



A Comparative Study Of Different Types Of Fertilizer On In Vitro Antioxidant Activity In *Curcuma Longa*

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ABSTRACT

A large amount of agricultural waste, including cow dung and other biowaste, exists in rural areas but is not recycled or properly utilized. Tiwari, KP and others said vermicomposting is an alternative to the use of organic waste in agriculture. A comparative study of different types of fertilizers on antioxidant activity of phytochemicals in cultivated *Curcuma longa* was conducted, analyzed and documented. The results of this study also support the use of planting materials such as fertilizers in sustainable agriculture to provide nutrients to plants and increase productivity. The objective of this study is to understanding how different fertilization methods influence these compounds is crucial for optimizing the cultivation of these medicinal plants to maximize their health benefits. The findings of this research could provide valuable insights for farmers and health practitioners.

Keywords: antioxidant activity, organic fertilizer, chemical fertilizer, turmeric, growth, agricultural products

INTRODUCTION

The use of plants with bioactive compounds that can enhance the immune system (Gasmi *et al.*, 2023). Among these plants, *Curcuma longa* (turmeric) has been extensively studied for their medicinal properties (Ajanaku *et al.*, 2022; Habib *et al.*, 2023). This plant is known for their potent bioactive compounds, which contain curcumin. This compound has shown significant potential in boosting the immune system, providing anti-inflammatory, antioxidant, and antimicrobial effects (Alolga *et al.*, 2022).

Fertilization is a critical aspect of agriculture that affects the yield and quality of crops (Liliane *et al.*, 2020). The use of organic and chemical fertilizers can significantly influence the concentration and efficacy of bioactive compounds in medicinal plants.

Turmeric has a long history of medicinal use and consists of approximately 120 species (Jani *et al.*, 2024). Among *Curcuma* species, *Curcuma longa* (Turmeric) is the most widely recognized; a cultivated plant that grows in warm climates in many parts of the world (Daniel-Ogbonna *et al.*, 2023).

Turmeric has a variety of beneficial pharmacological properties, including antioxidant effect (Angel *et al.*, 2014). Interestingly, this natural polyphenol is commonly known as the “wonder drug of life” (Kakkar *et al.*, 2024). The hydrophobic nature of curcumin results in lower gastrointestinal (GI) absorption after oral administration. Curcumin, on the other hand, appears to offer good potential for therapeutic development from turmeric, which is classified as generally recognized as safe with stable metabolism and low toxicity (J. Sharifi-Rad *et al.*, 2020). Turmeric was used in Ayurvedic medicine for different health issues (Dosoky *et al.*, 2018). Turmeric has antioxidant abilities that help to protect the liver from being damaged by toxins (Ghasemzadeh Rahbardar *et al.*, 2024). The antioxidant power of curcumin is significant.

Curcumin's impact on reactive oxygen species (ROS) can be mediated in several different ways. Scavenging can be used to get rid of free radicals like reactive oxygen species and reactive nitrogen species. Additionally, curcumin can inhibit the production of ROS by downregulating enzymes such as NADPH oxidase, which are responsible for ROS generation. It can also upregulate antioxidant defenses by increasing the expression of enzymes like superoxide dismutase (SOD) and catalase, which neutralize ROS. Moreover, curcumin can chelate metal ions, preventing them from catalyzing reactions that generate ROS (Mittal *et al.*, 2024). Through these multifaceted mechanisms, curcumin helps maintain cellular redox balance and protect against oxidative stress. Reducing the formation of reactive oxygen species-generating enzymes including "lipoxygenase/cyclooxygenase and xanthine hydrogenase/oxidase;" blocking oxidative neutralization proteins like Glutathione, catalase, and SOD.

MATERIAL AND METHOD

Details of Experiment: This study was conducted to find the effect of organic and chemical fertilizers on antioxidant activity in *curcuma longa* (turmeric).

Field experiment details

The experiment includes the application of organic fertilizer, chemical fertilizer and their combination in two levels. The experimental design consisted of 4 plots planted with *curcuma longa* plants. The Single block area = 0.70m x 0.70m = 0.49 square meters. Area of each plot = 0.49 square meters.

Treatment

- i Preparation of container for a raised bed system suitable for *curcuma longa* plants.
- ii Fertilizer must not only be applied according to treatment, but also systematically mixed with the soil.
- iii The best irrigation method has been provided for the required water amount to *curcuma longa* plants .
- iv An organic spray was applied for the protection of plants from disease.

METHOD

Curcuma longa was harvested after 8 months from the time of planting. Five fully grown mature plants were randomly selected from each container. Rhizome samples were harvested and coded as container: 1 (C=1), container:2 (C=2), container:3 (C=3) and container:4 (C=4). Plant yield was dried in the shade for a few days and rhizome was made into the powder that met the requirements.

Table 1: Coding of different samples based on fertilizer treatment

Sr. No.		Sample code	Treatment of plot done by different type of fertilizers
1.	Container:1	C=1	Organic fertilizer
2.	Container:2	C=2	Chemical fertilizer
3.	Container:3	C=3	Mix (Both Organic and Chemical fertilizer)
4.	Container:4	C=4	No treatment

Table 2: List of Fertilizers

S. No.	Name of Fertilizer	Type of Fertilizer
1.	Organic Fertilizers	Cow Manure
2.	Chemical Fertilizer	NPK

STATICAL ANALYSIS

In-vitro antioxidant activity using DPPH method

The spectrophotometer was used to measure the DPPH scavenging activity. The stock solution (6 mg in 100 ml methanol) was produced to give an initial absorbance of 1.5 ml in 1.5 ml methanol. After 15 minutes, there was a decrease in absorbance in the presence of sample extract at various concentrations (10-100 g/ml). 1.5 ml of DPPH solution was added to 3 ml of methanol, and the absorbance was measured at 517 nm for the control reading. 1.5 ml of DPPH and 1.5 ml of varying concentrations of the test sample were placed in a succession of volumetric flasks, and the final volume was adjusted to 3 ml using methanol. Three test samples were collected and processed in the same way. Finally, the average was calculated. After 15 minutes at 517 nm, the absorbance of DPPH with varied concentrations showed a final reduction (**Parkhe et al., 2018**).

$$\text{Radical scavenging activity (\%)} = (A_{\text{control}} - A_{\text{test}}) / A_{\text{control}} \times 100$$

Where A_{control} is the absorption (without extract) of the control and where A_{test} is the absorption in the presence of the extract/standard.

Result

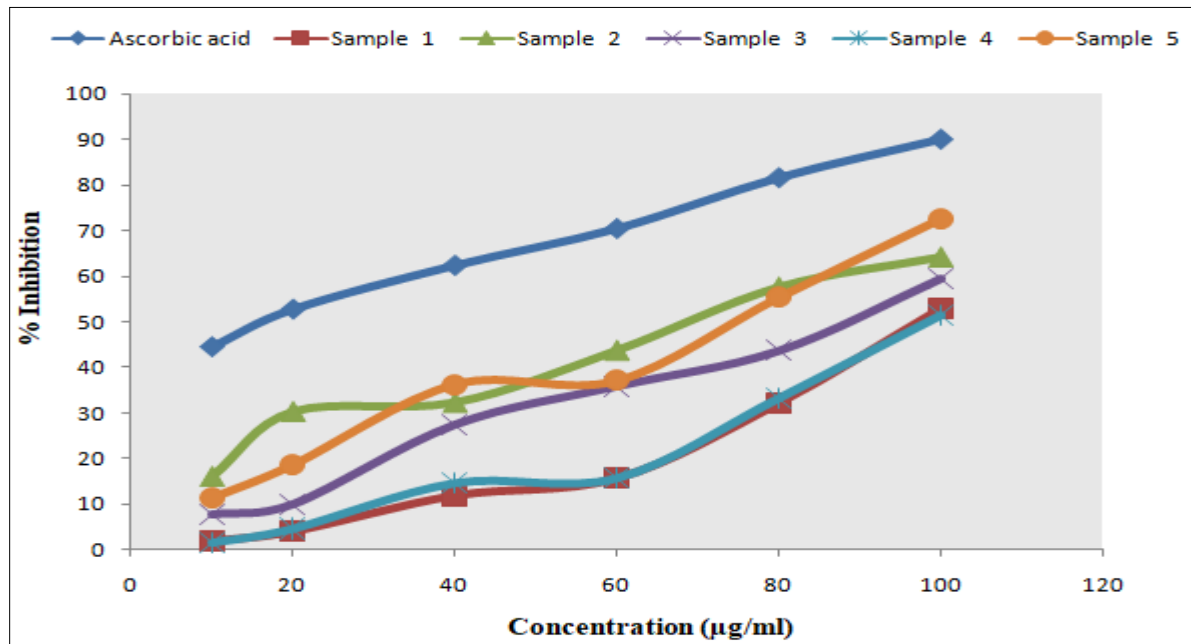
In vitro antioxidant activity results**Table 3:** Absorbance of ascorbic acid and given samples using DPPH method

S. No.	Concentration (µg/ml)	Absorbance				
		Ascorbic acid	Sample I	Sample II	Sample III	Sample IV
1	10	0.614	1.086	0.93	1.023	1.089
2	20	0.523	1.062	0.772	0.998	1.055
3	40	0.417	0.975	0.750	0.805	0.945
4	60	0.328	0.933	0.623	0.712	0.933
5	80	0.205	0.75	0.469	0.626	0.740
6	100	0.112	0.521	0.396	0.451	0.540
	Control			1.108		

Table 4: % Inhibition of ascorbic acid and given *Curcuma longa* samples using the DPPH method

S. No.	Concentration (µg/ml)	% Inhibition				
		Ascorbic acid	Container I	Container II	Container III	Container IV
1	10	44.58	1.99	16.06	7.67	1.71
2	20	52.80	4.15	30.32	9.93	4.78
3	40	62.36	12.00	32.31	27.35	14.71
4	60	70.40	15.79	43.77	35.74	15.79
5	80	81.50	32.31	57.67	43.50	33.21
6	100	89.89	52.98	64.26	59.30	51.26
	IC₅₀ value	17.18	108.16	69.90	85.97	109.18

In vitro antioxidant activity graph



Graph : % Inhibition of ascorbic acid and given samples using the DPPH method

CONCLUSION:

This study has tested for in-vitro antioxidant activity *Curcuma longa* plants. DPPH activity of *Curcuma longa* was performed in this study. The DPPH test used in this research detects whether a sample possesses a scavenging effect on active radicals by donating hydrogen atoms to DPPH molecules. From % Inhibition of ascorbic acid and different samples graph, it is found that % inhibition of *curcuma longa* obtained from container II, is the most potent to removing DPPH as it has the lowest **IC₅₀ value 69.90**. Chemical fertilizer has the highest antioxidant activity among the different fertilizer application. Therefore, from the present findings all the samples have significant antioxidant activity in vitro systems.

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