



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 3888-3890
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www.thepharmajournal.com

Received: 29-12-2022

Accepted: 31-01-2023

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Effect of liquid organic formulations on growth, yield and quality of chickpea (*Cicer arietinum* L.)

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Abstract

A field experiment was conducted during *rabi* 2021-2022 at PGI-Research Farm, MPKV, Rahuri. The experiment was laid out in a randomized block design with 9 treatments replicated three times. Treatments consist of foliar spray of cow urine @ 10%, vermiwash @ 10%, panchagavya @ 3%, waste decomposer @ 25%, jeevamrut @ 10%, cow urine @ 10% + vermiwash @ 10%, cow urine @ 10% + waste decomposer @ 25% and vermiwash @ 10% + waste decomposer @ 25%. Foliar application of these treatments carried out at the branching, flowering and pod initiation stage. The results revealed that, application of Cow urine @ 10% + Vermiwash @ 10% observed to be significantly higher yield and yield attributing characters viz., number of pods plant⁻¹ (44.63), number of seeds pod⁻¹ (1.27), weight of pods plant⁻¹ (11.75 g), seed yield plant⁻¹ (8.44 g), test weight (178.84 g), seed yield (24.81 q ha⁻¹), haulm yield (29.87 q ha⁻¹), biological yield (54.68 q ha⁻¹) and harvest index %).

Keywords: Cow urine, vermiwash, panchagavya, waste decomposer, jeevamrut, yield and yield attributing characters

Introduction

Chickpea (*Cicer arietinum* L.), which belongs to the family of legumes, Fabaceae. Chickpea has a great nutritive value as it contains a high percentage of protein, carbohydrates and minerals thereby helps people in improving nutritional quality of their diets. 100 g of chickpea seed provides 180 calories of energy, 2.99 g of fat, 29.98 g of carbs and 9.54 g of protein. Per gram of chickpea have Lysine (0.44 mg), Thiamine (0.30 mg), Riboflavin (0.15 mg) and Niacin (2.9 mg), which accounts to 20-21% protein. It is also rich in soluble dietary fibre (Raffinose - 8.6 g), Na (243 mg), K (433 mg) and others like P, Ca, Mg, Fe, Cu and β -carotene. Chickpea seeds are good source of vitamin C, mainly germinated seeds are recommended against scurvy disease. Under better management practices, chickpea fix up to 135 kg nitrogen ha⁻¹ year⁻¹ (Herridge, 2015) [2]. There are two types of chickpeas, the brown-coloured "Desi" and the white-coloured "Kabuli". India is major Chickpea producing country, in which area of 9.85 Mha producing 11.99 Mt with 1217 kg ha⁻¹ productivity during 2020-2021. Cattle based products like cow urine, panchagavya, jeevamruth are organic soil conditioners rich in N, P and K, calcium, magnesium, chloride, sulphates, growth hormones with sufficient load of microbial mobilisers and solubilizers. Cattle-based products applied to soil increases microbial populations and their activities which further gear up nutrient cycling, production of plant growth- promoting materials and build up plant tolerance to micro-biotic attacks. These liquids can also be applied through fertigation and spraying which becoming common in most of the crops (Pradhan *et al.*, 2018) [8]. Foliar fertilization is capable of quickly, cheaply, economically, overcoming various deficiency symptoms (Alexander, 1986) [1].

Material and Methods

The present experiment was conducted at Organic Farming Research and Training Centre, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (MH), India, during, *rabi* 2022. The experiment was laid out in a randomized block design with 9 treatments replicated three times. Treatments consist of Control, Foliar spray of Cow urine @ 10%, Vermiwash @ 10%, Panchagavya @ 3%, Waste decomposer @ 25%, Jeevamrut @ 10%, Cow urine @ 10% + Vermiwash @ 10%, Cow urine @ 10% + Waste decomposer @ 25% and Vermiwash @ 10% + Waste decomposer @ 25%. Foliar application of these treatments carried out at the branching, flowering and pod initiation stage.

Number of pods plant⁻¹

All the pods from five sampled plants were counted separately after harvest and the average number of pods plant⁻¹ was worked out.

Number of seeds pod⁻¹

After harvest and threshing number of seeds per pod from five sampled plants were counted separately and the average number of seeds per pod was worked out.

Weight of pod plant⁻¹ (g)

The total seeds obtained from 5 observed plant were weighed separately on analytical weighing balance and average value was calculated for obtaining weight of seeds plant⁻¹.

Seed yield plant⁻¹

After harvest and threshing number of seeds per plant from five sampled plants were weighed separately and the average number of seed yield plant⁻¹ was worked out.

Test weight (g)

After harvesting and threshing of all samples from each treatment, from composite sample of net plot 1000 seeds were counted and weighted on analytical weighing balance and values were recorded and expressed in gram.

Seed yield (q ha⁻¹)

The produce was dried in sun for a week. After threshing, the seeds were cleaned of dried leaves, soil and other trash material. The seed yield from net plot-1 was recorded and then converted on hectare basis by multiplying with hectare factor.

Haulm yield (q ha⁻¹)

After removing the seed from pods, the stalks along with empty pods were dried in the sun. Upon drying, the weight of the bundle of stalk plot-1 was recorded. The weight plot-1 was converted into q ha⁻¹ basis by utilizing hectare factor.

Biological yield (q ha⁻¹)

Biological yield of a crop is the total biomass put by a crop, and is calculated by summing up the seed yield and haulm yield.

Harvest index (%)

Harvest index of chickpea was calculated by using formula

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (q ha}^{-1}\text{)}}{\text{Biological yield (q ha}^{-1}\text{)}} \times 100$$

Results and Discussion

Persual of data revealed that in case of number of pods plant⁻¹, number of seeds pod⁻¹, weight of pods plant⁻¹, seed yield plant⁻¹, test weight, seed yield, haulm yield, biological yield and harvest index is presented in the Table 1 shows that treatment T7 i.e. the application of Cow urine @ 10% + Vermiwash @ 10% exhibited good results, which have higher number of pods plant⁻¹ (44.63), number of seeds pod⁻¹ (1.27), weight of pods plant⁻¹ (11.75 g), seed yield plant⁻¹ (8.44 g), test weight (178.84 g), seed yield (24.81 q ha⁻¹), haulm yield (29.87 q ha⁻¹), biological yield (54.68 q ha⁻¹), harvest index (45.39%). Treatment T4 i.e. the application of Panchagavya @ 3% was found to be on par in respect to number of pods plant⁻¹ (42.00), number of seeds pod⁻¹ (1.07), weight of pods plant⁻¹ (10.75 g), seed yield plant⁻¹ (8.16 g) and test weight (174.89 g), seed yield (23.94 q ha⁻¹), haulm yield (28.86 q ha⁻¹), biological yield (52.80 q ha⁻¹) and harvest index (45.33%). Chickpea crop treated with control recorded remarkably reduced values of yield attributes viz., number of pods plant⁻¹ (31.91), number of seeds pod⁻¹ (1.07), weight of pods plant⁻¹ (10.04 g), seed yield plant⁻¹ (7.16 g) and test weight (169.77 g), seed yield (20.74 q ha⁻¹), haulm yield (24.84 q ha⁻¹), biological yield (45.58 q ha⁻¹) and harvest index (45.47%). 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. The growth enzymes found encouraged quick cell division and multiplication due to the positive effects of the foliar spray, the growth and yield characteristic of the chickpea crop has been improved, which boost photosynthetic activity and facilitate the effective transfer of photosynthates from source to sink. It was found that applied cow urine and vermiwash work together synergistically to improve the energy sources available to microorganisms for their growth and development. Similar results were published by Mahto and Yadav (2005) [5], Patil *et al.* (2012) [7], Jadhav *et al.* (2014) [3], Jitendra *et al.* (2017) [4], Vora *et al.* (2019) [10], Prem Kumar *et al.* (2021) [9], Nitin and Purohit (2021) [6], Vora *et al.* (2019) [10]

Table 1: Effect of liquid organic formulations on yield and yield attributing characters of chickpea

Treatment	Number of pods plant ⁻¹	Number of seeds pod ⁻¹	Weight of pods plant ⁻¹ (g)	Seed yield -1 (g)	Test weight (g)	Seed yield (q ha ⁻¹)	Haulm yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Harvest Index (%)
T1	31.91	1.07	10.04	7.16	169.77	20.74	24.84	45.58	45.47
T2	35.02	1.07	10.24	7.35	170.60	21.36	25.99	47.35	45.13
T3	33.75	1.13	10.19	7.26	172.88	21.09	25.71	46.79	45.03
T4	42.00	1.07	10.75	8.16	174.89	23.94	28.86	52.80	45.33
T5	35.09	1.13	10.12	7.30	173.25	21.12	25.83	46.96	44.95
T6	35.47	1.13	10.17	7.28	175.48	21.07	25.45	46.52	45.32
T7	44.63	1.27	11.75	8.44	178.84	24.81	29.87	54.68	45.39
T8	34.85	1.07	10.10	7.32	74.27	21.29	26.19	47.47	44.87
T9	35.19	1.07	10.22	7.32	173.42	21.31	25.50	46.81	45.46
S.Em. ±	2.13	0.07	0.49	0.32	6.49	0.99	1.02	1.94	-
C.D. at 5%	6.38	NS	1.47	0.96	NS	2.99	3.09	5.82	-
General mean	36.44	1.11	10.39	7.51	173.71	21.86	26.47	48.33	45.22

T1: Control, T2: Cow urine @ 10%, T3: Vermiwash @ 10%, T4: Panchagavya @ 3%, T5: Waste decomposer @ 25%, T6: Jeevamrut @ 10%, T7: Cow urine @ 10% + Vermiwash @ 10%, T8: Cow urine @ 10% + waste decomposer @ 25%, T9: Vermiwash @ 10% + waste decomposer @ 25%

Conclusion

Application of Cow urine @ 10% + Vermiwash @10% observed to be significantly higher yield and yield attributing characters viz., number of pods plant⁻¹ (44.63), number of seeds pod⁻¹ (1.27), weight of pods plant⁻¹ (11.75 g), seed yield plant⁻¹ (8.44 g), test weight (178.84 g), seed yield (24.81 q ha⁻¹), haulm yield (29.87 q ha⁻¹), biological yield (54.68 q ha⁻¹), harvest index (45.39%), Treatment T4 i.e. the application of Panchagavya @ 3% was found to be on par and Treatment T1 i.e. control yields least.

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