



Enhancing Biochemical Attributes of Wheat (*Triticum aestivum*) through Weeds-Derived Vermicompost in the Malwa Region of Madhya Pradesh.

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Abstract

A nutrient-dense organic fertilizer, vermicompost improves soil fertility, structure, and plant yields. This study aimed to determine how biochemical characteristics of wheat (*Triticum aestivum* var. WH-147) were affected by vermicompost made from local weeds in the Shajapur district of the Malwa region (M.P.). The soil was treated with vermicompost, and a control plot of 1 m² was also set up. Every fifteen days, using the same procedures as before (Arnon, 1949; Jensen, 1978; Lowry, 1951; Phenol-sulphuric acid method; Bligh and Dyer, 1959), biochemical parameters such as carbohydrates, proteins, lipids, pigment contents chlorophyll (a and b) and carotenoids were examined. The plants treated with vermicompost showed a marked improvement in all biochemical parameters when compared to the control group. An increase of 0.76 mg/ml of protein, 0.87 mg/ml of carbohydrates, 0.46 mg/ml of lipids, 1.764 mg/g of total chlorophyll and 0.0097 mg/100 g of carotenoids was seen in plants that were 60 days old. Research in the Malwa region shows that using vermicompost increases soil health, plant development, and biochemical composition, all of which lead to more sustainable wheat harvests.

Keywords: Vermicompost, *Triticum aestivum*, biochemical parameters, soil fertility, sustainable agriculture.

Introduction

Vermicompost is a unique microbiological fertilizer with the community of useful soil microorganism improving soil fertility (Teka et al., 2024). Vermicompost does not contain pathogenic microflora, helminth eggs, weed seeds and heavy metals (Thakur et al., 2024). Vermicompost improves agro chemical characteristics, increases quality and yield of agricultural crops. Vermicompost quickly restores natural soil fertility, improves its structure and health. It is highly effective, plants and seeds immediately response to it. It reduces seed germination period, promotes plant growth and blossom, fruits ripen 2-3 weeks earlier (Guo et al., 2023).

Vermicompost provides plants with durable immunity, increasing their resistance to stress, unfavourable–environmental conditions, bacterial and putrefactive diseases. It also provides high seedlings survival, optimum growth of flower and full blossom (Rehman et al., 2023). Vermicompost considerably increases yield capacity and improves taste of the production grown. The organic fertilizer is provided with high agrochemical and growth stimulant characteristics. All nutrients are balanced and biologically available compounds for plants. When vermicompost is applied they inhibit soil, excrete phytohormones antibiotics, fungicides and antibacterial compounds that help control pathogenic microflora(Kasahun et al., 2022). Eventually soil is improved and many wide spread plant diseases are eliminated. From earlier studies also it is evident that vermicompost provides all nutrients in readily available form and also enhances uptake of nutrients by plants (Kocaman et al., 2024).

Wheat is common crop in Malwa reason so response of the vermicompost on this crop was observed comparatively. Significant observations were occurred by the application of Vermicompost on selected crop during this investigation. Vermicompost was prepared by weed biomass of Shajapur city. *Cassia tora*, *Cassia occidentalis*, *Alternanthera* spp.,

Achyranthus aspera, *Parthenium hysterophorus* and *Lantana camara* etc. local weed species were used for making valuable Vermicompost. Vermicompost enhances the growth of crop plants along with biochemical and improve soil quality also.

In present investigation we analysed the Effect of Vermicompost on Biochemicals in wheat crop (*Triticum aestivum*) in Malwa region of M.P. The Wheat variety WH-147 is commonly grown in this area has been taken for bioassay.

Materials and Methods

Selection of agronomic crops – *Triticum aestivum* var.WH-147 (Wheat)-

Wheat is grown on more land area than any other commercial crop and is the most important staplefood for humans. World trade in wheat is greater than for all other crops combine Globally, wheatis the leading source of vegetable protein in human food, having a higher protein content than either maize (corn) or rice, the other major cereals.

In present investigation we analysed the effect of Vermicompost on Biochemicals in wheat crop (*Triticum aestivum*) in Malwa region of M.P. The Wheat variety WH-147 is commonly grown in this area has been taken for bioassay.

The following Biochemical parameters were selected for bioassay –

1. Protein contents
2. Carbohydrates contents
3. Lipid contents
4. Pigment contents - Chlorophyll and Carotenoids

In present study the effects of vermicompost on Biochemicals in Wheat (*Triticum aestivum* var.WH- 147) as rabi crop was studied in its particular season. Wheat seed were purchased from local market of Shajapur and used in the experiment.

Study of agronomic effects

Two plots were prepared in size of 1m², one plot for vermicompost treated soil and one plot for control. Seeds of Wheat Were sown in these plots and following observations were taken at the interval of 15 days. Biochemical parameters were observed at the interval of 15 days.

Biochemical parameters

Estimation of chlorophyll a and chlorophyll b

Estimation of chlorophyll a and chlorophyll b was performed by (Arnon, 1949) in soybean and wheat leaves at interval of 15 days with selected different treatments.

Calculation:

Calculated the amount of chlorophyll present in the extract (mg chlorophyll /gm tissue) using the following equation :

$$\text{mg chlorophyll a/g tissue} = 12.7 (A_{663}) - 2.69 (A_{645}) \times \frac{V}{1000 \times W}$$

$$\text{mg chlorophyll b/g tissue} = 22.9 (A_{645}) - 4.68 (A_{663}) \times \frac{V}{1000 \times W}$$

$$\text{mg total chlorophyll per g tissue} = 20.2 (A_{645}) + 8.02 (A_{663}) \times \frac{V}{1000 \times W}$$

Where,

A = Absorbance at specific wavelengths,

V = Final volume of Chlorophyll extract in 80 % acetone

W = Fresh weight of the tissue extracted.

Estimation of carotenoids

Estimation of carotenoids was performed by Jensen A, 1978.

An estimation of total carotenoid content of crude plant extracts containing negligible amounts of chlorophylls may be obtained directly as follows:

Make suitable dilution of the acetone or methanol extracts of the plant tissue and measure the absorbance at 450 and 670 nm in a colorimeter . If A₄₅₀ is 10 time that of A₆₇₀ ,the carotenoids present in the extract may be estimated from the A₄₅₀ values using the following formula :

$$C = \frac{D \times V \times f \times 10}{2500}$$

C = Total amount of carotenoids (mg)

D = Absorbance at 450 nm in a 1.0 cm cell

V = Volume of the original extract in ml

f = Dilution factor and

2500 = Average extinction coefficient of the pigments.

Estimation of protein content

Estimation of Protein was performed by Lowry method, 1951.

Procedure –Extraction of protein from sample-

1. Grinded 0.5g of the sample with a suitable solvent system (water or buffer) in a pestle and mortar.
2. Centrifuged and used the supernatant for protein estimation.

Pipette out 0.2, 0.4, 0.6, 0.8, and 1.0ml of the working standard solution into series of test tubes. Pipette out 0.1ml and 0.2ml of the sample extract into two other test tubes. Make up the volume to 1ml with water in all the tubes. A tube with 1ml of water serves as the blank. Added 5ml of solution C, mix well and incubate at room temperature for 10 min. Added 0.5ml of FCR, mix well immediately and incubate at room temperature in dark for 30 min. Read the absorbance at 660nm against the blank. Drawn a standard graph, calculated the amount of protein in the sample and expressed the result as mg/g or mg/100g sample or percentage.

Estimation of carbohydrate

Carbohydrate was performed by Phenol-sulphuric acid method (Mecozzi, 2005).

Results and Discussion

Calculation

Absorbance corresponds to 0.1 mL of the test
= xmg of glucose

$$100\text{mL of the sample solution contains} = \frac{x}{0.1} \times 100\text{mg of glucose}$$

= % of total carbohydrate present.

Estimation of lipid content

Total Lipid content was estimated by Bligh and Dyer method, 1959.

Calculation

Weight of lipids (g): (b - a) - (c - a) = d.g

$$\text{Total lipid(g)} = \text{Weight of lipid(d)} \times \frac{\text{Total vol. of chloroform layer(Xml)}}{\text{Vol. of chloroform layer evaporated(yml)}}$$

$$\% \text{ Total lipids} = \frac{\text{Total lipids(g)}}{\text{Weight of sample (g)}} \times 100$$

a, is the weight of empty flask .

Statistical Analysis

Data were Statically analysed by Mean \pm Standard Error (SE) using Microsoft Office Excel 2007.

The results were showed in Tables 1-5 & figures 1-7 the levels of protein, carbohydrate, lipid, chlorophyll and carotenoid significantly increased in Wheat crop in vermicompost treated soil as compared to control. Amounts of Protein, carbohydrate, lipid , total chlorophyll and carotenoids in 60 days old plants of vermicompost treated soil were recorded as 0.76 mg/ml, 0.87mg/ml, 0.46 mg/ml , 1.764 mg/gm and 0.0097 mg/100gm. Levels of protein, carbohydrate ,lipid , chlorophyll and carotenoid significantly increased with vermicompost treated soil as compared to control. Similar findings were also observed by Vijayalakshmi, A., & Karthiyayini, R. (2018). Vermicompost significantly stimulates the growth of a wide range of plant species including several horticultural crops such as tomato (Atiyeh et al., 1999; Atiyeh et al., 2000a, Atiyeh et al., 2000b; Atiyeh et al., 2001), pepper (Atiyeh et al., 2000, 2001, 2002), garlic (Argüello et al, 2006), aubergine (Gajalakshmi and Abbasi, 2004), strawberry (Arancon et al., 2004b), sweet corn (Lazcano et al, 2011) and green gram (Karmegam et al., 1999).

Table-1.Effect of Vermicompost on Protein, Carbohydrate and Lipid concentrations in Wheat.

S. No.	No. of Days	Protein concentration in mg/ml.		Carbohydrate concentration in mg/ml.		Lipid concentration in mg/ml.	
		Control	Vermicompost	Control	Vermicompost	Control	Vermicompost
1	15	0.16±0.015	0.65±0.035	0.41±0.020	0.68±0.041	0.14±0.020	0.31±0.030
2	30	0.19±0.020	0.68±0.026	0.47±0.035	0.77±0.035	0.17±0.030	0.33±0.056
3	45	0.21±0.023	0.71±0.030	0.51±0.049	0.82±0.035	0.19±0.020	0.38±0.041
4	60	0.23±0.025	0.76±0.035	0.56±0.023	0.87±0.015	0.21±0.020	0.46±0.030
5	75	0.36±0.030	0.81±0.030	0.62±0.035	0.94±0.045	0.23±0.015	0.49±0.020

Data are given in Mean \pm SE of three replicates.

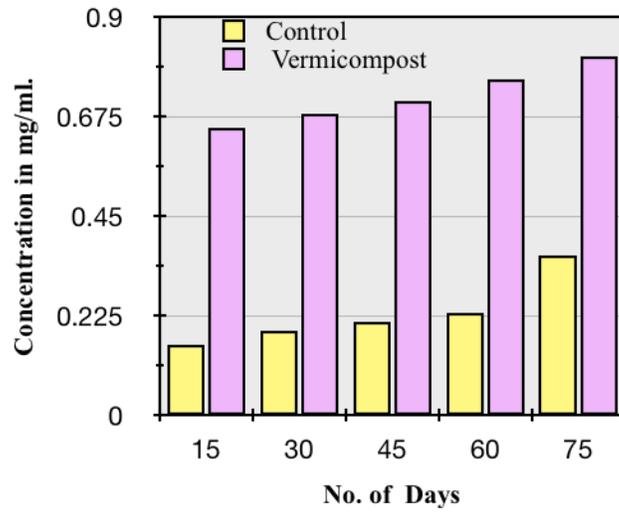


Figure 1. Effect of Vermicompost on Protein concentration in Wheat.

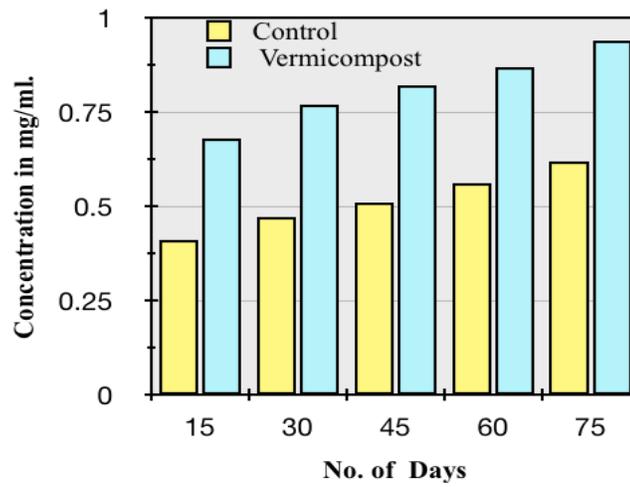


Figure 2. Effect of Vermicompost on Carbohydrate concentration in Wheat.

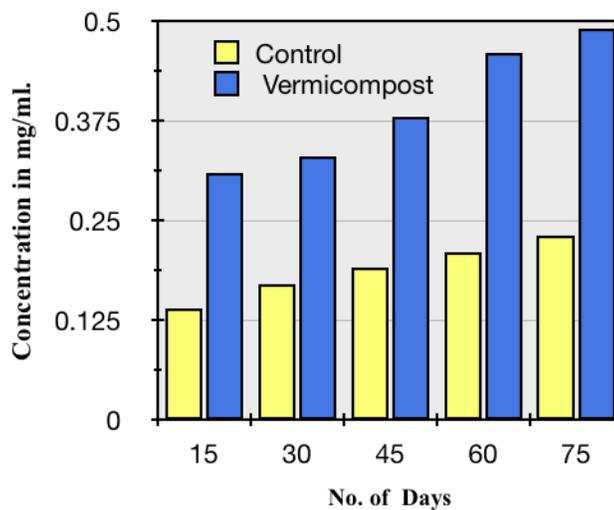


Figure 3. Effect of Vermicompost on Lipid concentration in Wheat.

Table-2.Effect of Vermicompost on Chlorophyll concentration in Wheat.

S.No.	No. of Days	Chlorophyll concentration in mg/gm.	
		Control	Vermicompost
1	15	0.794±0.020	1.086±0.057
2	30	0.861±0.041	1.218±0.025
3	45	1.023±0.040	1.489±0.045
4	60	1.152±0.026	1.764±0.025
5	75	1.263±0.040	1.981±0.036

Data are given in Mean ± SE of three replicates.

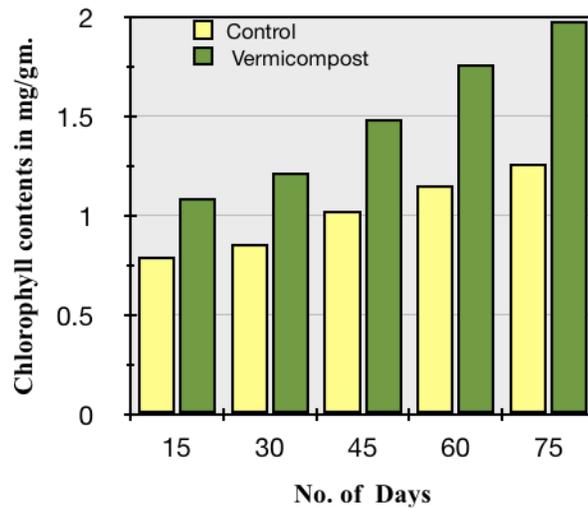


Figure 4. Effect of Vermicompost on Chlorophyll concentration in

Table-3.Effect of Vermicompost on Carotenoid concentration in Wheat.

S.No.	No. of Days	Carotenoid concentration in mg /100 gm.	
		Control	Vermicompost
1	15	0.0031	0.0083
2	30	0.0035	0.0089
3	45	0.0038	0.0093
4	60	0.0042	0.0097
5	75	0.0049	0.0099

Data are given in Mean ± SE of three replicates.

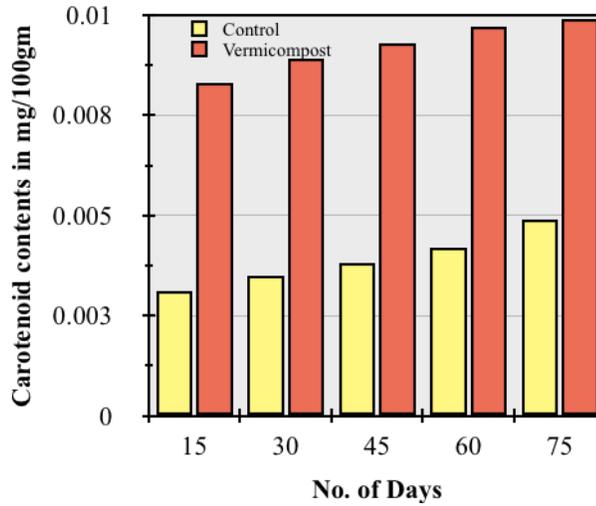


Figure 5. Effect of Vermicompost on Carotenoid concentration

Table-4. Effect of Vermicompost on Biochemicals in Wheat (60 day old plant).

S.No.	Parameter Studied	Control	Vermicompost
1	Concentration of protien (mg./ml.)	0.23±0.025	0.76±0.035
2	Concentration of carbohydrates (mg./ml.)	0.56±0.023	0.87±0.015
3	Concentration of Lipid (mg./ml.)	0.21±0.020	0.46±0.030

Data are given in Mean ± SE of three replicates.

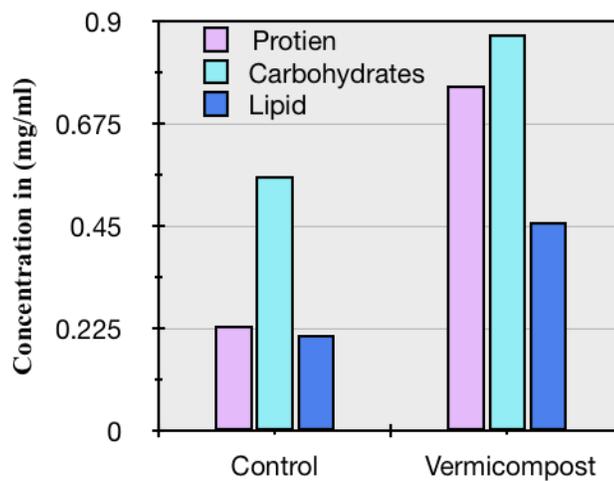


Figure 6. Effect of Vermicompost on Biochemicals in Wheat (60 day old plant).

Table-5. Effect of Vermicompost on Pigments contents in Wheat (60 days old plant)

S.No.	Parameter Studied	Control	Vermicompost
1	Concentration of Chlorophyll (mg./gm.)	1.152±0.026	1.764±0.025
2	Concentration of Carotenoid (mg./100gm.)	0.0042	0.0099

Data are given in Mean ± SE of three replicates.

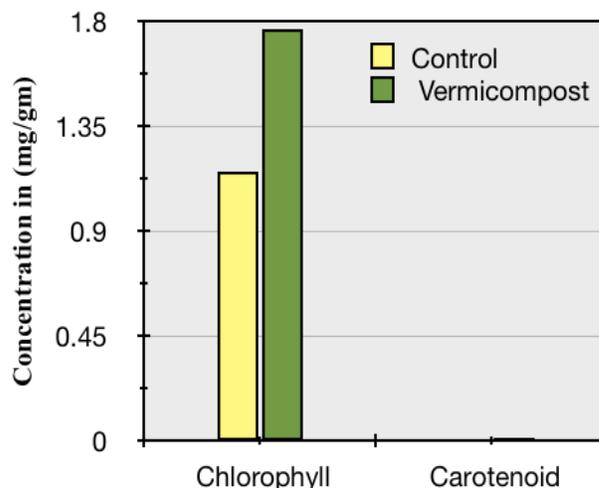


Figure 7. Effect of Vermicompost on Pigment contents in Wheat (60 day old plant).

In addition to increasing plant growth and productivity, vermicompost may also increase the nutritional quality of some vegetable crops such as tomatoes (Gutierrez-Miceli et al., 2007), Chinese cabbage (Wang et al., 2010), spinach (Peyvast et al., 2008), strawberries (Singh et al., 2008), lettuce (Coria- Cayupán et al., 2009), and sweet corn (Lazcano et al., 2011).

Conclusion

In the present study we investigated the effect of vermicompost on biochemicals in wheat crop in Malwa region of Madhya Pradesh. The findings indicated that vermicompost application significantly enhance the biochemical potential of wheat plants. It improves chlorophyll and carotenoids contents, thereby increasing photosynthetic efficiency and overall plant

vigour. Elevated levels of soluble proteins, total carbohydrates, and free amino acids reflect enhanced metabolic activity and better nutrient assimilation in wheat. Improved nitrogen and phosphorus uptake further supports enzymatic and protein synthesis processes. Thus, vermicompost not only promotes growth and yield of wheat but also augments its internal biochemical functioning, contributing to improved crop quality and physiological resilience.

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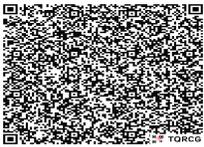
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