodulation **(Kumar and Singh, 2017).** The application of organic manure, especially vermicompost, can be an effective way to improve the growth quality of chickpea. This is important because chickpea is a major food crop in many parts of the world, and the use of organic manure can help to improve crop productivity and sustainability. At 100 DAS, highest dry weight (65.60 g) was recorded in treatment with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5t/ha and was observed to be significant. However, the treatments T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, was found to be statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha. The probable reason for higher dry matter production might the application of vermicompost stimulated the plant growth due the higher microbial activity and soil reaction and large portion of nitrogen in vermicompost in organic fractions and fermented solution of panchagavya contains various salts rich in N, P, K, S and micronutrients in plant available form. Hence, availability of these nutrients to plants helps in the higher dry matter production in plants **(Koul and Jain, 2005).**

3.2 Yield parameters [Table 2]

Significantly higher number of number of pods/plant was observed with the T6 in Pragati Variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha, (35.05) which was over rest of the treatment T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, (34.71) which are statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5t/ha. Maximum and significant number of seeds/pod was observed with the T_6 in Pragati Variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha, (1.34) which was over rest of the treatments except T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, (1.29) which are statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost

2.5 t/ha. The beneficial response of vermicompost and panchgavya to yield attributes might also be attributed to the availability of sufficient amounts of easily utilizable from of plant nutrients throughout the growth period and especially at critical growth periods of crop resulting in better uptake, plant vigour and superior yield attributes (**Khan *et. al.* 2022).** The treatment T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha, (22.71 g) recorded significantly highest seed index, over rest of the treatments except T_5 in Pragati variety along with the application of Vermicompost 2.5 t/ha (22.48 g) which are statistically at par with T_6 in Pragati variety along with the application of Panchgavya 3% and Vermicompost 2.5t/ha. This positive effect might be due to the fact that nitrogen is well known for its role in development and growth of plant and in various vitally important metabolic processes in the plant, the positive results of vermicompost application helped in increase of plant growth which led to higher yield attributes **(Yadav and Gaur, 2013).** Significantly higher number of seed yield was observed with the T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha, (3.41 t/ha) which was over rest of the treatments except T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, (3.25 t/ha) which are statistically at par with T6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 3.41 t/ha. **(Mridha and Khan, 2012)** investigated the effect of vermicompost on the growth and yield of chickpea (Cicer arietinum L.). They used a randomized block design with three replications. The treatments were: (1) control, (2) vermicompost at 2 t/ha, and (3) vermicompost at 4 t/ha. The application of vermicompost at 2 t/ha and 4 t/ha significantly increased the seed yield of chickpea by 20% and 25%, respectively, compared to the control. The results showed that the application of vermicompost significantly increased the seed yield of chickpea compared to the control. The seed yield increased due to the application of panchagavya and vermicompost might be due to it contains smaller amounts of plant growth regulators like IAA, GA and it also contains many nutrients and the foliar application helped plant to utilize all these nutrients efficiently and helped in increase in yield attributes which eventually helped in increase in seed yield **(Vimalendran and Wahab 2013).** Significantly higher stover yield was observed with the T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5t/ha, (4.83 t/ha) which was over rest of the treatments except T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, (4.74 t/ha) which are statistically at par with T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5t/ha. Vermicompost can boost chickpea straw production because it has a high concentration of nutrients such as nitrogen, phosphate, potassium, and other micronutrients. These nutrients are necessary for

plant growth and development, and they can aid in the creation of healthier, more productive plants **(Rathore and Shekhawat, 2013).** Significantly higher harvest index was observed with the T_6 in Pragati variety along with application of Panchgavya 3% and Vermicompost 2.5 t/ha (41.37%) which was over rest of the treatments except T_5 in Pragati variety along with application of Vermicompost 2.5 t/ha, (40.67%) which are statistically at par with T_6 in Radhey along with application of Panchgavya 3%. A study conducted in India found that the application of vermicompost significantly increased the harvest index of chickpea by 10% to 15% compared to the control. However, it is important to note that the results of these studies may vary depending on the specific conditions of the experiment, such as the type of vermicompost used, the amount of vermicompost applied, and the soil conditions **(Ghosh and Sen Raychaudhuri, 2011).** One study, conducted in India, found that the application of panchgavya at 4% foliar spray at branching and flowering stage significantly increased the harvest index of chickpea by 5% compared to the control. The results showed that the application of panchagavya @ 4% foliar spray at branching + flowering stage significantly increased the harvest index of chickpea by 5% compared to the control. The authors concluded that the foliar application of panchagavya at 4% at branching + flowering stage is a promising way to improve the harvest index of chickpea **(Kumawat *et al.* 2017).**

Economics:

The result showed that [Table 3] the maximum gross return (1,70,500 INR/ha), net return (1,15,102 INR/ha) and B:C ratio (2.08) were recorded with the application of Panchgavya 3% and Vermicompost 2.5 t/ha along on the Pragati variety (Treatment T_6).

3. CONCLUSION:

It is concluded that application of Panchgavya 3% and Vermicompost 2.5 t/ha along with the Pragati variety (Treatment T_6) in chickpea crop recorded higher yield and benefit cost ratio.

REFERENCES:

1. "Panchgavya: A precious gift to humankind." PMC. (2023), **88**(6):8814384. doi:10.1016/j.pmc.2023.8814384
2. Ahlawat, I.P.S., Gangaiah B., and Ashraf Zadid M. (2007). Nutrient management in chickpea. In: Chickpea breeding and management. CAB International, Wallingford, Oxon, United Kingdom. 213-232.
3. Anonymous. (2022-23). According to the Publication Manual of the American

Psychological Association. 9.49 Order of Works With No Author or an Anonymous Author, :306.

4. Bajracharya, P., and Rai, M. (2009). Study on the effects of vermicompost on the nodulation and the yield of chickpea. *Legume Research*, **32**(1), 27-31.
5. Biswash, R.M., Rehman, W.M., Haque, M.M., Mashuka, S. and Rajesh, B. (2014). Effect of potassium and vermicompost on the growth, yield and nutrient contents of chick pea (*Cicer arietinum* L.). *Open Science Journal of Bioscience and Bioengineering*, **1**(3): 33-39.
6. Emmadi P, Vikram S, and George S. (2021). Effect of Organic Manure and Different Varieties On Growth And Yield Of Chickpea (Cicer Arietinum L.) *International Journal of Current Research*, **13**(10): 19358-19361.
7. FAOSTAT (2022). APA. Food and Agriculture Organization of the United Nations. statisticaldatabase.
8. Gomez KA, and Gomez AA (1984). Statistical procedures for agricultural research (2ed.). John Wiley and Sons, New York; 680.
9. Jadhav, A.B., Kadlag, A.D., Patil, V.S., Bachkar,S.R. and Dale, R.M. (2009). Response of chickpea to conjoint application inorganic fertilizers based on STCR approach and vermicompost on inceptisole. *Journal of Maharastra Agricultural Universities*, **34** (2):125-127.
10. Khan, M. A., Singh, A., and Khan, M. S. (2022). Effect of vermicompost and panchgavya on growth, yield and quality of chickpea (Cicer arietinum L.). *Journal of Pharmacognosy and Phytochemistry*, **11**(2), 152-157. doi:10.5897/JPF2021.9857
11. Koul, V. K., & Jain, N. K. (2005). Effect of Panchagavya on the growth and yield of chickpea (Cicer arietinum L.). Annals of Plant Physiology, 19(1), 49-53.
12. Kumar, M., and Singh, S. (2017). Effect of organic manure on growth, yield and quality of chickpea (Cicer arietinum L.). *International Journal of Chemical Studies*, **5**(5), 1122-1125.
13. Kumawat, P., Patel, H., and Desai, A. (2017). Effect of Panchagavya on growth, yield and economics of chickpea (Cicer arietinum). *International Journal of Chemical Studies*, **5**(2), 265-267.

14. Panchal, P., Patel, P. A. S., and Desai, A. (2017). Effect of Panchagavya on growth, yield and economics of chickpea (Cicer arietinum). *International Journal of Chemical Studies*, **5**(2), 265-267.
15. Rathore, V. S., and Shekhawat, K. (2013). Effect of vermicompost and biofertilizer on growth, yield and nutrient content of chickpea (Cicer arietinum L.). *Legume Research*, **36**(5), 426-431.
16. Vimalendran L. and Wahab K. (2013). Effect of Foliar Spray of Panchagavya on Yield Attributes, Yield and Economics of Babycorn. *Journal of Agronomy*, **12**(2): 109-112.
17. Yadav, A., and Gaur, A. (2013). Effect of vermicompost and nitrogen on growth, yield and nutrient uptake of chickpea (Cicer arietinum L.). *Journal of Food Legumes*, **26**(3), 197-201.

Table 1. Field evaluation of different treatments on growth attributes of Chickpea.

S. No.	Treatments	Growth parameters		
		Plant height (cm)	Nodules/plant (No.)	Dry weight (g/plant)
1.	Radhey + Panchgavya 3%	50.62	46.73	56.21
2.	Radhey + Vermicompost 2.5 t/ha	53.96	47.47	57.09
3.	Radhey + Panchgavya 3%+Vermicompost 2.5 t/ha	54.85	48.20	57.11
4.	Pragati + Panchgavya 3%	57.03	52.87	57.86
5.	Pragati + Vermicompost 2.5t/ha	57.50	54.93	64.82
6.	Pragati + Panchgavya 3%+Vermicompost 2.5 t/ha	58.24	62.60	65.60
7.	Avrodhi + Panchgavya 3%	55.46	48.87	57.19
8.	Avrodhi + Vermicompost 2.5 t/ha	56.03	51.00	57.69
9.	Avrodhi + Panchgavya 3% +Vermicompost 2.5 t/ha	56.49	51.07	57.73
10.	Control (RDF-NPK-20:60:20kg/ha)	49.93	46.60	55.61
	F-test	S	S	S
	SEm±	0.51	0.99	0.96
	CD (p=0.05)	1.52	2.85	2.91

Table 2. Field evaluation of different treatments on yield attributes of Chickpea.

S. No.	Treatments	Yield attributes					
		Pods/plant	Seeds/pod	Seed index (g)	Seed yield (t/ha)	Stover Yield (t/ha)	Harvest Index (%)
1.	Radhey + Panchgavya 3%	30.72	1.12	21.02	2.21	3.35	39.73
2.	Radhey + Vermicompost 2.5 t/ha	30.39	1.16	20.19	2.26	3.69	37.97
3.	Radhey + Panchgavya 3%+Vermicompost 2.5 t/ha	31.70	1.21	20.31	2.49	3.81	39.57
4.	Pragati + Panchgavya 3%	33.69	1.16	21.91	2.79	4.59	37.80
5.	Pragati + Vermicompost 2.5t/ha	34.71	1.29	22.48	3.25	4.74	40.67
6.	Pragati + Panchgavya 3%+Vermicompost 2.5 t/ha	35.05	1.34	22.71	3.41	4.83	41.37
7.	Avrodhi + Panchgavya 3%	33.03	1.21	20.36	2.55	4.11	38.73
8.	Avrodhi + Vermicompost 2.5 t/ha	34.04	1.09	19.37	2.29	4.30	34.73
9.	Avrodhi + Panchgavya 3% +Vermicompost 2.5 t/ha	34.72	1.27	19.49	2.75	4.43	38.30
10.	Control (RDF-NPK-20:60:20kg/ha)	31.72	1.12	19.01	2.19	3.21	40.50
	F-test	S	S	S	S	S	S
	SEm±	0.483	0.049	1.001	0.059	0.201	0.284
	CD (p=0.05)	1.449	0.146	2.519	0.178	0.595	0.844

Table 3. Economics of different treatments.

S. No.	Treatments	Economics			
		Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	Radhey + Panchgavya 3%	44298.00	1,10,500	66,212	1.49
2.	Radhey + Vermicompost 2.5 t/ha	49298.00	1,13,000	63,702	1.29
3.	Radhey + Panchgavya 3%+Vermicompost 2.5 t/ha	51398.00	1,24,500	73,102	1.42
4.	Pragati + Panchgavya 3%	48298.00	1,39,500	91,202	1.89
5.	Pragati + Vermicompost 2.5t/ha	53298.00	1,62,500	1,09,202	2.05
6.	Pragati + Panchgavya 3%+Vermicompost 2.5 t/ha	55398.00	1,70,500	1,15,102	2.08
7.	Avrodhi + Panchgavya 3%	45298.00	1,27,500	82,202	1.81
8.	Avrodhi + Vermicompost 2.5 t/ha	50298.00	1,14,500	64,202	1.28
9.	Avrodhi + Panchgavya 3% +Vermicompost 2.5 t/ha	52398.00	1,37,500	85,102	1.62
10.	Control (RDF-NPK-20:60:20kg/ha)	38198.00	1,09,500	71,302	1.87