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Research article

Nutrient contents in different sources of organic manures used in different farms of Bhaktapur district, Nepal

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ABSTRACT

Organic manure contributes carbonaceous matter to soil, which when decomposed, offers mineral nutrients to plants, also acts as a base exchange material, and helps to improve the physical, chemical, and biological aspects of soil. This study was conducted to assess the amount of total nitrogen, available phosphorous, available potassium, pH, under various organic manure sources. Collected organic matter samples were tested for total nitrogen, available phosphorus, available potassium, soil organic matter, and pH at the soil laboratory of Nepal Polytechnic College, Bharatpur-11, Chitwan, using the NARC, Soil Science Research Centre, Khumaltar, Lalitpur standard rating. The overall nitrogen concentration of goat dung was 1.667%, whereas buffalo manure had the lowest at 0.665%. The available phosphorus content of organic manure in the research area ranged from 0.732% in vermi-compost to 0.432% in compost, with substantial differences amongst manure samples. The goat manure had the highest potassium level (0.853%), whereas buffalo manure had the lowest (0.513%). The pH value of goat manure was 8.4 while the pH content of compost manure was 7.567. The maximum amount of organic matter (54.8) was found in buffalo manure, while the lowest (46.3) was found in vermi compost. The maximum amount of organic matter (54.8%) was found in buffalo manure, while the lowest (46.3%) was found in vermi compost. Modern technology must be adapted for successful and improved manure production. To increase the availability and maintenance of nutrients in organic manure, methods such as covering the manure to protect it from rain and sun, avoiding waterlogged conditions, and correct manure decomposition can be implemented.

Keywords: Nitrogen, Nutrient content, Phosphorous, Potassium, Organic manures

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INTRODUCTION

The use of organic manures is vital not only for the immediate economic competition in fertilizer consumption, but also for the long-term preservation of soil fertility and productivity (More and Ghonsikar, 1988). Organic manure contributes carbonaceous matter to soil, which when decomposed offers mineral nutrients to plants, also acts as a base exchange material, and helps to improve the physical, chemical, and biological aspects of soil. Organic manure also gives energy to soil microbes, increasing biological activity in the soil.

Manures contain a significant amount of nutrients, including trace elements required for crop growth. The application of FYM and/or the application of chemical fertilizers are the two main practices for sustaining soil fertility in Nepal's mid hills (Pilbeam *et al.*, 2005). FYM and compost are the primary sources of plant nutrients and organic matter in the mid hills subsistence upland farming system. However, there are two challenges with the use of FYM and compost: difficulty with delivering a suitable amount of FYM and compost, and problems with the quality of FYM and compost (Ndegwa and Thompson, 2001).

Organic manure is a simple and rich source of soil nutrients in a variety of agroclimatic conditions and soil types. It is especially crucial to apply organic manure to soils with high sand and silt concentration (Stoskop, 1981). The use of organic manure enhances the tilth of clayey soils, increases aeration, aids drainage, and requires less water for crops.

In the country, many organic activities such as vermiculture technology, cow shed improvement programs, organic fertilizer manufacturing plant establishment programs, and price subsidies for organic fertilizer purchases have been adopted. Nepal has no chemical fertilizer facility, and the current total demand for urea, DAP, and MoP is 785,000 tons per year, resulting in a significant demand and supply mismatch. This supports MoAD's primary interest in promoting organic fertilizers (MoAD, 2016).

One of the most common deficiencies in degraded soils is a lack of soil organic matter (OM), and OM is the primary indicator of soil quality and health (Lehman *et al.*, 2015). Crop production and ecological stability can be benefitted from adequate OM through enhancing water and nutrient retention, nutrient cycling, carbon transformation, soil biodiversity, soil structure, and soil aggregation. Adoption of agricultural practices that build and keep OM is thus a crucial pillar of sustainable crop production.

Inorganic chemicals are increasingly being used, with high input methods being adopted. Because of population expansion and increased desire for financial income, farmers are beginning to adopt modern farming techniques, including food production (Tamang *et al.*, 2011). There have been several reports on the detrimental effects of unbalanced and excessive usage of chemical fertilizer and pesticide on human and animal health and the environment. To mitigate these risks, several types of environmentally friendly agriculture, alternative agriculture, ecological agriculture, bio-dynamic agriculture, and sustainable agriculture should be implemented (Tamang *et al.*, 2011).

In most cultivated soils in Nepal's mid highlands, the overall state of inherent soil fertility is poor. Because of inadequate farmyard manure management, low organic matter content in the soil, and growing urbanization and infrastructure construction in agricultural area, soil

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fertility has been declining day by day. Due to the inability to obtain an adequate quantity of chemical fertilizers in a timely manner, as well as the subsequent increase in the price of chemical fertilizers, increasing the use of organic fertilizers has become the only option for farmers to meet plant nutrient demand and maintain soil fertility (Paudel & Thapa, 2001).

For a country like Nepal, where transportation is difficult and chemical fertilizer supply is entirely dependent on import, the manufacturing and use of organic fertilizer at the local level is critical for following sustainable agricultural practices. Farmers, on the other hand, do not follow the scientific approach of composting. Most farmers refer to collecting garbage and putting it in a pit as composting (Jaishy *et al.*, 1997). Because the manure is not turned over, nutrients are lost through leaching and runoff. According to Khadka and Chanda (1987), compost heaps losses 50% nitrogen and 90% potash during the rainy season.

Organic manures, despite having a lower nutrient content, contain many critical nutrients for plant growth and release them slowly over a longer period of time (Sherchan and Gurung, 1996). This study focuses on the distribution of organic manure chemical properties across diverse sources, which might provide basic information for evaluating the quality of organic manure in Bhaktapur. The primary goal of this research is to assess the state of organic manure in the Bhaktapur district. The study will assess the amount of total nitrogen, available soil phosphorous, available potassium, soil pH, and organic matter dispersion under various organic manure sources.

MATERIALS AND METHODS

Sample collection

This study was conducted in the Bhaktapur district, which spans the northern latitude of 27°36′-27°44′ and the eastern longitude of 85°21′-85°32′. Of which Suryavinayak municipality wards 1 (Sirutar), 2 (Balkot), 3 (Katunje), and 4 (Dadikot) were chosen because a considerable number of farmers rely on small-scale animal farming. A total of 36 samples were obtained at random. Representative samples of vermicompost, cow dung, compost, poultry manure, goat manure, and buffalo manure were gathered with 6 each. Manure samples were collected, labeled, transported to the laboratory, and air dried in the shade. A sample of air-dried manure was crushed and sieved through a 2.00 mm sieve before proceeding for chemical analysis.

Table 1: Organic manure and sample size

Sample size	Types of organic manure
Six	Vermicompost
Six	Cow manure
Six	Compost
Six	Poultry manure
Six	Goat manure
Six	Buffalo manure

Laboratory analysis

Soil samples were prepared from May to August and were analysed for their Total nitrogen, available phosphorus, available potassium, soil organic matter, and pH in September in the soil laboratory of Nepal Polytechnic College, Bharatpur-11, Chitwan, Nepal. Standard laboratory procedures were used to analyze the chemical characteristics of organic manure, as stated in Table 2.

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Table 2: Techniques used for analysis of manure chemical properties

Parameters	Analysis technique
Total nitrogen	Kjeldhal distillation unit (Bremner,1965)
Available phosphorous	Modified Olsen bicarbonate method (Watanabe & Olsen, 1965)
Available potassium	Ammonium acetate extraction method,(Pratt, 1965)
Soil organic matter	Wet digestion method (Walkley & Black, 1934)
Soil pH	Digital pH meter.

Statistical Analysis

R-studio (32 bit version) a computer package tool, was used to analyze the data. For data analysis, the Duncan multiple range test and coefficient of variation, both major inferential statistics, were used.

RESULTS AND DISCUSSION

The chemical characteristics of organic manure varied depending on the source. The organic manure NPK content, organic matter, and pH content of the various sources. Available nitrogen (ammonium-N, nitrate-N, and uric acid-N) is nitrogen that is thought to be potentially available for crop uptake. The overall nitrogen concentration of goat manure was 1.667 % which was highest of all, whereas buffalo manure had the lowest of 0.665 %. Second highest concentration was recorded in cow manure with 0.830 %. Similar N concentration was observed in vermi compost and compost with 0.783 and 0.722 respectively. The nitrogen concentration of manure varied greatly depending on the source. It could be a combination of characteristics such as animal type, age, species, body weight, gender, type of feeding supplies, bedding materials, or other inherent factors such as rainfall and temperature, site conditions such as moisture, kind of manure storage system, and biological breakdown (USDA). The chemical properties of different Organic manure after their analysis is given below in table 3.

Table 3: Analysis for chemical properties of different Organic manure

Source Of Nutrient	N%	P_2O_5%	K_2O%
Vermi compost	0.783b	0.732a	0.763ab
Cow manure	0.830b	0.638a	0.616bc
Compost	0.722b	0.432b	0.720ab
Poultry Manure	0.690b	0.786a	0.668bc
Goat Manure	1.667b	0.706a	0.853a
Buffalo	0.665b	0.478b	0.513c
GM	0.893	0.629	0.689
SEM	0.0764	0.0499	0.0537
CV %	21	19.4	19.1

GM= Grand mean, CV= coefficient of variation, LSD= Least Significant Difference.

The goat manure had the highest potassium level (0.853 %), whereas buffalo manure had the lowest (0.513 %). The finding is in the line of Usman *et al*. (2013). Similar amount of potassium was observed in cow manure and poultry manure with concentration of 0.616 % and 0.668 % respectively. Vermi compost and compost also yielded similar results with concentration of 0.763 % and 0.720 % respectively. The available potassium concentration varied greatly depending on the source of organic manure.

The accessible phosphorus concentration of organic manure ranged from 0.732 % to 0.432 %. Highest phosphorous concentration was observed in poultry manure with 0.786 %. Tarafder

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et al. (2020) also reported the same results. It was followed by vermicompost with phosphorous concentration of 0.732 %. Lowest concentration of phosphorous was observed in buffalo manure and compost with 0.478% and 0.432 % respectively.

Table 4: Analysis for chemical properties of different Organic manure

Source of nutrient	Organic matter %	pH %
Vermi compost	46.3a	7.833ab
Cow manure	46.7a	7.8ab
Compost	49.8a	7.567b
Poultry Manure	49.2a	8.367a
Goat Manure	50.2a	8.4a
Buffalo	54.8a	7.917ab
GM	49.5	7.981
SEM	2.85	0.2045
CV %	14.1	6.3

GM= Grand mean, CV= coefficient of variation, LSD= Least Significant Difference.

The maximum amount of organic matter was found in buffalo manure with concentration of 54.8 %. It was followed by goat manure with concentration of 50.2 %. Poultry manure and compost had similar results with concentration of 49.2 % and 49.8 % respectively. Cow manure and vermicompost were observed with lowest concentration of 46.7 % and 46.3 % respectively. The maximum quantity of organic matter was detected in buffalo manure, which could be attributed to proper decomposing of buffalo dung. The lowest amount of organic matter was detected in vermi compost, which could be attributed to the several factors that influence vermi composting, such as substrate, temperature, and so on. Different waste materials may necessitate different earthworm species and environmental conditions. Integrated nutrient management is a tool that can offer good options and economic choices to supply plants with a sufficient amount of nutrients in need and can also reduce total costs, its improve to physical, chemical and biological properties of soil hence improve growth and yield of the crops (Verma *et al*., 2022).

There was a considerable change in pH across different organic manures. The pH value of goat manure and poultry manure were highest (alkaline) with pH value of 8.4 and 8.367 respectively. The pH of vermicompost and cow manure were similar with value of 7.833 and 7.8 respectively. Variation on pH of different manure was observed. It could be because of the Composting is a microbial process, hence the overall performance of the composting process is the combined effect of individual microbe activity. The interaction between processes that produce hydrogen (H+) ions and those that consume them determines pH conditions (Brady & Weil, 2002).

CONCLUSION

This study, which examines six organic manures, discovers that there are considerable variances in chemical qualities across organic manure sources in the Bhaktapur district. The right use of compost manure is required for the long-term maintenance of the country's soil health. For successful manure, technologies must be adapted. Approaches such as covering the manure to protect it from rain and sun, avoiding waterlogged conditions, and proper manure decomposition can be used to improve the availability and maintenance of nutrients in organic manure.

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Authors' contributions

R. Sharma designed and performed the experiment, and recorded and analyzed data together with S. Kandel, S. Khadka and S. Chaudhary helped to edit the manuscript.

Conflicts of Interest

The authors declare that they have no conflict of interest.

REFERENCES

Bremner, J.M. (1965) Inorganic Forms of Nitrogen. In: Black, C.A., et al., Eds., Methods of Soil Analysis, Part 2, Agronomy Monograph No. 9, ASA and SSSA, Madison, 1179-1237.

Brady, N.C. and Weil,R. R. (2002). The Nature and Properties of Soil . 13th Edition, Prentice Hall, Upper Saddle River, New Jersey.

Jaishy, S.N., Mahato, N., Manandhar, R., & Maskey, K.H. (1997). Study on use of Compost at farmers level, a report published in Annual Report 20.53154. Soil Testing and Service Section, Dept. of Agriculture, Kathmandu, Nepal.

Khadka, R. J., & Chand, S. P. (1987). The organic materials: a valuable source of soil nutrients in the eastern hills of Nepal. Working Paper 12. Parkhribas Agricultural Center, Dhankuta, Nepal.

Lehman, R.M., Cambardella, C.A., Stott, D.E., Acosta-Martinez, V., Manter, D.K., Buyer, J.S., & Karlen, D.L. (2015). Understanding and enhancing soil biological health: the solution for reversing soil degradation. *Sustainability*, *7*(1), 988-1027.

MOAD. (2016) Statistical Information on Nepalese Agriculture (2015/13). Government of Nepal, Ministry of Agricultural Development, Agribusiness Promotion and Statistics Division, Singha Durbar, Kathmandu.

More, S. P., & Ghonsikar, C. P. (1988). Effect of some organic manures on the availability of phosphorus. *Journal of Indian Society of Soil Science*, *36*, 372-374.

Ndegwa, P.M., & Thompson, S.A. (2001). Integrating composting and vermicomposting the treatment and bioconversion of biosolids. *Bioresource Technology, 76*, 107–112

Paudel, G.S., & Thapa, G.B. (2001). Changing farmers' land management practices in the hills of Nepal. *Environmental Management*, *28*(6), 789-803

Pilbeam, C.J., Mathema, S.B., Gregory, P.J., & Shakya, P.B. (2005). Soil fertility management in the mid-hills of Nepal: Practices and perceptions. *Agriculture and Human Values*, *22*(2), 243-258.

PRATT, P.E, 1965. Potassium. In Methods of Soil Analysis. C.A. S. Afr. Tydskr. Plant Grond 1995, 12(1) Black (ed). Part 2. Agronomy 9, Amer. Soc. of Agron., Madison, Wis., pp. 1022 -1030

Sherchan, D. P., & Gurung, G. B. (1996). Sustainable Soil Management Issues in the Eastern Hills of Nepal: PAC Experience. In Proceedings of National Workshop on Soil

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DOI: https://doi.org/10.3126/janr.v5i1.50705

Fertility and Plant Nutrition Management (pp. 27-41), 19-20 December, Lalitpur: SSD (NARC), DOA and FADINAP, Nepal.

Stoskop, N.C. (1981). Understanding crop production. Reston Publishing Company, Inc.

Tamang, S., Dhital, M., & Acharya, U. (2011). Status and scope of organic agriculture in Nepal. Food and Sustainable Agriculture Initiative, Forest action, Lalitpur.

Tarafder, Subrata & Rahman, Md & Hossain, Md & Chowdhury, Md. (2020). Yield of Vigna radiata L. and Post-harvest Soil Fertility in Response to Integrated Nutrient Management. *Agricultural and Biological Sciences Journal*, 6, 32-43.

Usman, S., Burt, P., Aminu, A., Hamisu, I., & Lawal, U. (2013). “Improvements in geophysical surface soil assessment and classification using modifying Jenny's equation of soil forming factors in the Sudan Savannah. *IOSR Journal of Applied Physics*, 2, 37-46.

Verma, K., Sharma, P., & Saini, S. P. (2022). Impact of Integrated Nutrient Management in Enhancing the Growth and Yield of Crops. *Vigyan Varta, 3*(9), 83-93.

Walkley, A.J. and Black, I.A. (1934) Estimation of soil organic carbon by the chromic acid titration method. *Soil Science*, *37*, 29-38.

Watanabe, F.S. and Olsen, S.R. (1965) Test of an Ascorbic Acid Method for Determining Phosphorus in Water and NaHCO3 Extracts from the Soil. *Soil Science Society of America Journal*, *29*, 677-678. DOI: http://dx.doi.org/10.2136/sssaj1965.03615995002900060025x