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Nutritional Composition from Manure of Bovine Native Bargur Cattle and Jersey Cattle in the Anthiyur Taluk of Erode District, Tamil Nadu, India

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ABSTRACT

Background: A study was carried out to compare, the nutritional composition of manures from indigenous Bargur cattle and Jersy Cattle in the Bargur hills of Anthiyur Taluk in Erode district of Tamil Nadu, India. The moisture content was higher in Jersy cattle at 52% and free-ranging cattle with 37%, but the highest pH values were noticed in dry manure samples of Jersy cattle. Similarly, the highest values of NPK, trace elements and minerals such as Mg, Zn and Fe were also noticed in dry manure samples of Jersy cattle than in indigenous Bargur cattle, but the highest percentage of Cu and organic carbon was observed in the free-ranging Bargur cattle. However, the highest growth rate of *Lagenaria siceraria* plant was shown in the manure of Bargur cattle.

Methods: Fresh manure samples were collected from Bargur and Jersey cattle, which were sun-dried. The manure samples further analyzed for total nutrients like NPK and Ca, Zn, Cu, Fe and Mn using spectrophotometry and experimental methods. In a pot culture study, *Lagenaria siceraria* seeds were planted in soil mixed with these manures to compare growth effects and chlorophyll content in the plant leaves was quantified using spectrophotometric analysis.

Result: Fresh dung samples of Indigenous Bargur and Jersey Cattle showed differences in color, moisture and nutrient content; Bargur dung had higher organic carbon and trace elements, while Jersey dung had higher NPK levels. In growth tests, plants in Bargur dung exhibited better growth and chlorophyll content than those in Jersey dung or control soil.

Key words: Breed, Chlorophyll, *Lagenaria siceraria*, Moisture content, Nutrients, Trace elements.

INTRODUCTION

Livestock animals play an important role in providing energy to the ecosystem by providing dung. The dung is traditionally used as fuel, dung cakes, or biogas to replace charcoal, fuel wood and firewood. In addition, the dung is predominately used as manure for growing agricultural crops and plays an important role for green economy because it has essential micro and macro nutrients for soil reclamation (Eneji *et al.,* 2003c). The nutrient content of manure varies widely with animal species, age, ration and feed consumption, as well as with different methods of storage, handling methods, housing type, temperature and moisture content, treatment and land application (Camberato *et al.,* 1996; Fulhage, 2000). The cows, bullocks and milk buffaloes provide dung and urine in order to enrich the soil, while crop residues and fodder form the bulk of the feed for these animals (Kesavan and Swaminathan, 2008). Livestock manure is an important resource of organic matter used by soil microorganisms and a source of plant nutrients. The cow dung manure has been collected and used to supply NPK to the soil for plant production (Smith and Wheeler, 1979). The cattle manure contains organic and inorganic nutrients that may be dissolved or suspended within the liquid phase and used by farmers for various agricultural crop cultivation. In addition, cow dung and cow urine products such as *Panchkaviya* are used as fertilizers for raising agricultural crops and as a pest repellent to control various pests (Rawal *et al.,* 2024). In modern practices and application of inorganic fertilizers have altered soil fertility and become the greatest biophysical constraint to the production of agroforestry crops across the world (Ajayi, 2007). The cow dung comprises ash, nitrogen, carbon, cellulose, hemicelluloses, magnesium, manganese, calcium, zinc

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and trace elements (Fulhage, 2000). These nutrients are essential to enrich and maintain the production capacity of soil and enhance the soil microbial population in order to maintain healthy soil (Adegunloye *et al.,* 2007). The management of livestock manures with consideration for environmental quality should be an important goal when recycling farm wastes as soil amendments (Eneji *et al.,* 2003a). The human population drastically increased in India and the population pressure and demand for food resources increased. The farmers use chemical fertilizers and apply pesticides to cultivate agricultural crops due to poor soil quality and to protect their crops from pests. The usage of inorganic fertilizers and pesticides may alter the physiochemical properties of soil texture, porosity and soil microbial population. It has been reported elsewhere that chemical composition affected the decomposition rate of all organic matter, including crop residues (Kumar and Goh, 2000; Martens, 2000), compost (Tiquia *et al.,* 2002) and manure (Gordillo and Cabrera, 1997).

The use of cattle manure has been a common fertilizer practice for centuries, especially in agricultural lands in India. The nutrient contents of cow dung may vary depending on the animal species, age, ration and feed consumption, as well as with different methods of storage, handling methods, housing type, temperature, moisture content, treatment and land application (Camberato *et al.,* 1996). The major components of cow manure such as nitrogen, phosphorus and potassium (NPK), as well as many essential nutrients such as Ca, Mg, S, Zn, B, Cu and Mn (Fulhage, 2000). These nutrients generally improve soil tilts, aeration and water-holding capacity of the soil and promote the growth of beneficial soil organisms in order to provide sufficient energy for the growth of agricultural crops. Recently, cow dung used as the substrate for the production of proteolytic enzymes from Halomonas sp (PV1), *Bacillus* sp (Vijayaraghavan and Vincent, 2012) and fibrinolytic enzymes from *Shewanella* sp (IND20) (Vijayaraghavan *et al.,* 2015). The present study investigated and determined the different physical and nutritional characteristics of manures of native free-ranging Bargur cattle and housed Jersey Cattle. The native Bargur cattle are medium-sized animals, primarily a hilly draught breed, red-colored with varying extent of white marking and they are semi-wild and hardy to handle (Pundir *et al.,* 2009). These cows are poor milkers and produce about 0.5 to 3.0 liters of milk per day after suckling a calf (Sapkal *et al.,* 2025). However, bullocks are famous for their endurance and speed in trotting. The Bargur Cattle is maintained by a particular indigenous community for dung and draft in the Anthiyur Taluk of Erode District breeding tract in Tamil Nadu, India. This study investigates the variations in nutritional composition from the manure of indigenous Bargur Cattle and Jersey cattle and their role in plant growth.

MATERIALS AND METHODS

Manure sample collection

The 10 kg of fresh dung samples from 12 indigenous cattle were collected from the bargur cattle research station (BCRS) and 10 kg of fresh dung from 6 Jersey cattle were collected from the organised cattle farm situated near Anthiyur. Bargur Cattle Research station located, the hilly terrain covered with dry deciduous forest is a part of Eastern Ghats with an altitude 1050 Mtrs above MSL, with a temperature ranging from 15°C to 32°C and rainfall about 400 cm per annum. BCRS is located at the longitude of 77.072′ E and latitude of 11.034′ N. The study was conducted from February 2023 to December 2023. The dung samples moisture contents were removed by sun-dried for five days. The sun-dried samples were weighed and packed in an air-flow bag for further laboratory analysis. The laboratory analysis was done at the Department of soil science and agricultural chemistry in Tamil Nadu Agricultural University (TNAU), Coimbatore.

Estimation of moisture content and pH from dung

The 100 grams of fresh and dry samples were wrapped in aluminium foil and kept in a hot air oven at 105°C for 7 hours. The dried samples were weighed using a digital electronic balance. The percentage of moisture content present in the samples was calculated using the following formula:

$$\text{Percentage of moisture present in the sample} = \frac{\text{Weight of fresh sample - Weight of dry sample}}{\text{Weight of dry sample}} \times 100 \quad \ldots(1)$$

Estimation of micro and macronutrients

Analytical techniques

A suitable aliquot of the dung samples was dried eight hours in the hot air oven at 100±10°C and dried samples were pooled for 6 days. Total carbon content was determined by dry combustion using the method proposed by Nelson and Sommers (1982). The pooled dried dung

Table 1: Physical characterization of dung from Bargur and Jersey cattle, highlighting differences in color, moisture content and pH between fresh and dry samples.

Characters	Free ranging bargur cattle		Jersey cattle	
Color	Greenish brown		Dark brown	
Moisture %	37		52	
	Fresh sample	Dry sample	Fresh sample	Dry sample
pH	6.0 -7.0	7-7.5	7.0-7.5	7.5-8.0

These parameters are essential for understanding the environment and agricultural impact of cattle dung.

samples were ground in a Willey mill and analyzed for phosphorus (P) was measured with a spectrophotometer according to the phosphomolybdate blue method (Olsen and Sommers, 1982). Potassium (K) was measured with a flame photometer (Soltanpur and Workman, 1979). The estimation of calcium (Ca) was done by the method (Talapatra *et al.,* 1940). The Trace minerals *viz.* Zinc (Zn), Copper (Cu), Iron (Fe) and Manganese (Mn) were analyzed from the mineral extracts of these samples by atomic absorption spectrophotometer. To determine the nitrogen content in the dung samples, a suitable aliquot was immediately preserved in dilute (1:4) sulphuric acid and pooled for 6 days. Nitrogen in the dung samples was estimated after digesting them with sulphuric acid by the Kjeldhal method (Kjeldahl, 1883).

Pot culture experiment

The pot culture study was conducted to find out the effect of various cow dungs on the growth of the *Lagenaria siceraria* plant. The seeds were soaked in water overnight and then were sown in different pots filled with soil (control) and cow dung (experimental) in a 1:2 ratio. Each experiment was replicated for 15 times, making a total of 15 experimental units. The pots were irrigated twice and the soil pH was recorded throughout the experiment. Plant growth parameters such as height, number of leaves and biomass were measured at regular intervals.

Estimation of chlorophyll

Fresh leaves of *Lagenaria siceraria* were collected for chlorophyll estimation. The 2 grams of leaves were homogenized in a mortar and pestle with acetone and centrifuged at 1000 rpm. The filtrate was collected and made up to 100 ml with acetone and 5 ml of extract was transferred into a 50 ml volumetric flask and diluted to 50 ml with 80% acetone. Absorbance was read at 645 nm and 663 nm using a spectrophotometer. The quantity of chlorophyll a, chlorophyll b and total chlorophyll was calculated using the following formula:

Total chlorophyll content (mg/g) =

$$20.2\,(A645) + 8.02\,(A663) \times V/1000 \times W \quad \ldots(2)$$

RESULTS AND DISCUSSION

The physical and chemical properties of dung from Bargur and Jersey cattle provide significant insights into their agricultural potential. The color of dung from Bargur cattle is greenish-brown with 37% moisture content, while Jersey cattle dung is dark brown with 52% moisture content (Table 1). The pH of fresh dung from free-ranging Bargur cattle is slightly acidic, becoming basic as it dries, which could enhance microbial activity and nutrient cycling in soil (Mostofa *et al.,* 2018; Zhang *et al.,* 2016). The nutrient profile varies notably between the two breeds, influenced by diet and digestion efficiency (Broderick *et al.,* 2003; Snijders and Wouters, 2003). Total nitrogen (N), phosphorus (P) and potassium (K) levels were higher in Jersey cattle dung compared to Bargur cattle dung (Table 2). This suggests that Jersey dung may offer greater fertilization benefits for crops (Smith *et al.,* 2015). However, total organic carbon was higher in Bargur cattle dung, which can contribute to long-term soil health and structure (Table 2). Trace elements also showed variations: magnesium (0.48%) and copper (23.8 ppm) were higher in Bargur cattle dung, while calcium, zinc, manganese and iron were more abundant in Jersey cattle dung (Table 2). These trace elements are crucial for soil fertility and plant growth (Adegunloye *et al.,* 2007; Faridullah *et al.,* 2014). The differences in nutrient content between Bargur and Jersey cattle dung highlight the importance of organic inputs in sustaining soil fertility and enhancing nutrient availability.

Table 2: Illustrates the chemical composition of dung from Bargur and Jersey cattle, detailing the concentrations of essential nutrients and trace elements.

Parameters	Free ranging bargur cattle	Jersey cattle
Total N (%)	0.93	0.98
Total P (%)	0.29	0.42
Total K (%)	0.61	0.72
Organic carbon (%)	8.67	7.01
Total Ca (%)	0.8	1.08
Total Mg (%)	0.48	0.43
Total Cu (ppm)	23.8	16.4
Total Zn (ppm)	39.7	46.2
Total Mn (ppm)	149	185
Total Fe (ppm)	487	584

This data provides insights into the nutrient content and potential agricultural applications of cattle dung.

Table 3: Displays the plant growth analysis over 14 days, comparing the effects of Bargur and Jersey cattle dung with a control.

Days	Growth in (cm)		
	Control	Free ranging bargur cattle	Jersey cattle
Day 1	0	0	0
Day 2	0	0	0
Day 3	0	0	0
Day 4	0	0	0
Day 5	0.5	0.9	0
Day 6	1.9	2.0	0
Day 7	2.5	3.1	0
Day 8	3.9	5.8	0.4
Day 9	5.2	7.9	1.8
Day 10	6.9	9.9	2.3
Day 11	8.5	13.8	3.7
Day 12	9.6	12.9	5.8
Day 13	11.0	15.0	7.0
Day 14	13.0	16.5	9.0

The data tracks the progression of plant height under different treatments, offering insights into the impact of dung on plant growth.

Table 4: Presents the estimation of chlorophyll content in leaves, comparing optical density (OD)values at 645 nm and 660 nm across the control.

Sample	OD value		Chlorophyll content
	645 nm	660 nm	in mg/g
Control	0.33	0.75	13.23
Free ranging bargur cattle	0.53	0.77	13.53
Jersey cattle	0.22	0.72	13.25

Bargur and Jersey cattle dung treatments. These results provide insights into the influence of cattledung on chlorophyll levels in plant leaves.

The variation in nutrient composition between Bargur and Jersey cattle dung aligns with findings that bio-organic manures influence soil fertility and plant growth, as observed in amaranthus cultivation (Vipitha *et al.,* 2016).

The effect of dung on plant growth was evident in *Lagenaria siceraria*. Plants grown in Bargur cattle dung showed the highest growth rate (16.5 cm), followed by control media (13 cm) and Jersey cattle dung (9 cm) (Table 3). Similarly, chlorophyll content was highest in plants grown with Bargur dung (13.53 mg/g), followed by Jersey dung (13.23 mg/g) and control samples (Table 4). Enhanced chlorophyll content indicates better photosynthetic efficiency and potential for improved crop yields (Njoku *et al.,* 2008; Manna *et al.,* 2007). The beneficial effects of cattle manure on plant growth, as observed in sweet corn (Sebetha *et al.,* 2019) and the positive impact of organic manures on cowpea yield (Joshi *et al.,* 2016), align with the observed improvements in chlorophyll content and growth rate of Lagenaria siceraria when fertilized with Bargur cattle dung.

These findings align with previous research showing that cow dung composition varies with diet and digestion, influencing its fertilization potential (Rajesh Singh, 2020; Kumar *et al.,* 2019). Composting can further stabilize nutrients in manure, reduce pH levels and enhance phosphorus availability, minimizing the risk of nutrient runoff (Irshad *et al.,* 2013; Traore *et al.,* 1999).

CONCLUSION

The dung samples of Bargur and the Jersey cattle show distinct variations in nutrient composition and physical characteristics. The moisture content was higher in Jersey cattle dung, while the pH of Bargur cattle dung changed from acidic to alkaline when it was dried. The total NPK levels were higher in the Jersey cattle dung, indicating greater nutrient availability. However, the Bargur cattle dung showed higher organic carbon and trace elements like magnesium and copper, while the Jersey dung contained more calcium, zinc, manganese and iron. The higher plant growth rate of the *L. siceraria* and chlorophyll content were observed in Bargur cattle dung, than the Jersey cattle dung may be due to the presence of organic carbon and various nutrients. This indicates that Bargur cattle dung may have more nutrients for promoting plant growth than the Jersey cattle. The differences in the nutrient content indicate that the diet and digestion between the breeds are more important to consider when their dung is used for growing various agricultural crops.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

No animals were used for this study.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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