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Effect of Organic and Inorganic Source of Nutrients on soil properties and quality of Fenugreek (*Trigonella foenum – graecum* L.)

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ABSTRACT: A field experiment was conducted during the *Rabi* season 2021-22 and 2022-23 at Rajasthan College of Agriculture, MPUAT, Udaipur (Rajasthan), to study the effect of organic and inorganic source of nutrients on soil biological properties and productivity. The research revolved around the cultivation of Fenugreek (*Trigonella foenum – graecum* L.). The experiment was thoughtfully organized using a Factorial Randomized Block design, thoughtfully replicated three times for robust statistical analysis and sixteen treatments. The treatments comprised of different combination of organic source and inorganic source *viz*. The significantly, bulk density, particle density, porosity, water holding capacity, pH, EC and organic carbon observed with the application of the full Recommended Dose of Fertilizer (100% RDF) coupled with a foliar spray of zinc 0.25% with 6 t vermicompost + foliar spray of @5% vermiwash (ION_3 ON_3) over control during both 2021-22, 2022-23 and in pooled analysis. Furthermore, the significantly protein content in seed and chlorophyll content was recorded with application of 100% RDF + foliar spray of zinc 0.25% with 6 t vermicompost + foliar spray of @5% vermiwash (ION_3 ON_3) In comparison to the control group, these superior results persisted consistently throughout both years and remained evident in the comprehensive pooled analysis.

Keywords: Vermicompost, foliar spray of vermiwash with fertility level, foliar spray of zinc, Physico-chemical properties and productivity of fenugreek.

INTRODUCTION

Fenugreek (*Trigonella foenum graecum* L.), commonly referred to by its vernacular name "Methi," holds a significant status as an essential condiment crop cultivated in the northern regions of India during the *Rabi* season. It occupied prime place amongst the seed spices grown in northern India particularly in the context of India, Fenugreek (*Trigonella foenum graecum* L.) commands a notable presence. It spans across an extensive 126,294 hectares of land, yielding an annual bounty of 182,170 tonnes. The average seed productivity stands impressively at 1,442 kilograms per hectare. Among the leading states contributing to fenugreek cultivation in India, we find Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, Maharashtra, and Punjab at the forefront.

Zooming in on Rajasthan, this state dedicates 52,661 hectares to fenugreek cultivation, reaping an annual harvest of 66,742 tonnes. The average productivity in Rajasthan is 1,267 kilograms per hectare. Noteworthy districts in Rajasthan where fenugreek thrives include Sikar, Chittorgarh, Jaipur, Pali, Nagaur, Jhalawar, and Alwar (FAI, 2021-22).

Vermicompost considered a valuable organic fertilizer as it supplies nutrients for the crop which results in saving cost of chemical fertilizers. Besides, it provide all the essential macro and micro nutrients in readily available forms, enhances uptake of these nutrients by the plants and play a major role in improving growth and yield of crops. Vermicompost also acts as a niche for microbes and enriches the soil with a variety of the indigenous micro-flora and fauna (Vuković *et al*., 2021).

Synthetic inorganic fertilizers are meticulously formulated compounds designed to furnish essential nutrients to crops. These fertilizers are synthetically produced through chemical processes and conventionally encompass crucial macronutrients: nitrogen (N), phosphorus (P) and potassium (K), pivotal for fostering plant growth and maturation. In the realm of modern agriculture, inorganic fertilizers have gained wide spread usage, bolstering soil fertility and amplifying crop output. The prevalence of inorganic

fertilizers has steadily risen over the past century due to their ability to promptly deliver nutrients to crops in a readily assimilation form, thereby expediting growth and ultimately yielding higher harvests (Jat and Saharawat 2019). Zinc assumes a pivotal role in fenugreek production as a micronutrient and its inadequacy is accentuated by factors such as the coarse soil texture, limited organic matter content, alkaline soil pH fostered by calcareous soil nature, and the impact of alkali and intensive cultivation on its heightened depletion. Particularly in Rajasthan, the soils exhibit coarseness.

MATERIALS AND METHODS

A. Experimental site and soil

The field experiment was meticulously conducted during the *Rabi* season of 2021-22 at the Instructional Farm (Agronomy) of Rajasthan College of Agriculture, Udaipur, strategically nestled at an elevation of 579.5 meters above the mean sea level with 24°34′ latitude and 73°42′ longitude. The region falls under agro-climatic zone IV-A (Sub-humid Southern Plain and Aravalli Hills) of Rajasthan. The mean maximum and minimum temperature are 34.40°C & 13.70°C in 2018 and 33.60°C & 13.20°C in 2022-23, respectively. Experimental soil was clay loam in texture. Experimental soil has bulk density (1.54 and 1.55 Mgm^{-3}), particle density (2.64 and 2.65 Mgm^{-3}), porosity (41.46 and 41.35%), water holding capacity (39.91 and 40.60%), pH (8.25 and 8.27), EC (0.84 and 0.85 dSm^{-1}) and organic carbon (0.51 and 0.53%), during 2021-22 and 2022-23, respectively,

B. Application of organic manure and nitrogen fertilization

The organic sources of nutrients were vermicompost with foliar spray of vermiwash. The vermicompost were applied in the field as per the treatment & thoroughly mixed before one month of sowing and fertilizers were applied at the time of sowing. The N, P_2O_5 and K_2O content of vermicompost (1.6, 1.3 and 1.2%), respectively. The recommended dose of nitrogen, phosphorus and potassium is 40: 40: 00 kg ha^{-1}. The recommended dose of nitrogen was applied though urea into equal splits, the half as basal and the remaining half as top dressing at knee high stage, phosphorus was applied though DAP in application of basal dose and foliar spray of zinc in after sowing 35 days.

C. Experimental design and treatments

The experiment was meticulously structured using a Factorial Randomized Block design, incorporating a total of 3 replications and treatments consisted of 4 levels of organic source of nutrients and 4 levels of inorganic source of nutrients to fenugreek. The different treatments and their symbols used are given in Table 1.

Table 1: Treatments and their symbols.

	Treatments	Symbols
Organic source of nutrients (kg ha^{-1})		
i.	Control	ON_0
ii.	Vermicompost 2 t ha^{-1} + Foliar spray @ 10% Vermiwash	ON_1
iii.	Vermicompost 4 t ha^{-1} + Foliar spray @ 7.5% Vermiwash	ON_2
iv.	Vermicompost 6 t ha^{-1} + Foliar spray @ 5% Vermiwash	ON_3
Inorganic source of nutrients (kg ha^{-1})		
i.	Control	ION_0
ii.	50% RDF + Foliar spray of Zn @ 0.75%	ION_1
iii.	75% RDF + Foliar spray of Zn @ 0.50%	ION_2
iv.	100% RDF + Foliar spray of Zn @ 0.25%	ION_3

Fenugreek variety RMT-1 was sown at the seed rate of 20 $kgha^{-1}$ at inter row of 30 and plant to plant spacing of 10 cm.

D. Statistical analysis

The data collected for various parameters underwent rigorous analysis utilizing the sophisticated technique of analysis of variance (ANOVA) tailored for a factorial randomized block design. The ensuing results are thoughtfully presented at a significance level of 5% (P=0.05).

RESULT AND DISCUSSION

A. Physical Properties

Effect of organic source of nutrients. It is apparent from the data in Table 2 showed that bulk density of soil after harvest of the fenugreek crop decreased significantly due to the application of vermicompost with vermiwash over the control during 2021-22 and 2022-23 Furthermore, when considering the pooled data analysis, the maximum values for bulk density, particle density and porosity were consistently observed at (1.48, 1.47, and 1.47 Mg m^{-3}) under the ON_0 (Control) treatment, (2.64, 2.66 and 2.65 Mg m^{-3}) and (47.52, 47.72 and 47.62 %)of soil was obtained under ON_3 (6 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) followed by ON_2 (4 t vermicompost + foliar spray @ 7.5% vermiwash ha^{-1}) and ON_1 (2 t vermicompost + foliar spray @ 10% vermiwash ha^{-1}) treatments as compared to control (ON_0) during 2021-22, 2022-23 and pooled analysis. similar results have also been reported by a numberof workers *viz.*, Biswas (2011); Kranz *et al.* (2020); Pandiyana *et al.* (2020)

Effect of inorganic source of nutrients. It is further apparent from the data in Table 2 also showed that the bulk density, particle density, and porosity of soil after harvest of the fenugreek crop was found to be non-significant with the application of inorganic levels along with foliar spray of zinc during both the years of experimentation as well as in pooled analysis.

B. Chemical Properties

Effect of organic source of nutrients. The data given in table 3 showed that the application vermicompost with foliar spray of vermiwash significantly decreased the pH of soil over control during both the years as well as in pooled analysis. The pH and EC of soil after harvest of the fenugreek crop varied from 8.10-8.25, 8.01-8.16, 8.05-8.20 and during 2021-22, 2022-23 and in pooled analysis, respectively. The minimum value of pH (8.10, 8.01 and 8.05) and EC (0.57, 0.58 and 0.57 dSm^{-1}) in soil was observed under the treatment of ON_3 (6 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) and maximum value of pH (8.25, 8.16 and 8.20) and EC (0.63, 0.65 and 0.64 dSm^{-1}) in soil was observed with the control (ON_0) during 2021-22, 2022-23 and in pooled, respectively. Maximum value of pH (8.20) and EC (0.64 dsm^{-1}) in soil was obtained under the control (ON_0) in pooled analysis which decreased by 0.15 under the application of ON_3 (6 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}). The organic carbon content in soil after harvest of the fenugreek crop varied from 0.62-0.73, 0.64-0.75 and 0.63-0.74% during 2021-22, 2022-23 and in pooled analysis, respectively. The maximum value of organic carbon content (0.73, 0.75 and 0.74%) in soil was observed under ON_3 (6 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) which was significantly superior over ON_2 (4 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) and ON_1 (2 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) treatments as well as control (ON_0) during 2021-22, 2022-23 and in pooled analysis. The lowest value of organic carbon content (0.62, 0.64 and 0.63%) in soil was recorded under control (ON_0). The data further revealed that the per cent increase in organic carbon content in soil were in order of 17.68, 16.98 and 17.33 in pooled analysis due to application of 6, 4 and 2 t vermicompost + foliar spray @ 5%, 7.5% and 10% vermiwash ha^{-1} as compared to control (ON_0). These results of present finding are in line with Nagar *et al.* (2016); Meena (2017); Meena (2019); Aechra (2021) who also reported decreased pH and electrical conductivity of soil with the application of vermicompost with foliar spray vermiwash reported by Dsouza *et al.* (2018). Similar results have also been reported by a number of workers *viz.*, Biswas (2011); Kranz *et al.* (2020); Pandiyana *et al.* (2020).

Effect of inorganic source of nutrients. It is further apparent from the data in Table 3 revealed that the pH of soil not influenced significantly due to the application of inorganic levels with foliar spray of zinc during 2021-22, 2022-23 and in pooled analysis, respectively. Electrical conductivity and organic carbon of soil after harvest of the fenugreek crop varied from 0.57-0.63, 0.58-0.65 and 0.57-0.64 dSm^{-1}, 0.62-0.73, 0.64-0.75 and 0.63-0.74% during 2021-22, 2022-23 and in pooled analysis, respectively. The maximum value of electrical conductivity (0.62, 0.64 and 0.63 dSm^{-1}) and organic carbon content (0.73, 0.75 and 0.74%) of soil was observed under the treatment of ION_3 (100% RDF + foliar spray of Zn 0.25%) and minimum value of electrical conductivity (0.58, 0.59 and 0.58 dSm^{-1}) and organic carbon content (0.62, 0.64 and 0.63%) and organic carbon of soil was observed with the control (ION_0) during 2021-22, 2022-23 and in pooled, respectively. Maximum electrical conductivity (0.62, 0.64 and 0.63 dSm^{-1}) in soil was obtained under the application of ION_3 (100% RDF + foliar spray of Zn 0.25%) which increased by 0.04, 0.04 and 0.04 dSm^{-1} under the application of ION_0 (Control) levels during 2021-22, 2022-23 and in pooled, respectively. Similar results were also reported by Ali *et al.* (2015); Zhu *et al.* (2020). The data further revealed that the per cent increase in organic carbon content in soil were in order of 17.54, 17.02 and 17.28 in pooled analysis due to application of 100% RDF + foliar spray of Zn 0.25% (ION_3), 75% RDF + foliar spray of Zn 0.50% (ION_2) and 50% RDF + foliar spray of Zn 0.5% (ION_1) as compared to control (ION_0), respectively. These results are in agreement with the findings of Jangir *et al*. (2017); Zhu *et al*. (2020).

Protein content and chlorophyll content Quality

Effect of organic source of nutrients: The split application of increasing levels of vermicompost with foliar spray vermiwash significantly increased the chlorophyll and protein content in fenugreek seeds (Table 4). The maximum protein content in seed (19.83, 19.85 and 19.84%) and chlorophyll content in leave (3.06, 3.07 and 3.07 mg g^{-1}) was recorded under ON_3 (6 t vermicompost + foliar spray @ 5% vermiwash ha^{-1}) followed by ON_2 (4 t vermicompost + foliar spray @ 7.5% vermiwash ha^{-1}) and ON_1 (2 t vermicompost + foliar spray @ 10% vermiwash ha^{-1}) treatments as compared to control (ON_0) during 2021-22, 2022-23 and in pooled basis, respectively. However, the difference between ON_2 and ON_3 treatment were found to be statistically at par. This might be due to the application of vermicompost with foliar spray vermiwash to legume crop increased the availability of nitrogen. Nitrogen is one of the main constituents required for protein and chlorophyll synthesis, therefore increased nitrogen absorption enhanced the seed protein and chlorophyll content (Meena *et al*., 2021).

Effect of inorganic source of nutrients: The application of 100% RDF + foliar spray of zinc @ 0.25% ha^{-1} recorded the significantly highest protein content in seed (19.98, 20.00 and 19.99%) and chlorophyll content in leave (3.08, 3.10 and 3.09 mg g^{-1}) over control (Table 4) were consistently observed under the ION_3 treatment (100% RDF + foliar spray of Zn 0.25%), displaying significant superiority over the ION_2 (75% RDF + foliar spray of Zn 0.50%) and ION_1 (50% RDF + foliar spray of Zn 0.75%) treatments, as well as the control (ION_0) during both the 2021-22 and 2022-23 seasons, and in the pooled analysis. Conversely, the significant increase in protein content in seed and chlorophyll content in leave due to RDF with foliar spray of zinc fertilization could be attributed to the fact that zinc fertilization increased nitrate reductase enzymes which is responsible for higher nitrogen content and ultimately protein content. Similar, results have also been reported by Meena *et al*. (2021) and Todawat *et al.* (2017).

Table 2: Effect of organic and inorganic source of nutrients on BD, PD, porosity and water holding capacity in soil after harvest of fenugreek.

Treatments	Bulk density (Mg m^{-3})			Particle density (Mg m^{-3})			Porosity (%)			Water holding capacity (%)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Organic source of nutrients (t ha^{-1})												
Control (ON_0)	1.48	1.47	1.47	2.52	2.55	2.54	41.46	42.39	41.92	39.16	40.30	39.73
V 2 t ha^{-1} + FS @ 10% Vermiwash (ON_1)	1.42	1.41	1.41	2.58	2.61	2.59	45.02	45.83	45.42	40.34	41.40	40.87
V 4 t ha^{-1} + FS @ 7.5% Vermiwash (ON_2)	1.41	1.40	1.40	2.61	2.63	2.62	45.87	46.77	46.32	42.26	43.37	42.81
V 6 t ha^{-1} + FS @ 5% Vermiwash (ON_3)	1.39	1.39	1.39	2.64	2.66	2.65	47.52	47.72	47.62	44.49	45.52	45.01
SEm±	0.01	0.01	0.01	0.02	0.03	0.01	0.68	0.65	0.35	0.38	0.35	0.19
CD (P=0.05)	0.04	0.04	0.02	0.05	0.07	0.02	1.98	1.89	0.98	1.10	1.01	0.55
Inorganic source of nutrients (kg ha^{-1})												
Control (ION_0)	1.44	1.43	1.43	2.56	2.58	2.57	43.86	44.59	44.22	41.27	42.51	41.89
50% RDF + FS of Zn 0.75% (ION_1)	1.43	1.43	1.43	2.58	2.61	2.60	44.45	45.17	44.81	41.40	42.55	41.97
75% RDF + FS of Zn 0.50% (ION_2)	1.41	1.41	1.41	2.60	2.63	2.62	45.64	46.31	45.98	41.77	42.76	42.26
100% RDF + FS of Zn 0.25% (ION_3)	1.41	1.40	1.41	2.61	2.63	2.62	45.92	46.63	46.28	41.81	42.77	42.29
SEm±	0.01	0.01	0.01	0.02	0.03	0.01	0.68	0.65	0.35	0.38	0.35	0.19
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3: Effect of organic and inorganic source of nutrients on pH, EC and organic carbon in soil after harvest of fenugreek.

Treatment	pH			EC (dSm^{-1})			Organic Carbon (%)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Organic source of nutrients (t ha^{-1})									
Control (ON_0)	8.25	8.16	8.20	0.63	0.65	0.64	0.62	0.64	0.63
V 2 t ha^{-1} + FS @ 10% Vermiwash (ON_1)	8.17	8.08	8.12	0.63	0.64	0.63	0.67	0.68	0.68
V 4 t ha^{-1} + FS @ 7.5% Vermiwash (ON_2)	8.15	8.06	8.11	0.59	0.60	0.59	0.69	0.71	0.70
V 6 t ha^{-1} + FS @ 5% Vermiwash (ON_3)	8.10	8.01	8.05	0.57	0.58	0.57	0.73	0.75	0.74
SEm±	0.03	0.03	0.01	0.002	0.003	0.001	0.007	0.008	0.004
CD (P=0.05)	0.07	0.07	0.04	0.005	0.009	0.003	0.02	0.02	0.01
Inorganic source of nutrients (kg ha^{-1})									
Control (ION_0)	8.22	8.13	8.17	0.58	0.59	0.58	0.62	0.64	0.63
50% RDF + FS of Zn 0.75% (ION_1)	8.19	8.10	8.14	0.60	0.62	0.61	0.66	0.67	0.67
75% RDF + FS of Zn 0.50% (ION_2)	8.14	8.05	8.10	0.61	0.63	0.62	0.71	0.72	0.72
100% RDF + FS of Zn 0.25% (ION_3)	8.12	8.03	8.08	0.62	0.64	0.63	0.73	0.75	0.74
SEm±	0.03	0.03	0.01	0.002	0.003	0.001	0.007	0.008	0.004
CD (P=0.05)	NS	NS	NS	0.005	0.009	0.003	0.02	0.02	0.01

Table 4: Effect of organic and inorganic source of nutrients on protein and chlorophyll content of fenugreek.

Treatments	Protein %			chlorophyll content (mg g^{-1})		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Organic source of nutrients (t ha^{-1})						
Control (ON_0)	17.59	17.60	17.60	2.86	2.87	2.87
V 2 t ha^{-1} + FS @ 10% Vermiwash (ON_1)	18.95	18.97	18.96	2.94	2.96	2.95
V 4 t ha^{-1} + FS @ 7.5% Vermiwash (ON_2)	19.75	19.77	19.76	3.03	3.05	3.04
V 6 t ha^{-1} + FS @ 5% Vermiwash (ON_3)	19.83	19.85	19.84	3.06	3.07	3.07
SEm±	0.13	0.13	0.07	0.02	0.02	0.01
CD (P=0.05)	0.38	0.37	0.19	0.05	0.06	0.02
Inorganic source of nutrients (kg ha^{-1})						
Control (ION_0)	17.62	17.64	17.63	2.85	2.86	2.86
50% RDF + FS of Zn 0.75% (ION_1)	18.94	18.96	18.95	2.94	2.96	2.95
75% RDF + FS of Zn 0.50% (ION_2)	19.58	19.60	19.59	3.02	3.03	3.03
100% RDF + FS of Zn 0.25% (ION_3)	19.98	20.00	19.99	3.08	3.10	3.09
SEm±	0.13	0.13	0.07	0.02	0.02	0.01
CD (P=0.05)	0.38	0.37	0.19	0.05	0.06	0.02

CONCLUSIONS

Based on the insightful findings of this experiment, it can be definitively concluded that the utilization of 6 tons of vermicompost, coupled with a 5% foliar spray of vermiwash, in combination with 100% RDF and a foliar spray of zinc at a concentration of 0.25%, leads to a significant enhancement in various soil attributes. These improvements encompass bulk density, particle density, porosity, water-holding capacity, pH levels, electrical conductivity (EC), and the organic carbon

content in the soil following the harvest. Moreover, this treatment regimen also demonstrates a notable increase in the protein content of Fenugreek seeds and the chlorophyll content within Fenugreek plants. As a result, it is strongly recommended to employ the combination of RDF with zinc foliar spray, in conjunction with vermicompost and vermiwash foliar application, to effectively ameliorate the physicochemical properties of the soil within the Typic Haplustepts soil category found in the sub-humid southern plains of Rajasthan.

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Conflict of Interest. None.

REFERENCES

Aechra, S. (2021). Effect of biofertilizer and split application of vermicompost on nitrogen dynamics and productivity of wheat (*Triticum aestivum* L.). Ph.D. Thesis, Maharana Pratap University of Agriculture & Technology, Udaipur.

Ali, A., Ibrahim, N. B. and Usman, M. (2015). Yield of maize-soybean intercrop and soil properties as influenced by fertilizer in the southern guinea savanna zone of Nigeria. *International Journal of Scientific and Research Publications*, *5*(7), 2250-3153.

Biswas, D. R. (2011). Nutrient recycling potential of rock phosphate and waste mica enriched compost on crop productivity and changes in soil fertility under potato-soybean cropping sequence in an Inceptisol of Indo-Gangetic Plains of India. *Nutrient Cycling in Agroecosystems*, *89*, 15-30.

Dsouza, A., Deshmukh, P. W., Bhoyar, S. M. and Rakesh, R. (2018). Effect of phospho compost and nitrophospho-sulpho compost on soil chemical and biological properties under Soybean in Vertisols. *International Journal of Plant and Soil Science*, *21*(2), 1-7.

FAI (2021-22). Fertiliser Statistics. The Fertiliser Association of India, New Delhi.

Jangir, C. K., Singh, D. P., Meena, R. H. and Yadav, M. (2017). Effect of fertility levels and biofertilizers on physical and chemical properties of soil under blackgram (*Vigna mungo* L.). *International Journal of Current Microbiology and Applied Sciences*, *6*(3), 223-228.

Jat, M. L. and Saharawat, Y. S. (2019). Inorganic fertilizers. *Encyclopedia of Sustainable Technologies*, *2*, 703-711.

Kranz, C. N., Mclaughlin, R. A., Johnson, A., Miller, G. and Heitman, J. L. (2020). The effects of compost incorporation on soil physical properties in urban soils-A concise review. *Journal of Environmental Management*, *261*, 110209.

Meena, M., Jat, G., Meena, R. H., Sharma, S. K., Choudhary, R., Yadav, S. K., ... & Jat, H. (2021). Effect of phospho enriched compost and zinc on soil properties and productivity of blackgram (*Vigna mungo*). *Indian Journal of Agricultural Sciences*, *91*(9), 1333–6.

Meena, M. (2019). Effect of enriched compost and zinc on soil fertility and productivity of blackgram (*Vigna mungo* L.) in Typic Haplustepts. M. Sc. Thesis, Maharana Pratap University Agriculture and Technology, Udaipur.

Meena, R. (2017). Response of greengram (*Vigna radiata*) to rock phosphate enriched compost on yield, nutrient uptake and soil fertility in Inceptisol. *International Journal of Chemical Studies*, *5*(2), 513-516.

Nagar, R. K., Goud, V. V., Kumar, R. and Kumar, R. (2016). Effect of organic manures and crop residue management on physical, chemical and biological properties of soil under pigeonpea based intercropping system. *International Journal of Farm Sciences*, *6*(1), 101-113.

Pandiyana, V., C., Balajib, K., Sarava, S., Shylajaa, S. G., Srinivasanc, G. R., Kiresee, P. R., and Maniveld, G. (2020). Effect of vermicompost on soil health and yield of sesamum (*Sesamum indicum* L.). *Journal of Soil Science and Plant Nutrition*, *2*, 311-316.

Todawat, A. Sharma, S. R., Lakharan, H. and Hemraj (2017). Effect of vermicompost and zinc on growth, yield attribute and yield of Greengram (*Vigna radiata* L.) Under semi-arid region of Rajasthan. *International Journal of Current Microbiology and Applied Science*, *6*(9), 175-180.

Vuković, A., Velki, M., Ečimović, S., Vuković, R., Štolfa Čamagajevac, I. and Lončarić, Z. (2021). Vermicomposting—Facts, Benefits and Knowledge Gaps. *Agronomy*, *11*(10), 1952.

Zhu, Z., Bai, Y., Lv, M., Tian, G., Zhang, X., Li, L., Jiang, Y. and Ge, S. (2020). Soil Fertility, Microbial Biomass, and Microbial Functional Diversity Responses to Four Years Fertilization in an Apple Orchard in North China. *Horticultural Plant Journal*, *6*(4), 223–230.

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