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Impact of various sources of organic nitrogen management on the protein content of *kharif* crops

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ABSTRACT

To find out the organic nitrogen management in agricultural field using neem cake vermicompost and NADEP compost as organic sources in *kharif* crops and best *kharif* crop for this region. Five organic nitrogen management practices *viz*., Control (No manure), 5 t ha^{-1} crop residue + 50% RDN through FYM, 50% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost, 75% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost and 100% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost in main plot and five *kharif* crops were selected for the experiment *viz*., maize, sweet corn, blackgram, greengram and soybean in sub plot. The experiment was carried out in split plot design with three replications. Application of 100% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost recorded significantly higher protein content in grain/seed of maize, sweet corn, blackgram, greengram and soybean over rest of the treatments except application of 75% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost.

Key words: *Kharif crops, Protein content, Neem cake, Vermicompost, NADEP compost*

Introduction

A farming practice known as organic farming is one that promotes soil, ecological, and human health. It does not use harmful inputs; instead, it depends on ecological processes, biodiversity, and cyclical adaptation to local conditions. In order to improve the common environment, foster just relationships, and improve everyone's quality of life, organic agriculture integrates tradition, creativity, and science (IFOAM, 2018).

As an alternative to traditional agriculture, organic farming has gained popularity since it uses fewer pesticides and fertilisers while maintaining the health of the land and producing wholesome food. Composting, vermicomposting, and farm yard waste are all used in organic farming to offer nutritious food and enhance soil health and biodiversity (Das *et al*., 2021; Reganold and Wachter, 2016). These characteristics make organic farming a long-term, practical, and sustainable choice (Schoonbeek *et al*., 2013). Furthermore, organic farming promotes sus-

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tainable development objectives and guarantees sustainability on all fronts-economic, environmental and social (Bandanaa *et al*., 2021 and Šeremešiæ *et al*., 2021).

Organic farming has gained popularity recently everywhere, especially in developed and developing nations. The demand for organic products has increased significantly, and more agricultural area is used for organic farming as a result (Willer *et al*., 2022). In 2020, the sales of organic food and drink exceeded 120.6 billion euros worldwide (Willer *et al*., 2022).

Vermicompost contributes to increased humic acid content, reduced C:N ratio, increased action exchange capacity, and water-soluble carbohydrates. Vermicompost is a byproduct of organic materials decomposing non-thermophilically as a result of earthworms and microorganisms cooperating (Adhikary, 2012). After oil is produced from neem (*Azadirachta indica* L.), concentrated plant-based organic manure is removed (as a residue). Neem cake has a high concentration of potash and a small amount of phosphoric acid in addition to nitrogen. Globally, there is rising concern over the declining efficiency of fertilizer use, particularly with regard to phosphorus in soils. Efforts are being undertaken to switch from using 100% water soluble phosphorus to using phosphorus connected to organic carbon.

The quality of farm food was impacted by the unbalanced and inappropriate use of agricultural chemicals, such as synthetic pesticides and fertilizers, which led to unhealthy soil. It is believed that farm products contaminated with needless chemicals pose a risk to the health of consumers. When the need for higher-quality food is rising daily, one practical approach is to farm crops in an environmentally responsible manner. Improved soil chemical and biological qualities as well as increased soil fertility can be achieved via the use of organic farming practices (Yadav *et al*., 2013). Agrochemicals, or chemical insecticides and fertilizers, were first used in agriculture during the Green Revolution in the 1960s in an effort to increase crop productivity. The usage of fertilizers and pesticides using inorganic chemicals has increased over time, degrading the soil. By altering the soil's natural composition and causing a pH and nutrient imbalance, these hazardous compounds contaminate the soil and groundwater. Chemical pesticides also cause the death of insects, microorganisms, and other organisms, both useful and harmful (Fang *et al*., 2021).

Overuse of agrochemicals in recent years has led to environmental pollution, ground water contamination, and soil degradation, all of which have caused ecological imbalances. The potential of organic farming to increase crop quality and yield maximum yield is attributed to its ability to improve soil fertility and provide a variety of nutrients that are readily available in the area. In order to investigate the impact of various organic sources on the quality of maize, sweet corn, blackgram, greengram and soybean crop, the current experiment was carried out.

Materials and Methods

The field experiments were conducted at Organic Farm, Department of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan 313 001 India for two consecutive *kharif* season (sowing time; July; harvesting time- October) in the cropping years 2022-23 and 2023-24 at 74°42′ E Longitude and 24°35′ N latitude with an altitude of 581.13 m above msl. The soil of the experimental site was clay-loam in texture with 36.55 and 36.53% sand, 28.20 and 28.22% silt, 34.65 and 34.66% clay during both the years 2022 and 2023, respectively. The average soil pH and EC were around 8.10 and 1.02 dS m^{-1}, respectively. The soil was found medium in available nitrogen (278.42 and 279.78 kg ha^{-1}) and phosphorus (18.07 and 18.77 kg ha^{-1}) and high in available potassium (312.45 and 313.09 kg ha^{-1}).

A total of twenty treatment combinations were considered, where four organic nitrogen management practices (N_2-N_5) and one control treatment (N_1) with no manure, five *kharif* crops (C_1-C_5) was used for experimentation. The treatment details are as follows: N_1: Control (No manure), N_2: 5 t ha^{-1} crop residue + 50% RDN through FYM, N_3: 50% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost, N_4: 75% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost, N_5: 100% RDN through $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost and C_1: maize, C_2: sweet corn, C_3: blackgram, C_4: greengram and C_5: soybean. The recommended dose of nitrogen for maize, sweet corn, blackgram, greengram and soybean was 120, 90, 20, 20 and 20 kg ha^{-1}, respectively.

The recommended dose of nitrogen for maize, sweet corn, blackgram, greengram and soybean was

120, 90, 20, 20 and 20 kg ha^{-1}, respectively. Maize (PHM-3), sweet corn (Sugar-75), blackgram (PU-1), greengram (Green Gold) and soybean (JS 335) were grown with the package of practices for Udaipur region. Crops were sown after receive first monsoon rainfall i.e. 25 July and 17 July during both the years of 2022 and 2023, respectively. The field was allowed for decomposition for 15 days after incorporation of organic manures as per treatments. The crop was irrigated using bore well water. One irrigation was given as life-saving irrigation. Frequency of irrigation was adjusted according to weather conditions and the receipt of rain. Gap filling was also done to maintain uniform population. Manual weeding was carried out at the appropriate time. Thinning was done by leaving only one healthy and vigorous seedling per hole. Preventive plant protection measures were taken to protect the crop from the damage of pest and diseases and silicon also used for plant protection. The protein content in grain/seed was calculated by nitrogen content in grain/seed multiplied with a factor of 6.25 (Angelo and Mann, 1973). Nitrogen content in grain/seed was determined by standard methods of analysis of Nesseler's reagent colorimetric method (Snell and Snell, 1949). The data recorded for quality of crops were requested to statistically analysis by techniques of analysis of variance for Randomized Block Design as advocated by Fisher (1950).

Results and Discussion

A perusal of data in Table 1 reveals that maximum protein content of maize (11.29%), sweet corn (10.53%), blackgram (24.75%), greengram (24.34%) and soybean (40.25%) was recorded under application of 100% RDN through neem cake, vermicompost, NADEP compost ($^1/_3$ each) which was found at par with the application of 75% RDN through neem cake, vermicompost, NADEP compost ($^1/_3$ each) and both these treatments significantly higher over rest of the treatments. Further data reveals that application of 5 t ha^{-1} crop residue + 50% RDN through FYM and 50% RDN through neem cake, vermicompost, NADEP compost ($^1/_3$ each) significantly increased protein content in grain of maize by 6.07 and 6.76 per cent, sweet corn by 7.06 and 7.40 per cent, blackgram by 5.99 and 6.93 per cent, greengram by 6.27 and 6.88 per cent and soybean by 4.36 and 4.57 per cent, respectively over control.

Table 1. Effect of organic nitrogen management practices on protein content in grain/seed of blackgram

	Protein content (%)														
	Maize			Sweet corn			Blackgram			Greengram			Soybean		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
Control	10.03	10.13	10.08	9.13	9.17	9.15	21.60	21.73	21.67	21.02	21.23	21.12	36.75	36.88	36.81
5 t ha^{-1} crop residue + 50% RDN (FYM)	10.63	10.76	10.69	9.75	9.84	9.79	22.93	23.00	22.97	22.40	22.50	22.45	38.40	38.44	38.42
50% RDN*	10.68	10.85	10.76	9.79	9.86	9.83	23.07	23.27	23.17	22.50	22.65	22.58	38.44	38.55	38.50
75% RDN *	11.15	11.34	11.24	10.36	10.49	10.43	24.38	24.51	24.45	23.74	24.12	23.93	40.06	40.19	40.13
100% RDN *	11.19	11.40	11.29	10.50	10.57	10.53	24.68	24.81	24.75	24.31	24.36	24.34	40.19	40.31	40.25
S.Em.±	0.14	0.16	0.10	0.16	0.18	0.12	0.40	0.38	0.28	0.37	0.34	0.25	0.47	0.49	0.34
C.D. (P=0.05)	0.45	0.51	0.31	0.51	0.59	0.36	1.29	1.25	0.83	1.20	1.11	0.75	1.54	1.58	1.02

* $^1/_3$ Neem cake + $^1/_3$ Vermicompost + $^1/_3$ NADEP compost

Results of indicated that combined use of neem cake, vermicompost and NADEP compost improved the nutrient content and uptake by the crops. According to Yadav *et al*. (2019), using neem cake, vermicompost and NADEP compost in combination significantly improved macronutrient and micronutrient intake compared to the control (no manure). This showed that the addition of neem cake, vermicompost and NADEP compost had created a favourable soil microclimate régime.

The increased nitrogen content and uptake by the grain or seed following the administration of the aforementioned treatment may have contributed to the improvement in protein content by increasing photosynthesis, protoplasm production and protein synthesis. These results are strongly related to those of Virkar and Tumbare (2011) in soybean, Patil *et al.* (2012) in soybean, Shariff *et al*. (2017) in greengram, Patel *et al*. (2020) in greengram and Sharma *et al*. (2022) in sweet corn. Using organic sources is known to boost microbial activity, improve the physico-chemical environment of the soil, and increase nutrient availability for plant absorption. Increased protein content was also observed in the combo treatments (Shekhawat *et al*., 2018). Previous research on soybeans by Nagrarae *et al*. (2018) and maize by Krishna *et al*. (2022) supports these findings.

Conclusion

That maize, sweet corn, blackgram, greengram and soybean reacted best to the combination of neem cake, vermicompost, and NADEP compost in the sub humid region of Udaipur. The combination of organic sources was found to be best for ensuring batter quality *i.e*. protein content of organic maize grain, sweet corn grain, blackgram seed, greengram seed and soybean seed.

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References

Adhikary, S. 2012. Vermicompost, the story of organic gold: A review. *Agric. Sci.* 3: 905-917.

Angelo, A.J. and Mann, G.E. 1973. Peanut culture uses. *Am. Peanut Res.* Ed. Soc. Soc. Stone Printing Co., Raonote USA. Page 561.

Bandanaa, J., Asante, I.K., Egyir, I.S., Schader, C., Annang, T.Y., Blockeel, J., Kadzere, I. and Heidenreich, A. 2021. Sustainability performance of organic and conventional cocoa farming systems in Atwima Mponua District of Ghana. *Environmental and Sustainability Indicators*. 11(February), 100121.

Das, S., Chatterjee, A. and Pal, T.K. 2021. Organic farming in India: A vision towards a healthy nation. *Food Quality and Safety*. 4(2): 69-76.

Fang, H., Liu, K., Li, D., Peng, X., Zhang, W. and Zhou, H. 2021. Long-term effects of inorganic fertilizers and organic manures on the structure of a paddy soil. *Soil and Tillage Research*. 213: 105137.

IFOAM General Assembly, 2008. Definition of organic agriculture. *IFOAM Organic International*. https://www.ifoam.bio/why-organic/organic-landmarks/definition-organic.

Krishna, J.R., Bhat, M.A., Bhat, J.A., Nazir, S., Kanth, R.H., Maqbool, S. and Mughal, A.H. 2022. Effect of chemical fertilizers, farm yard manure and biofertilizers on quality of maize (*Zea mays* L.) under rainfed conditions of North Kashmir. *The Pharma Innovation Journal.* 11(11): 493-497.

Nagrare, I.M., Raskar, B.S., Kamble, D.R., Sonawane, C.J. and Badole, W.P. 2018. Effect of organic sources of fertilizers on growth and yield of soybean. *Journal of Agriculture Research and Technology.* 43(2): 253.

Patel, B.K., Patel, H.K., Makwana, S.N., Patel, M.P. and Chotaliya, R.L. 2020. Effect of various sources of nitrogen and phosphorus on seed quality, soil nutrient status and plant nutrient contents and uptake in summer greengram (*Vigna radiata* L. Wilczek). *International Journal of Current Microbiology and Applied Science.* 11:739-744.

Patil, D.U., Laharia, G.S. and Damre, P.R. 2012. Effect of different organic sources on biological properties of soil, nutrient uptake, quality and yield of soybean. *Asian Journal of Soil Science.* 7(2): 190-193.

Reganold, J.P. and Wachter, J.M. 2016. Organic agriculture in the twenty-first century. *Nature Plants*. 2: 15221.

Schoonbeek, S., Azadi, H., Mahmoudi, H., Derudder, B., De Maeyer, P. and Witlox, F. 2013. Organic agriculture and undernourishment in developing countries: main potentials and challenges. *Critical Reviews in Food Science and Nutrition*. 53(9): 917-928.

Seremesic, S., Dolijanovic, Z., Simin, M.T., Vojnov, B. and Trbic, D.G. 2021. The future we want: Sustainable development goals accomplishment with organic agriculture. *Problemy Ekorozwoju*. 16(2): 171-180.

Shariff, A.F., Sajjan, A.S., Babalad, H.B., Nagaraj, L.B. and Palankar, S.G. 2017. Effect of organics on seed yield and quality of greengram (*Vigna radiata* L.). *Legume Research-An International Journal.* 40(2): 388-392.

Sharma, A., Sharma, S.K., Choudhary, R., Jat, G., Dubey, R.B. and Kaushik, M.K. 2022. Nutrient content, uptake and economics of sweet corn {*Zea mays* (L.) spp. *Saccharata*} grown under organic farming. *Frontiers in Crop Improvement.* 10(8): 3772-3775.

Shekhawat, A.S., Purohit, H.S., Jain, H.K., Meena, R.H. and Meena, R. 2018. Effect of phosphorus & bio-organics on quality and symbiotic efficiency of blackgram (*Vigna mungo* L.). *Journal of Pharmacognosy and Phytochemistry.* 7(2): 3419-3422.

Snell, F.D. and Snell, G.T. 1949. *Colorimetric Methods Of Analysis.* 3rd Edn. II D Van Nostrand Co., Inc. New York.

Virkar, A.T. and Tumbare, A.D. 2011. Effect of integrated nutrient management on growth and yield of soybean-wheat cropping sequence. *Journal of Agricultural Research and Technology.* 36(3): 358-363.

Willer, H., Trávníèek, J., Meier, C. and Schlatter, B. 2022. The world of organic agriculture: Statistics and emerging trends 2022. *Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM*.

Yadav, K., Meena, S.C., Jat, G., Meena, R.H. and Dhansil, A. 2019. Nutrient content and uptake by soybean (*Glycine max* L. Merril) as influenced by use of enriched compost and biofertilizers. *Int. J. Curr. Microbiol. Appl. Sci*. 8: 2959-2966.

Yadav, S.K., Babu, S., Singh, Y., Yadav, M.K., Yadav, G.S., Pal, S. and Singh, K. 2013. Effect of organic nutrient sources on yield, nutrient uptake and soil biological properties of rice (*Oryza sativa*) based cropping sequence. *Indian J. Agron*. 58(3): 271-276.