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Effect of cow urine and vermiwash application on growth and yield of organic chickpea

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Abstract
Organic farming is one of the best and the most viable alternative to traditional farming techniques. As livestock is major resource to mankind for doing allied activity the abundant quantity of cattle waste containing cow urine and cow dung is available at farm level which is good source of N, P, K, Ca, Mg, S, and Cl. Vermiwash is also very good plant tonic which is used for foliar spray. As it contains plant nutrients, vitamins, plant growth promoting substances. The present experiment entitled, "Effect of cow urine and Vermiwash application on growth and yield of organic chickpea" conducted at AICRP IFS (All India Coordinated Research Project farm on Integrated Farming system), Mahatma Phule Krishi Vidyapeeth Rahuri, Dist. Ahmednagar (Maharashtra) during *Rabi* season of 2020-21. The RBD (Randomised Block Design) was used for the field experiment with three replications. There were ten treatments *viz.*, T_1- Cow urine 6 ml L^{-1}, T_2- Cow urine 8 ml L^{-1}, T_3- Cow urine 10 ml L^{-1}, T_4- Vermiwash 6 ml L^{-1}, T_5- Vermiwash 8 ml L^{-1}, T_6- Vermiwash 10 ml L^{-1}, T_7- Cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1}, T_8- Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}, T_9- Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1}, T_{10} – Control. Foliar application of these treatments were done on crop at flowering as well as at pod formation stage. After applying above treatments the growth contributing characters *viz.*, plant height, number of branches plant^{-1}, plant spread and dry matter plant^{-1} of the crop sprayed with treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} was recorded higher values of growth, yield, quality attributing characters and economic returns as compared with rest of foliar application treatments and it is reported at par with treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} at 70, 84 DAS and at the time of harvest. Based on one season trial data, foliar spray of treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} at the stage of flowering and at pod formation found suitable for achieving desirable growth, yield, nutrient uptake, higher protein content of seed and economic returns in chickpea.

Keywords: Vermiwash, foliar application, treatment, yield, replications

Introduction
Pulses play a crucial role in Indian agriculture. Chickpea (*Cicer arietinum* L.) is one of India's most significant *Rabi* season pulse crop, valued for its economic importance and it is having ability to preserve soil fertility by atmospheric nitrogen fixation through a symbiotic association with the *Rhizobium spp*., so that the soil fertility for succeeding cereal crop production is improved. Chickpeas are believed to be originated in south-eastern Turkey, from where it has spread to various parts of the world. India is the world's top producer, accounting for 65 percent of global production (FAOSTAT. 2015) [4]. Despite being the world's top producer of chickpeas, India continues to import chickpea from other countries. It is essential to increase productivity and cultivable area under chickpea. The cultivated area of chickpea in India was 9.44 million hectares, having production of 10.13 MT and having average productivity 1073 kg per hectare. Chickpeas seeds are good source of calcium, iron, niacin, vitamin B and C, and also good source of highly digestible dietary protein (19.5%). In general, desi chickpeas are used to make split dal or flour (Besan). Tender leaves of gram are consumed as a vegetable, whereas dried plant parts are fed to cattle. The decline in per capita availability of the pulses from 69.0 gm in 1961 to 35.9 gm in 2004 has created alarming situation there is need to improvement in it's area and production. (Moorthy and Dubey, 2004) [9]. As livestock is major resource to mankind for doing allied activity the abundant quantity of cattle waste containing cow urine and cow dung is available at farm level which is good source of N, P, K, Ca, Mg, S, and Cl. cow urine acts as a important source of improving soil fertility, productivity and quality. Vermiwash is also very good plant tonic that is used for foliar spray. As it contains plant nutrients, vitamins, plant growth promoters.

It plays a important role in growth of plants and its development contributes root initiation, growth of roots, plant development, promoting growth rate and improvement in crop production results in higher crop yield. It is eco-friendly so there is no adverse effect on ecosystem and human health. The supply of nutrients through the roots is restricted in some soil conditions such as higher pH and high lime content. To overcome such problem, we can provide nutrients through foliar application. Foliar fertilization is able to quickly, cheaply, economically, overcoming various deficiency symptoms (Alexander, 1986) [1]. It was thought to use foliar application of the cow urine as an organic source in combination with vermiwash to get optimum yield and quality.

Materials and Methods

The experiment entitled the "Effect of cow urine and vermiwash application on growth and yield of organic chickpea" conducted at Integrated Farming System research farm, MPKV Rahuri. During *Rabi* season of 2020-21. Geographically IFSRP situated at 19^0 22' N latitude and 74^0 38' E latitude with altitude 539 m above mean sea level. Climatologically, this area falls in the semi-arid tract with average annual rainfall of 527 mm and rainy days are 15 to 45. The experimental plot soil having clay loam texture, alkaline in reaction (pH 7.80), low in organic carbon (0.45%) with electrical conductivity (0.26 dSm^{-1}). The soil was also low in available nitrogen (188.2 kg ha^{-1}), it is having medium amount of available phosphorus (16.22 kg ha^{-1}) and very high amount of available potassium (356.48 kg ha^{-1}), respectively. Chickpea seeds of variety Phule Vikram are used for sowing. The experiment was conducted in Randomized Block Design (RBD) with ten treatments and three replications. *viz.*, T_1- Cow urine 6 ml L^{-1}, T_2- Cow urine 8 ml L^{-1}, T_3- Cow urine 10 ml L^{-1}, T_4- Vermiwash 6 ml L^{-1}, T_5- Vermiwash 8 ml L^{-1}, T_6- Vermiwash 10 ml L^{-1}, T_7- Cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1}, T_8- Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}, T_9- Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1}, T_{10} – Control. Foliar application of treatments were done on crop at the stage of flowering and pod formation. Biometric observations recorded on the various growth characters *viz.* Height of plant, plant spread, number of the branches $plant^{-1}$, dry matter $plant^{-1}$. The yield attributes *viz.* No. of pods $plant^{-1}$, weight of pods $plant^{-1}$, seeds yield (g) $plant^{-1}$, straw yield, seed index, biological yield, harvest index. Quality characters such as protein content. Observations were recorded at different growth parameters and at harvest.

Results

1. Growth Parameters

A. Plant height: The plant height influenced significantly after 70, 84 DAS and at the stage of harvest due to different treatments of foliar application at flowering as well as pod formation stage. The treatment T_9 *i.e.* foliar application of the Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} has exhibited higher plant height of chickpea at 70, 84 DAS and at a time of harvest. While, Treatment T_8 *i.e.* application of the Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} was found at par in respect to plant height. The minimum plant height was reported in the treatment T_{10} *i.e.* absolute control were no foliar application were done.

B. Number of branches $plant^{-1}$: The data related to no. of branches $plant^{-1}$ in chickpea were influenced significantly after 70, 84 DAS and at the harvesting stage due to different foliar application treatments at flowering and pod formation stage. The treatment T_9 *i.e.* application of the Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} has produced higher number branches $plant^{-1}$ at 70, 84 DAS and at time of harvest it is at par with Treatment T_8 *i.e.* application of the Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}.

C. Plant spread: The treatment T_9 *i.e.* foliar application of the Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} produces significantly higher plant spread of chickpea at 70, 84 DAS and at harvest because foliar spray was carried out at flowering and pod formation stage. While, it was at par with treatment T_8 *i.e.* application of Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}. No application of foliar spray to chickpea produced minimum plant spread at 70, 84, DAS and at harvest during the experimentation.

D. Dry matter $plant^{-1}$: The maximum value dry matter production $plant^{-1}$ at 70, 84 DAS and at harvest was registered by foliar application of cow urine and vermiwash. The treatment T_9 *i.e.* application of the Cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over other treatment (18.52 gm) 70 DAS, (31.02 gm), 84 DAS and (33.76 gm) at harvest. The treatment T_8 *i.e.* application of Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} is at par with treatment T_9.

Table 1: Effect of foliar application on different growth parameters of chickpea at harvest

Treatment	Plant Height (cm)	Number of branches	Plant Spread	Dry matter accumulation (g) $Plant^{-1}$
T_1: Cow urine 6 ml L^{-1}	51.00	17.85	39.20	28.34
T_2: Cow urine 8 ml L^{-1}	51.86	18.37	39.60	30.03
T_3: Cow urine 10 ml L^{-1}	52.77	18.70	40.30	30.75
T_4: Vermiwash 6 ml L^{-1}	50.83	17.66	38.73	28.06
T_5: Vermiwash 8 ml L^{-1}	51.36	18.20	39.47	29.18
T_6: Vermiwash 10 ml L^{-1}	52.07	18.47	39.82	30.20
T_7: Cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1}	53.00	18.50	40.54	31.72
T_8: Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}	53.22	19.10	41.66	32.80
T_9: Cow urine 10 ml L^{-1} +Vermiwash 10 ml L^{-1}	54.35	19.18	42.37	33.76
T_{10}: Control	50.60	17.12	38.64	27.83
S.Em ±	0.22	0.12	0.17	0.30
C.D. at 5%	0.65	0.37	0.52	0.89
General mean	52.10	18.31	40.03	30.27

2. Yield attributing characters and yield

A. Number of pods $plant^{-1}$: The treatment T_9 *i.e.* application of the cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over rest of treatment (62.33) at harvest. The treatment T_8 *i.e.* application of the Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} at par with treatment

T_9 (61.33) at harvest. The lowest value number of pods plant^{-1} (43.67) was reported in control.

B. Weight of pods plant^{-1}: The treatment T_9 *i.e.* foliar spray of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over other treatments (26.17 gm) at harvest and it is superior over treatment T_8 *i.e.* foliar spray of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} (25.03 gm) at harvest. The lowest value of weight of pods plant^{-1} (17.70 gm) was reported in control.

3. **Seed yield (g) plant^{-1}:** Foliar application of the cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} on chickpea was recorded the higher seed yield plant^{-1} (23.56 g). Whereas the minimum seed yield plant^{-1} was recorded in control (16.17 g). The treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} at par with treatment T_9 (22.50 g) at harvest.
4. **Seed yield (q ha^{-1}):** The higher seed yield is function of luxurious growth, higher dry matter, yield attributes and physiological characters. The treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over all other treatment (29.98 q ha^{-1}) at harvest and it is at par with treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} (29.86 q ha^{-1}) and it is followed by treatment T_7 *i.e.* application of cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1} (29.23 q ha^{-1}) at harvest. The significantly lower seed yield of chickpea was observed with control (23.50 q ha^{-1}).
5. **Straw yield (q ha^{-1}):** The treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over all treatment (37.95 q ha^{-1}). The significantly lower chickpea seed yield was recorded in control (27.67 q ha^{-1}).
6. **Biological yield (q ha^{-1}):** The biological yield was influenced significantly due to different foliar sprays. Among the foliar sprays the higher value of biological yield was recorded in case of treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} (67.93 q ha^{-1}) and it is followed by treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} (66.76 q ha^{-1}) and it is followed by treatment T_7 *i.e.* application of cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1} (65.26 q ha^{-1}) at harvest. The value of biological yield ranges between 51.17 - 67.93 within all the treatments. Whereas the minimum biological yield was recorded with control (51.17 q ha^{-1}).
7. **Protein content in seed:** Higher value of protein content in seeds of chickpea was recorded in treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1}. The treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} have better results over rest of treatment (20.87%) at harvest and it is at par with treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} (20.78%) at harvest

Table 2: Effect of foliar application on Yield attributing characters and yield of chickpea at harvest

Treatment	Number. of pods plant^{-1}	Weight of pods plant^{-1} (g)	Seed yield plant^{-1} (g)	Seed yield q ha^{-1}	Straw yield q ha^{-1}	Biological yield (q ha^{-1})	Protein content in seed (%)
T_1: Cow urine 6 ml L^{-1}	46.67	18.16	17.20	25.00	29.93	54.93	20.30
T_2: Cow urine 8 ml L^{-1}	50.67	20.07	18.27	25.70	30.85	56.55	20.42
T_3: Cow urine 10 ml L^{-1}	53.33	23.10	20.23	28.20	34.92	63.12	20.59
T_4: Vermiwash 6 ml L^{-1}	45.00	17.85	16.90	24.80	28.00	52.80	20.24
T_5: Vermiwash 8 ml L^{-1}	48.33	19.03	18.00	25.10	30.75	55.85	20.33
T_6: Vermiwash 10 ml L^{-1}	52.67	21.24	20.00	26.27	32.15	58.42	20.47
T_7: Cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1}	58.00	24.00	21.64	29.23	36.03	65.26	20.66
T_8: Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}	61.33	25.03	22.50	29.86	36.90	66.76	20.78
T_9: Cow urine 10 ml L^{-1} +Vermiwash 10 ml L^{-1}	62.33	26.17	23.56	29.98	37.95	67.93	20.87
T_{10}: Control	43.67	17.70	16.17	23.50	27.67	51.17	20.16
S.Em ±	1.36	0.30	0.38	0.36	0.22	1.24	0.026
C.D. at 5%	4.07	0.90	1.13	1.07	0.66	3.71	0.079
General mean	52.40	21.24	19.45	26.76	32.52	59.28	20.48

C. Economics

1. **Gross monetary returns:** Mean value of gross monetary returns of chickpea during *Rabi* 2020-21 were 137027 ₹ ha^{-1}. It is influenced significantly because of different treatments of foliar application. The treatment T_9 *i.e.* application of the cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} found superior and obtained higher gross monetary returns of 153250 ₹ ha^{-1} during *Rabi* 2020-21, which was at par with treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} 152990 ₹ ha^{-1}. Treatment T_{10}-control produced significantly lower values of a gross monetary returns 120267 ₹ ha^{-1}.
2. **Cost of cultivation:** The mean value of the cost of cultivation of chickpea crop was 52793 ₹ ha^{-1}.
3. **Net monetary returns:** The mean value of net monetary returns were 84232 ₹ ha^{-1} during *Rabi* 2020-21. The value of net monetary return significantly influenced due to different treatments of foliar application. The chickpea crop sprayed with treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1}. produced maximum value of net monetary returns of 99850 ₹ ha^{-1} during *Rabi* 2020-21 as compared to all other treatments and treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} produce net monetary returns of 99500 ₹ ha^{-1} which is found at par with treatment T_9. The chickpea crop with control treatment obtained lowest value of net monetary returns 66767 ₹ ha^{-1} than rest of foliar application treatments.
4. **Benefit: cost ratio:** The mean value of benefit cost ratio of chickpea was 2.59 during *Rabi* 2020-21. The mean value of B:C ratio of chickpea sprayed with treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} was found superior (2.87) as compared to other treatments of foliar application which is at par with

treatment T_8 *i.e.* application of cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1} having benefit cost ratio (2.86). Significantly minimum benefit cost ratio (1.24) was obtained in chickpea with control treatment during *Rabi* 2020-21.

Table 3: Effect of different treatments on economics of chickpea

Treatment	Gross monetary returns (₹ /ha^{-1})	Cost of cultivation (₹ /ha^{-1})	Net monetary returns (₹ /ha^{-1})	B:C ratio
T_1: Cow urine 6 ml L^{-1}	127993	53813	74180	2.37
T_2: Cow urine 8 ml L^{-1}	131585	51492	80093	2.55
T_3: Cow urine 10 ml L^{-1}	144492	52400	92092	2.75
T_4: Vermiwash 6 ml L^{-1}	126800	53860	72940	2.35
T_5: Vermiwash 8 ml L^{-1}	128575	52940	75635	2.42
T_6: Vermiwash 10 ml L^{-1}	134565	50452	84113	2.66
T_7: Cow urine 6 ml L^{-1} + Vermiwash 6 ml L^{-1}	149753	52600	97153	2.84
T_8: Cow urine 8 ml L^{-1} + Vermiwash 8 ml L^{-1}	152990	53490	99500	2.86
T_9: Cow urine 10 ml L^{-1} +Vermiwash 10 ml L^{-1}	153250	53400	99850	2.87
T_{10}: Control	120267	53480	66767	2.24
S.Em±	320.18	-	42.12	-
C.D. at 5%	951.31	-	125.17	-
General mean	137027	52793	84232	2.59

Discussion

The present studies revealed that the foliar spray of cow urine and vermiwash at definite concentration leads to improvement in various parameters of the plant**.** The increased value of plant height has observed in chickpea because cow urine consists of uric acid, ammonical nitrogen which may easily absorbed by crop plants and vermiwash consists of readily available macro and also micro nutrient sources it also has hormonal action leads to enhanced growth if concentration of both increases it significantly effect on crop growth. The results found simmilar with Jandaik *et al.* (2015) [8].

The reason to increase no. of branches plant^{-1} due to the growth enzymes present in cow urine and vermiwash which favoured rapid cell division and multiplication. Similar result were recorded by Deogirkar (2010) [3].

The foliar applications having beneficial effects on cell elongation and cell division that increase photosynthetic activity and supported efficient translocation of the photosynthates from source to sink resulted in higher plant spread and increase dry matter production of plant it also increases straw yield. This results are found simillar with Hatti *et al.* (2010) [5], Rahate *et al.* (1990) [11], Sadhukhan *et al.* (2018) [13].

The different foliar spray application increased number of primary and secondary branches plant^{-1} due to that no. of pods plant^{-1} will also increase this might be due to the application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} increased in flower retention also increase no. of pods and weight of pods plant^{-1} because vermiwash contains growth hormones like auxine, cytokinins etc and cow urine also contains mixture of hormones, enzymes, minerals etc, which resulted into more no. of pods per plant in chickpea crop. The results are found simillar with Ingle S.R. (2007) [6], Jadhav *et al.* (2014) [7] and Thakare *et al.*, (2006) [14].

Increased seed yield plant^{-1} due to combined effect of yield attributing characters, enhanced photosynthetic efficiency and improvement in the capacity of reproductive sinks to utilize the incoming assimilates. The foliar sprays increases primary and secondary branches of chickpea and ultimately increased the no. of pods plant^{-1} which resulted in the increased seed yield plant^{-1}. These results found similar with Pawar *et al.* (2008) [10] and Rekha *et al.* (2013) [12], Yadav and Lourduraj (2006) [16], Jadhav *et al.* (2014) [7].

If we say about biological yield the foliar spray produced higher quantity of grain as well as straw yield due to the healthy crop growth which was reflected in higher biological yield.

In case of quality parameters like protein content of chickpea the foliar application effects positively. Plant shows increased in chlorophyll as well as protein content with increasein concentration of cow urine. The results are found similar to Jandaik *et al.* (2015) [8].

The chickpea crop sprayed with treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} has been produced higher grain yield and straw yield due to boosting of luxurious growth of crop and yield attributes. This was reflected in obtaining higher values of gross as well as net monetary returns. Results are is close association with Behera P.K., and Bhoi, (2021) [2].

The benefit cost ratio is the function of gross monetary returns and cost of cultivation. The chickpea crop sprayed with treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} obtained higher value of gross monetary returns which was reflected in achieving maximum benefit cost ratio. Results are is close association with Behera P.K., and Bhoi, (2021) [2], in organic farming costs are relatively lower as compared to cost of inorganic farming and organic farms have secured relatively higher net returns than inorganic farms.

Conclusion

From present study, it is clear that foliar spray of treatment T_9 *i.e.* application of cow urine 10 ml L^{-1} + Vermiwash 10 ml L^{-1} at the time of flowering as well as at pod formation stage is the most useful foliar spray and it is suited to achieve maximum growth and yield attributes, nutrient uptake, protein content and economic returns in chickpea. Therefore the efficient use of cow urine and vermiwash provides a better alternative to the synthetic chemicals/Artificially manufactured chemicals which are costly and cause potential danger to the farmers, consumers, marketers, habitat and environment.

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References

1. Alexander A. Foliar fertilization. International Standard Book Number. 1986;90-247-3288.
2. Behera PK, Bhoi B. Cost and return analysis of inorganic and organic agriculture. International Journal of Modern Agriculture. 2021;10(1):2305-7246.
3. Deogirkar MS. Physiological responses of chickpea to foliar sprays of cow urine and NAA, M. Sc. (Agri.) thesis submitted to Dr. P. D. K. V. Akola; c2010.
4. Food and Agriculture Organization (FAO). FAOSTAT Statistical Database of the United Nation Food and Agriculture Organization (FAO) statistical division. Rome; c2015.
5. Hatti SS, Londonkar RL, Patil SB, Gangawane AK, Patil CS. Effect of *Eisenia foetida* vermiwash on the growth of plants. Journal of Crop Science. 2010;1(1):6-10.
6. Ingle SR. Physiological responses of black gram to foliar sprays of cow urine and NAA. M.Sc. (Agri.) thesis submitted to Dr. P. D. K. V. Akola; c2007.
7. Jadhav PB, Kireeti A, Patil NB, Dekhane SS, Patel DJ. Effect of different levels of vermiwash spray on growth and yield of radish *cv*. local variety. The Asian Journal of Horticulture. 2014;9(2):449-452.
8. Jandaik S, Thakur P, Kumar V. Efficacy of cow urine as plant growth enhancer and antifungal agent. Advances in Agriculture. 2015;15(9):7-10.
9. Moorthy BT, Dubey RP. Techniques of weed management in chickpea. Indian Journal of Weed Science. 2004;36:274-75.
10. Pawar B, Sujata RD, Deotale NH, Sable VK, Baviskar SB. Influence of foliar sprays of cow urine and NAA on chemical and biochemical parameters of groundnut. Journal of Soils and Crops. 2008;18(2):398-404.
11. Rahate RS, Thosar VR, Mahajan AG. Manurial efficiency of Biogas effluent slurry on growth and yield of groundnut crop (*Arachis hypogea* L.) var. Phule Pragati. PKV Research Journal. 1990;14(2):197-200.
12. Rekha GS, Valivittan K, Kaleena PK. Studies on the influence of vermicompost and vermiwash on the growth and productivity of black gram (*Vigna mungo*). Advances in Biological Research. 2013;7(4):114-121.
13. Sadhukhan R, Bohra JS, Choudhury S. Effect of fertility levels and cow urine foliar spray on growth and yield of wheat. International Journal of Current Microbiology and Applied Sciences. 2018;7(03):907-912.
14. Thakare KG, Deotale RD, Chore CN, Lende SR, Pawar SB. Influence of nutrients and hormones on biological and yield and yield contributing parameters of soybean. Journal of Soils and Crops. 2006;16(1):210-216.
15. Verma S, Singh A, Pradhan SS, Singh RK, Singh JP. Bio-efficacy of organic formulations on crop production. International Journal Current Microbiology and Applied Sciences. 2017;6(5):648-665.
16. Yadav BK, Lourduraj AC. Effect of organic manures and panchagavya spray on yield attributes, yield and economics of rice (*Oryza sativa* L.) Crop Research. 2006;31(1):1-5.