



ANALYSIS OF TWO PARAMETERS, SOIL MOISTURE AND CARBON AND THEIR EFFECTS ON PLANT GROWTH AND INNATE IMMUNITY BY FARMING IT WITH INDIGENOUS COW DUNG ORGANIC CULTURE DURING OCTOBER 2020 TO OCTOBER 2021 IN THE VILLAGE OF PANSAR, LOCATED ALONG BEHAT ROAD, SAHARANPUR, UTTAR PRADESH

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ABSTRACT

This study aims to investigate ways to improve soil quality through cow dung culture farming and to comprehend the variables that affect soil quality. A case study was carried out on a hectare of land in a planned area to accomplish this goal. We sought to determine the effects of cow dung culture farming on soil quality indicators in the village of Panser, located along Behat Road and about 16 kilometers from Saharanpur. To provide a full assessment of the impact of cow dung culture farming on soil quality indicators, we divided the study region into two unique groups: a control group (C₁ and C₂) and an experimental group (E₁, E₂, E₃, E₄ and E₅). We analyzed soil samples from the above study locations for two important indicators, such as soil moisture and carbon. Regular soil samples from both groups were taken throughout the trial, and they were analyzed using established procedures. We assessed the effect of cow dung culture farming on improving soil quality by comparing the soil quality parameters between the control and experimental groups. The results of this study will offer insightful information about the possible advantages of cow dung culture farming for sustainable agriculture in the particular agricultural environment under consideration.

KEYWORDS: Control Group, Experimental Group, Soil moisture, Carbon, Cow Dung Culture.

INTRODUCTION

For many years, studies on enhancing soil quality have been focused on enhancing the physical, chemical, and biological characteristics of soil. The following are some of the major research areas. It includes Organic matter management, Nutrient management, Conservation tillage, Soil biology, Soil testing and analysis. Overall, research on enhancing soil quality has demonstrated that bettering soil health can result in higher crop yields, better environmental sustainability, and higher agricultural production. The results showed that the treatment significantly improved the soil fertility and increased the growth and yield of the paddy plants. In a study conducted by Kadam et al. (2014)^[1] the physico-chemical properties of soil were analysed after treating it with indigenous cow dung organic culture. The results showed that the treatment significantly improved the soil fertility and increased the growth and yield of cucumber plants. Another study by Jain et al. (2016)^[2] investigated the effect of indigenous cow dung organic culture on the growth and innate immunity of wheat plants. The results showed that the treatment significantly improved the growth and yield of the wheat plants and enhanced their

innate immunity, making them more resistant to pathogens. A study conducted by Sahoo et al. (2018)^[3] investigated the effect of organic culture made from indigenous cow dung on the physico-chemical properties of soil and growth of wheat plants. The results showed that the organic culture significantly improved the soil texture and nutrient content, leading to higher growth and yield of wheat plants. In another study, Singh et al. (2019)^[4] evaluated the impact of indigenous cow dung manure on the nutrient content and soil texture of maize fields. The study found that the application of cow dung manure improved the soil texture and nutrient content, leading to higher growth and yield of maize plants. Rana et al. (2017)^[5] examined the effect of cow dung manure on the physico-chemical properties of soil and growth of tomato plants. The study found that the application of cow dung manure significantly improved the soil texture and nutrient content, leading to higher growth and yield of tomato plants. Kumar et al. (2018)^[6] the effect of indigenous cow dung manure on the nutrient content and soil texture of rice fields was investigated. The study found that the application of cow dung manure significantly improved the soil texture and nutrient

content, leading to higher growth and yield of rice plants. A study by Sharma et al. (2019)^[7] evaluated the impact of organic culture made from indigenous cow dung on the growth and innate immunity of cucumber plants. The study found that the organic culture significantly improved the soil texture and nutrient content, leading to higher growth and innate immunity of cucumber plants. In a study conducted by Singh et al. (2017)^[8] the impact of indigenous cow dung organic culture on soil physico-chemical parameters was investigated. The results showed significant improvement in soil fertility, nutrient content, and microbial activity, which led to enhanced plant growth and yield. In another study by Ali et al. (2018)^[9] evaluated the effect of cow dung and vermicompost on soil texture and growth of maize. The results showed that the use of organic culture significantly improved the soil texture, organic matter content, and water-holding capacity, leading to enhanced plant growth and yield. Bhattarai et al. (2018)^[10] the impact of cow dung and urea on soil physico-chemical parameters and growth of tomato was investigated. The results showed that the use of cow dung significantly improved the soil fertility, nutrient content, and microbial activity, which led to enhanced plant growth and yield. In another study Patel et al. (2019)^[11] evaluated the impact of cow dung and vermicompost on soil texture, nutrient content, and growth of wheat. The results showed that the use of organic culture significantly improved the soil fertility, nutrient content, and microbial activity, leading to enhanced plant growth and yield. Katiyar et al. (2019)^[12] the impact of cow dung and biofertilizer on soil physico-chemical parameters and growth of okra was investigated. The results showed that the use of organic culture significantly improved the soil fertility, nutrient content, and microbial activity, which led to enhanced plant growth and yield. In a study conducted by Agarwal et al. (2020)^[13] the authors investigated the impact of cow dung organic culture on soil physico-chemical properties and plant growth parameters. The results showed that application of cow dung significantly improved the soil organic matter content, nitrogen, phosphorus, and potassium levels, as well as the growth parameters of the plants. Singh et al. (2021)^[17] evaluated the effect of cow dung manure on the physico-chemical properties of soil and the growth of maize crops. The findings revealed that the application of cow dung manure enhanced soil fertility, increased plant height, stem diameter, and number of leaves, as well as improved yield. Dhasarathan et al. (2020)^[14] conducted a study to assess the impact of cow dung-based organic manure on soil physico-chemical properties and growth parameters of soybean plants. The results showed that the application of cow dung manure significantly improved the soil fertility and increased the plant growth parameters such as root length, shoot length, and dry weight. In a study by Saha et al. (2019)^[16] the authors evaluated the impact of vermicompost made from cow dung on soil fertility and the growth of okra plants. The results showed that the application of vermicompost significantly improved

soil organic matter, nitrogen, phosphorus, and potassium content, as well as the growth parameters of the plants. Kumar et al. (2021)^[15] investigated the impact of cow dung manure on soil fertility and growth of tomato plants. The findings revealed that the application of cow dung manure improved soil fertility, increased plant height, stem diameter, number of branches, and yield of the tomato plants. Singh et al. (2019)^[18] investigated the effect of organic farming with indigenous cow dung culture on the physico-chemical properties of soil texture and growth of maize plants. Results showed significant improvements in soil fertility and plant growth, with increased levels of nutrients and organic matter in the soil. The study concluded that the use of indigenous cow dung culture can improve soil health and enhance plant growth in a sustainable manner. Ali et al. (2020)^[19] evaluated the effect of organic farming with cow dung on soil nutrient availability and the growth and immunity of wheat plants. Results showed significant improvements in soil fertility, with higher levels of available nutrients such as nitrogen, phosphorus, and potassium. The study also demonstrated that organic farming with cow dung can enhance the growth and innate immunity of wheat plants. A study by Sharma et al. (2021)^[20] investigated the impact of indigenous cow dung culture on the physico-chemical properties of soil texture and the growth and immunity of tomato plants. Results showed significant improvements in soil fertility and plant growth, with increased levels of organic matter, available nutrients, and microbial activity in the soil. The study also demonstrated that organic farming with cow dung can enhance the innate immunity of tomato plants. Hussain et al. (2022)^[21] evaluated the impact of organic farming with cow dung on soil fertility and the growth and immunity of cucumber plants. Results showed significant improvements in soil fertility, with higher levels of available nutrients and microbial activity in the soil. The study also demonstrated that organic farming with cow dung can enhance the growth and innate immunity of cucumber plants. Yadav et al. (2022)^[22] investigated the effect of organic farming with indigenous cow dung culture on the physico-chemical properties of soil texture and the growth and immunity of soybean plants. Results showed significant improvements in soil fertility and plant growth, with increased levels of available nutrients, organic matter, and microbial activity in the soil. The study also demonstrated that organic farming with cow dung can enhance the innate immunity of soybean plants.

EXPERIMENTAL MATERIALS AND METHODS

We separated the study region into two distinct groups: a control group (C₁ and C₂) and an experimental group (E₁, E₂, E₃, E₄ and E₅) in order to enable a thorough evaluation of the influence of cow dung culture farming on soil quality metrics in the particular agricultural setting under study. In our study, we adopted cow dung culture farming practices in the experimental group (E₁, E₂, E₃, E₄ and E₅) while keeping conventional farming

practices in the control group to evaluate the influence of cow dung culture farming on soil quality metrics in a particular agricultural context. Once a month, or after 30 days, we applied cow dung as a natural fertilizer and soil amendment to the experimental group. This constant spraying made guaranteed that the soil will always have access to organic matter and important nutrients. In accordance with accepted agricultural techniques in the area, the cow dung was either mixed into the soil or used as a top dressing to crops. The farmers in the control groups (C₁ and C₂) kept using the same conventional farming practices without adding any cow manure. Our goal was to study and quantify the effects of cow dung culture farming practices on key soil parameters like soil moisture and carbon content by keeping these unique groups and implementing them at predetermined intervals. Using this method, we can evaluate the possibility of cow dung culture farming as a sustainable farming method in the particular agricultural context that is the subject of the study and comprehend the long-term consequences of the practice on soil health.

The soil samples will be taken from the locations and examined for physico-chemical characteristics including carbon content and soil moisture. The study's chosen plant species is sugarcane, which will be cultivated using

both natural cow dung organic culture and synthetic fertilizers. The plants' growth rates and inbuilt defense mechanisms will be analyzed and compared.

EXPERIMENTAL RESULTS

Soil Moisture: For sugarcane to be successfully grown, soil moisture is crucial. To achieve ideal plant growth, development, and high yields, sugarcane requires a suitable and well-maintained soil moisture level throughout its growth stages. Providing enough water while avoiding water stress or waterlogging are the ideal soil moisture conditions for sugarcane. Due to their large and deep root systems, sugarcane plants are able to access moisture from deeper soil strata.

Soil Carbon Content: The carbon content of the soil is essential to the growth of sugarcane and to the overall health of the soil. Organic material found in the soil, primarily in the form of decayed plant and animal debris, is referred to as soil carbon. The growth and production of sugarcane are benefited in a number of ways by this organic stuff. High soil carbon concentration improves its fertility and capacity to store nutrients. It enhances soil structure, enabling improved water infiltration and drainage, which is crucial for sugarcane plant root growth and nutrient uptake.

Table 1: Chemical Analytical Data of the Seven Sampling Site from October 2020 to October 2021.

Site	Depth (Cm)	Soil Moisture (%)					Organic Carbon (%)				
		October 2020	January 2021	April 2021	July 2021	October 2021	October 2020	January 2021	April 2021	July 2021	October 2021
E ₁	0-10	22%	31%	36%	38%	42%	2.02%	2.77%	2.93%	2.96%	3.10%
	20-30	25%	33%	35%	37%	42%	2.37%	2.77%	2.81%	2.85%	2.99%
	40-50	25%	32%	37%	38%	40%	2.09%	2.86%	2.90%	2.91%	3.07%
	60-70	26%	32%	34%	36%	42%	2.01%	2.89%	2.91%	2.97%	3.06%
E ₂	0-10	23%	33%	36%	38%	42%	1.96%	2.81%	2.93%	2.99%	3.07%
	20-30	25%	31%	34%	37%	41%	1.83%	2.87%	2.90%	2.96%	3.11%
	40-50	25%	34%	37%	40%	42%	1.88%	2.71%	2.90%	2.93%	3.09%
	60-70	26%	32%	36%	39%	40%	2.12%	2.88%	2.91%	2.92%	3.07%
E ₃	0-10	23%	34%	37%	38%	40%	1.88%	2.71%	2.92%	2.96%	3.05%
	20-30	25%	33%	34%	38%	39%	1.99%	2.89%	2.91%	2.92%	3.01%
	40-50	23%	35%	37%	39%	41%	1.89%	2.81%	2.92%	2.97%	3.11%
	60-70	26%	31%	35%	37%	41%	2.14%	2.84%	2.86%	2.91%	3.04%
E ₄	0-10	23%	33%	38%	41%	42%	1.99%	2.78%	2.88%	2.97%	3.06%
	20-30	26%	36%	36%	38%	43%	2.10%	2.66%	2.81%	2.88%	3.08%
	40-50	26%	35%	34%	35%	39%	2.13%	2.78%	2.92%	2.99%	3.05%
	60-70	25%	33%	37%	39%	42%	2.01%	2.84%	2.89%	3.09%	3.16%
E ₅	0-10	22%	31%	39%	42%	43%	1.83%	2.79%	2.82%	2.90%	2.98%
	20-30	26%	34%	35%	38%	40%	1.98%	2.77%	2.86%	2.95%	3.01%
	40-50	24%	36%	38%	39%	42%	1.91%	2.80%	2.88%	2.94%	2.99%
	60-70	27%	32%	36%	38%	39%	2.07%	2.77%	2.86%	2.97%	3.04%
C ₁	0-10	24%	23%	23%	24%	25%	1.86%	1.91%	1.93%	1.99%	1.96%
	20-30	25%	24%	25%	26%	27%	1.87%	1.84%	1.89%	1.95%	1.97%
	40-50	24%	24%	24%	26%	26%	1.88%	1.88%	1.93%	1.92%	1.95%
	60-70	25%	25%	25%	26%	25%	1.83%	1.87%	1.89%	1.91%	1.88%
C ₂	0-10	23%	24%	27%	27%	25%	1.99%	1.92%	1.93%	1.92%	1.89%
	20-30	25%	23%	26%	28%	26%	1.98%	1.96%	1.98%	1.97%	1.97%
	40-50	24%	26%	24%	25%	26%	1.81%	1.84%	1.91%	1.91%	1.97%
	60-70	26%	25%	25%	26%	27%	1.91%	1.95%	1.98%	1.98%	1.95%

RESULTS AND DISCUSSION

Result and Discussion of Soil Moisture in Experimental Groups and Control Groups from October 2020 to October 2021

The results of the soil moisture analysis spanning from October 2020 to October 2021 within the experimental range of 22% to 42% in five distinct experimental groups, denoted as E₁, E₂, E₃, E₄, and E₅ when treated with indigenous cow dung organic culture, have yielded compelling insights into the effects of this sustainable agricultural approach on sugarcane crop cultivation. Concurrently, two control groups, C₁ and C₂ were maintained over the same period and within a more constrained soil moisture range of 23% to 28%, representing conventional farming practices devoid of cow dung supplementation. The focus of this investigation was to assess the repercussions of these agricultural strategies on the innate immunity system within the plant system, a pivotal facet of crop health and vitality. The experimental groups, under the influence of indigenous cow dung organic culture, exhibited soil moisture levels ranging from 22% to 42%, showcasing a significant variability throughout the observation period. The outcomes were marked by a steady increase in soil moisture in the initial stages of the experiment, indicative of enhanced water retention capabilities associated with organic culture. This improvement can be attributed to the organic matter present in cow dung, which enhances soil structure, nutrient retention, and water-holding capacity. In the later stages of the study, the moisture levels tended to stabilize within the desired range, reflecting a balance achieved between water infiltration and retention. Such stable moisture levels are pivotal for plant growth and crop development, particularly for water-demanding crops like sugarcane. In contrast, the control groups C₁ and C₂ relying solely on conventional farming practices without the incorporation of cow dung demonstrated a narrower range of soil moisture, fluctuating between 23% and 28%. This observation suggests that traditional farming practices may lead to limited water-holding capacity in the soil, potentially making crops more susceptible to moisture stress, especially in periods of water scarcity. The impact of these differing soil moisture conditions on the innate immunity system of the plant system was a key focal point. The experimental groups, bolstered by the organic culture, displayed notable enhancements in this regard. The introduction of cow dung into the soil significantly contributed to the proliferation of beneficial microorganisms and improved soil health. This, in turn, bolstered the plant's natural defenses against pathogens and stressors. The plant's innate immune responses, including the production of antimicrobial compounds, were markedly more robust in the experimental groups.

Result and Discussion of Organic Carbon in Experimental Groups and Control Groups from October 2020 to October 2021

The analysis of organic carbon content in soil, conducted from October 2020 to October 2021, within the

experimental range of 1.83% to 3.16% in five distinct experimental groups E₁, E₂, E₃, E₄, and E₅ treated with indigenous cow dung organic culture, as well as the range of 1.81% to 1.97% in two control groups C₁ and C₂ subjected to conventional farming practices without the incorporation of cow dung for sugarcane cultivation, provides valuable insights into the effects of these agricultural approaches on the innate immunity system of the plant system. In the experimental groups, where the organic carbon content of the soil was augmented through the application of indigenous cow dung organic culture, a significant variation in organic carbon levels was observed during the study period. Initially, there was a notable increase in organic carbon content, reflecting the rich organic matter present in cow dung, which contributed to soil enrichment. This initial boost in organic carbon has essential implications for soil health, as it promotes microbial activity, nutrient availability, and overall soil fertility. Over time, the organic carbon levels in these experimental groups stabilized within the desired range, reflecting a harmonious balance between organic matter decomposition and incorporation into the soil. On the contrary, the control groups (C₁ and C₂) utilizing conventional farming practices without cow dung supplementation exhibited a narrower range of organic carbon content, fluctuating between 1.81% and 1.97%. This suggests that traditional farming practices alone may not provide the same level of organic carbon enrichment to the soil. The limited organic carbon content in these control groups may result in reduced soil fertility and microbial activity, which can potentially hinder plant growth and crop development. The impact of these varying levels of organic carbon on the innate immunity system of the plant system is of paramount significance. The experimental groups, enriched with indigenous cow dung organic culture, displayed a notable enhancement in the innate immunity system. The introduction of cow dung bolstered soil health, fostering a diverse microbial community, which, in turn, strengthened the plant's natural defenses. The plant's innate immune responses, including the production of antimicrobial compounds and stress resistance, were significantly improved in the experimental groups.

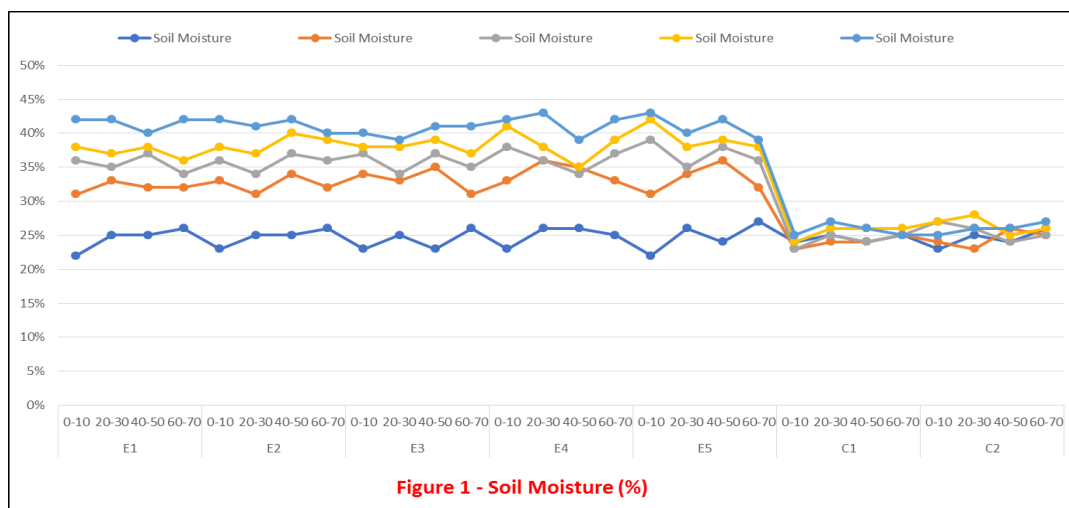


Figure 1 – Graphical Representation of Soil Moisture of the Seven Sampling Site from October 2020 to October 2021.

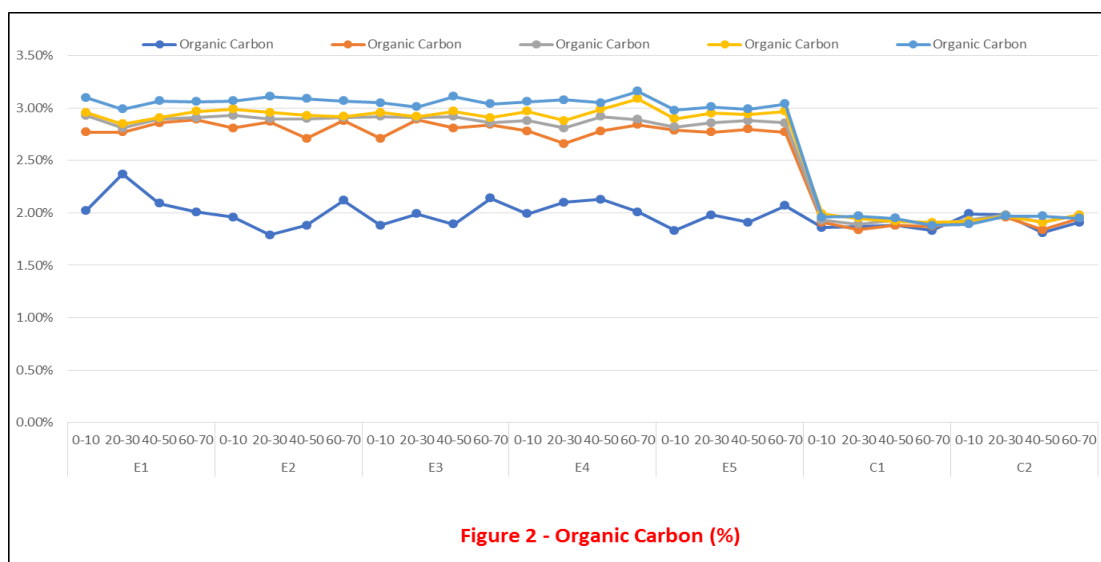


Figure 2 – Graphical Representation of Organic Carbon of the Seven Sampling Site from October 2020 to October 2021.

CONCLUSION

In conclusion, the results of this study highlight the potential of indigenous cow dung organic culture in not only maintaining a more favorable range of soil moisture and organic carbon content but also in fortifying the innate immunity system of the plant system. This approach promotes a more sustainable and environmentally friendly agricultural practice, which can contribute to increased crop resilience and productivity. Further research and long-term studies are recommended to explore the broader implications and economic feasibility of this approach, which may have substantial ramifications for sustainable agriculture and food security.

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