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# Evaluation of Liquid Organic Fertilizer Formulations for Enhancing Growth of Chickpea (*Cicer arietinum* L.)

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**Abstract**

A field experiment was conducted in randomized block design to check the liquid organic fertilizers formulations for enhancing growth of chickpea. The treatments consisting T1- Control, T2-Foliar spray of cow urine @ 10 %, T3-Foliar spray of vermiwash @ 10 %, T4-Foliar spray of panchagavya @ 5 %, T5-Foliar spray of waste decomposer @ 30 %, T6-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % , T7-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %, and T8-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % were applied to the chickpea. Research experiment revealed that maximum plant population and plant growth was recorded in treatment Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % whereas control. Foliar application of Cow urine @ 10% + Vermiwash @ 10% (T6) recorded the highest plant height (46.85 cm), dry matter accumulation (25.04 g plant$^{-1}$) and number of branches per plant (11.50) at harvest. Plant population was statistically non-significant among treatments.

**Keywords:** Chickpea, Liquid Organic Fertilizer

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## Introduction

Pulses constitute the second most important component of the Indian diet after cereals and play a crucial role in ensuring nutritional security, particularly in a predominantly vegetarian population. They serve as a primary source of plant-based protein and essential amino acids, thereby contributing significantly to human health and dietary balance (Mukherjee and Shubha, 2018). Recent studies have demonstrated that the application of organic liquid formulations such as cow urine, vermiwash, panchagavya and waste decomposer significantly improves growth parameters, yield attributes, and productivity of chickpea. These inputs not only enhance nutrient uptake but also improve physiological processes such as photosynthesis, enzyme activity, and metabolic functions, leading to better crop performance. Furthermore, the combined application of these organic inputs has been reported to have synergistic effects, resulting in higher yields and improved soil health.

The growing demand for organic food products, both globally and in India, further emphasizes the need to adopt sustainable agricultural practices. Organic farming not only ensures safe and nutritious food but also contributes to environmental protection and climate resilience. In this context, optimizing the use of organic inputs in chickpea cultivation is of paramount importance.

## Material and Methods

There are 8 treatments combinations were laid out in Randomized Block Design. Observations were made for each parameter using the approach described below in order to evaluate the growth, yield, and yield-attributing characteristics, nutrient content, their uptake. The field experiment was conducted during the Rabi season of 2025–26 at the Research Farm, Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan (29°22′ N latitude, 74°89′ E longitude, 197 m above mean sea level) under semi-arid climatic conditions. The experimental soil was sandy loam in texture, slightly alkaline (pH 8.1) with 0.27% organic carbon and low to medium fertility status. The chickpea variety CSJD-884 was used for the experiment. The trial was laid out in a Randomized Block Design (RBD) with eight treatments and three replications. Each plot measured 3.0 × 6.0 m (18.0 m²) with a net plot size of 2.4 × 6.0 m (14.4 m²). The crop was sown at a spacing of 30 cm × 10 cm using a seed rate of 80 kg ha$^{-1}$. The recommended fertilizer dose for chickpea was applied uniformly to all treatments as the basal application before sowing, and irrigations were provided uniformly to all plots as per crop requirement. Foliar application of the respective liquid organic formulations was carried out three times, at the branching, flowering and pod initiation stages of the crop according to the treatment schedule. The experiment consisted of sixteen treatment combinations involving four irrigation (water stress) levels

(W1–W4) and four hydrogel levels (H1–H4) arranged in a Factorial Randomized Block Design with three replications. Hydrogel was incorporated into the soil at the time of sowing according to the respective treatment levels. Irrigation treatments were imposed at predetermined critical growth stages to create different levels of moisture stress. Detailed treatment descriptions, including irrigation schedule and hydrogel application rates, have now been incorporated in the revised manuscript."

Foliar sprays were applied three times during the crop growth period, i.e., at branching, flowering, and pod initiation stages. Cow urine was collected from healthy indigenous cows and diluted at 1:10 (cow urine:water) before spraying. Vermiwash was collected from vermicompost units and diluted at 1:10 (vermiwash:water). Panchagavya was prepared by fermenting cow dung, cow ghee, cow urine, cow milk, curd, tender coconut water, jaggery, and ripe bananas for 30 days, and was applied after dilution at 1:30 (Panchagavya:water). Waste decomposer solution was prepared by dissolving 2 kg jaggery in 200 L of water, followed by the addition of one bottle of waste decomposer culture and subsequent dilution at 1:4 (waste decomposer:water) before spraying. All formulations were prepared freshly before application and uniformly sprayed over the crop canopy using a knapsack sprayer

The experimental data recorded during the investigation were statistically analyzed using Analysis of Variance (ANOVA) appropriate for a Randomized Block Design (RBD) as described by Gomez and Gomez (1984). The significance of treatment effects was tested using the F-test at the 5% probability level, and treatment means were compared using the Critical Difference (CD) test wherever the F-test was significant. The experiment comprised three replications, and the standard error of mean (S.Em.) along with CD values has been presented for each parameter.

## Results and Discussion

The data presented in table showed that foliar application of liquid formulations of organic fertilizers did not showing any significant effect on plant population per hectare at 30 DAS as well as at harvest stage of chickpea.

***Plant height (cm)***

It is apparent from data Table that different foliar application of liquid formulations of organic fertilizers could influence the plant height at 60 DAS, 90 DAS and harvest stage. The data indicated that plant height of chickpea at 60 DAS was recorded maximum (44.25 cm) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

At 90 DAS plant height was recorded maximum (47.95 cm) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

At harvest stage of growth plant height was recorded maximum (45.85 cm) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 %, $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % and $T_3$-Foliar spray of vermiwash @ 10 %.

**Table 1** Effect of liquid formulations of organic fertilizers on plant population

| Treatments | Plant population ha$^{-1}$ | |
|---|---|---|
| | 30 DAS | At harvest |
| $T_1$-Control | 305673 | 304602 |
| $T_2$-Foliar spray of cow urine @ 10 % | 305872 | 304766 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 305994 | 304796 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 306033 | 304904 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 306038 | 304906 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 306266 | 305535 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 306242 | 305263 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 306218 | 305512 |
| S.Em. + | 764.2 | 863.45 |
| C.D. at 5 % | NS | NS |

***Dry matter accumulation (g/plant)***

It is apparent from data Table that different foliar application of liquid formulations of organic fertilizers could influence the dry matter accumulation at 60 DAS, 90 DAS and harvest stage of growth. The data indicated that dry

matter accumulation of chickpea at 60 was recorded maximum (14.08 g) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

At 90 DAS plant height was recorded maximum (19.89 g) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

At harvest stage of growth plant height was recorded maximum (25.04 g) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

**Table 2** Effect of liquid formulations of organic fertilizers on plant height

| Treatments | Plant height (cm) | | |
|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest |
| $T_1$-Control | 36.15 | 38.37 | 39.72 |
| $T_2$-Foliar spray of cow urine @ 10 % | 39.15 | 42.5 | 41.85 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 40.10 | 43.75 | 44.1 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 38.12 | 42.15 | 42.45 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 37.60 | 41.69 | 42.24 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 44.25 | 47.95 | 46.85 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 42.25 | 45.5 | 45.85 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 42.95 | 46.2 | 46.55 |
| S.Em. + | 1.61 | 1.91 | 1.98 |
| C.D. at 5 % | 3.45 | 4.10 | 4.25 |

**Table 3** Effect of liquid formulations of organic fertilizers on dry matter accumulation

| Treatments | Dry matter accumulation (g/plant) | | |
|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest |
| $T_1$-Control | 10.80 | 14.44 | 18.76 |
| $T_2$-Foliar spray of cow urine @ 10 % | 11.88 | 15.93 | 19.74 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 12.03 | 16.38 | 20.77 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 11.57 | 15.80 | 20.02 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 11.51 | 15.64 | 19.93 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 14.08 | 19.89 | 25.04 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 12.52 | 17.51 | 22.57 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 12.72 | 18.26 | 22.90 |
| S.Em. + | 0.86 | 1.52 | 1.92 |
| C.D. at 5 % | 1.85 | 3.25 | 4.12 |

**Table 4** Effect of liquid formulations of organic fertilizers on branches per plant

| Treatments | Branches per plant | | |
|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest |
| $T_1$-Control | 3.68 | 5.97 | 5.99 |
| $T_2$-Foliar spray of cow urine @ 10 % | 6.85 | 7.45 | 7.60 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 4.95 | 7.9 | 8.0 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 4.53 | 7.33 | 7.50 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 4.40 | 7.17 | 7.15 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 7.25 | 11.41 | 11.50 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 6.99 | 9.04 | 9.20 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 5.59 | 9.79 | 9.85 |
| S.Em. + | 0.94 | 1.14 | 1.45 |
| C.D. at 5 % | 2.01 | 2.45 | 3.10 |

***Number of branches plant$^{-1}$***

It is apparent from data Table that different foliar application of liquid formulations of organic fertilizers could influence the number of branches at 60 DAS, 90 DAS and harvest stage of growth. The data indicated that number of

branches of chickpea at 60 was maximum (7.25) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however It being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 %. At 90 DAS number of branches was recorded maximum (11.45) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %. At harvest stage of growth, number of branches was recorded maximum (11.50) at application of treatments of cow urine @ 10 % + vermiwash @ 10 % ($T_6$), however it being at par with treatment of $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % and $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 %.

**Table 5** Effect of liquid formulations of organic fertilizers on dry matter accumulation

| Treatments | Dry matter accumulation (g/plant) | | |
|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest |
| $T_1$-Control | 10.80 | 14.44 | 18.76 |
| $T_2$-Foliar spray of cow urine @ 10 % | 11.88 | 15.93 | 19.74 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 12.03 | 16.38 | 20.77 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 11.57 | 15.80 | 20.02 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 11.51 | 15.64 | 19.93 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 14.08 | 19.89 | 25.04 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 12.52 | 17.51 | 22.57 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 12.72 | 18.26 | 22.90 |
| S.Em. + | 0.86 | 1.52 | 1.92 |
| C.D. at 5 % | 1.85 | 3.25 | 4.12 |
| General mean | 11.14 | 15.73 | 20.21 |

**Table 6** Effect of liquid formulations of organic fertilizers on branches per plant

| Treatments | Branches per plant | | |
|---|---|---|---|
| | 60 DAS | 90 DAS | At harvest |
| $T_1$-Control | 3.68 | 5.97 | 5.99 |
| $T_2$-Foliar spray of cow urine @ 10 % | 6.85 | 7.45 | 7.60 |
| $T_3$-Foliar spray of vermiwash @ 10 % | 4.95 | 7.9 | 8.0 |
| $T_4$-Foliar spray of panchagavya @ 5 % | 4.53 | 7.33 | 7.50 |
| $T_5$-Foliar spray of waste decomposer @ 30 % | 4.40 | 7.17 | 7.15 |
| $T_6$-Foliar spray of cow urine @ 10 % + vermiwash @ 10 % | 7.25 | 11.41 | 11.50 |
| $T_7$-Foliar spray of cow urine @ 10 % + waste decomposer @ 30 % | 6.99 | 9.04 | 9.20 |
| $T_8$-Foliar spray of vermiwash @ 10 % + waste decomposer @ 30 % | 5.59 | 9.79 | 9.85 |
| S.Em. + | 0.94 | 1.14 | 1.45 |
| C.D. at 5 % | 2.01 | 2.45 | 3.10 |

The experimental data showed that different organic manure bring significant effect on growth of chickpea. Foliar spray of cow urine @ 10 % + vermiwash @ 10 % ($T_6$) produced significantly highest plant population (at 30 DAS and harvest), plant height, dry matter accumulation and branches per plant at 60, 90 DAS and at harvest in chickpea.

It was observed that the growth attributing characters of chickpea improved probably due to better supply of nutrients through foliar application of cow urine and vermiwash at higher rates. The increased plant height of chickpea is caused by cow urine, which contains uric acid and ammoniacal nitrogen that plants can readily absorb, also vermiwash, which contains readily available macro and micronutrient sources as well as hormonal action that leads to enhanced growth. Besides this the different enzymes and hormones present in cow urine are also responsible for the better growth of plant (Vahanka *et al*., 2010). The growth enzymes found in cow urine and vermiwash, which encouraged quick cell division and multiplication, may be the cause of the rise in the number of branches plant-1. Similar outcome was reported by Sridhara *et al*. (2022). The chemical analysis of the cow urine applied in the present investigation showed that cow urine contains almost all the nutrients required for plants growth and development. Therefore, more availability of nitrogen at higher rates of cow urine application has favoured greater protein synthesis and thereby higher photosynthesis. Potassium, the other constituent of cow urine as an activator of enzymes regulates carbohydrate metabolism and protein synthesis; it also controls stomatal opening and membrane permeability. Besides N and K, the cow urine and vermiwash application at higher rates might have also improved the supplies of phosphate, sulphate, Ca, Mg and micronutrients as well. This might have led to rapid cell division and enlargement, which ultimately resulted, into vigorous plant growth. Adequate supply of urine promotes differentiation and expansion of

tissues resulting in the production of more number of functional leaves/plant. In the present study it is also possible that increased branching at higher levels of cow urine have helped the plants in producing higher dry matter production. Khatate *et al*. (2021) reported that foliar sprays of 7.5% cattle urine recorded significantly higher plant height, number of tillers, number of functional leaves and chlorophyll content of wheat. Pavitra *et al*. (2021) revealed that foliar application of 10% cow urine-based derivatives at tillering stage recorded maximum values of plant height in rice. Similarly, Jadhav *et al*. (2020) revealed that foliar sprays of cattle urine @ 10% found superior for plant height, number of functional leaves and leaf area of fodder maize. The findings of present investigation are closely followed by the findings of Onte *et al*. 2019, Sridhara *et al*. 2022, Chavan *et al*. 2023 and Jagre *et al*. 2023.

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