EJTAS
ISSN 2786-7447
EUROPEAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES
OPEN ACCESS
PEER REVIEWED

Effect of Natural Organic Fertilizers (Black Tea Waste and Orange Peel) on Active Compounds and Chemical Properties to Basil (*Ocimum basilicum* L.)

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Suggested Citation

Meteb, S.S., & Rhaif, M.M. (2025). Effect of Natural Organic Fertilizers (Black Tea Waste and Orange Peel) on Active Compounds and Chemical Properties to Basil (*Ocimum basilicum* L.). *European Journal of Theoretical and Applied Sciences, 3*(1), 100-106.
DOI: 10.59324/ejtas.2025.3(1).08

Abstract:

The aim from this study is known impartment natural organic fertilizers (black tea waste and orange peel) on active compounds (Linalool and Limonine mg. gm^{-1}) and chemical properties. Proportion and product of oil ($mg.h^{1-}$), carbohydrate seed content (mg g^{-1}), percentage of nitrogen and percentage of protein to basil (*Ocimum basilicum* L.), black tea wastes and orange peel powder were prepared from the house in 1 February 2023 and then we dried the samples under the open air so that we could maintain the active compounds. The operational experiment was carried out in plastics quotas according to the design of the random sectors in the wood shadow. Two factors included the first: mixing of black tea wastes and orange peels with soil with three levels (0, 20 ,40 and 80 g/kg). Soil (before cultivation and treatment), filled plastics with 10 kg dry soil and 3 replication per treatment. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. Soil at Proportion and product of oil ($mg.h^{1-}$), Carbohydrate seed content (mg g^{-1}), percentage of nitrogen, percentage of protein, Linalool and Limonine mg gm^{-1}that gave the highest concentration (51.15%, 19.67, 1.59, 21.43, 23.52 and 12.95) respectively. The results were found to have a moral effect in the treatment of orange peels of the level of concentration of 80 g/kg. Soil at Proportion and product of oil (M $g.h^{1-}$), carbohydrate seed content (mg g^{-1}), percentage of nitrogen, percentage of protein, Linalool and Limonine mg gm^{-1} that gave the highest concentration (50.12, 18.39, 1.66, 20.15, 22.98 and 11.88) respectively.

Keywords: *Ocimum basilicum L., black tea waste, orange peel.*

Introduction

Recently, chemical fertilizer has emerged as a feature of modern agriculture to reduce the shortage of macronutrients and micronutrients present in the soil and to increase plant productivity, but at the time of the excess of chemical fertilizers, it causes significant damage to soil and the environment, as well as to human and animal toxicity. Since chemical fertilizers cause significant damage to plants and humans, there must be an alternative, natural organic fertilizers such as plant residues and animal residues (Jiao *et.al.*, 2012). Organic manure has the advantage of improving the structure, composition and chemical properties of the soil and its ability to absorb and retain moisture for a long, untoxic and harmless period for the

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environment, vegetation and soil, such as the waste of household tea, which is considered to be a popular drink, using more than half of the world ' s population of tea containing chemical compounds that give special taste, such as the opromin and caffeine, as well as over volatile oils and oxidized enzymes, as well as on amino acids, vitamins A, C, H, B12 and B1 (Kuo *et al*, 2006). Indicate Saraa and Karkaz (2016) tea wastes has a significant effect on the decline in the apparent density of the soil and has a high moral effect on the increase in the number of branches, dry weight, the weight of 1,000 grains of the barley crop, as well as the increase in plant branches, and has an impact on the chemical properties of the soil. Indicate Abdulghani (2012) When mixed tea wastes with soil, the Tea excreta increases soil fertility, and when moisture increases, a series of chemical changes, enzyme degradation, oxidation, enzyme activity, oxides, phenol and tan are occurring, and tea contains compounds, phenols and proteins, where oxidation enzymes are important for metabolites.

Natural organic fertilizers include orange peels, which contain many active chemical compounds, including flavonoids, volatile aromatic oils, vitamin C, carotene and resins (Wafik *et al*.2015). peels also contain anti-insects, such as manure, worms and parasites (Tsai, 2008). Orange peels result in a significant increase in the number of ribbons, leaves, plant height, paper space, growth rate, paper weight, density, length and weight of the squirrel, sleeve height, squirrel weight, grain crop, total plant weight and 1,000 grain weight compared to the treatment of control (Zewde and Jembere, 2012). The sweet basil plant, *Ocimum basilicum L.,* is a member of the Lamiaceae family and is regarded as a healing plant because, it contains about 150 species that differ in leaf size, flower color, outward characteristics, and flavor. Africa and Asia are the original home of basil (Al-Ibrahemi *et al*., 2023), Basil is used as a medicinal plant to treat many diseases such as headaches, coughs, worms, gastroenteritis, malaria, and obesity. Also, it is used to reduce infections and colds. In addition, Basil can add a nice flavor to food, and its leaves are eaten as an appetizer or as a salad. Basil can be used for industrial use to make spices, vinegar, and pickles (AL-Ibrahemi *et al*., 2020; Abdel-Hamid and Ahmed, 2020).

Material and Method

Black Tea wastes and orange peel powder were prepared from the house in 1\February\ 2023 and then we dried the samples under the open air so that we could maintain the active compounds. The samples were then grinded by the electric mill and then the soil was prepared and the samples mixed with the soil. The operational experiment was carried out in plastics quotas according to the design of the random sectors in the wood shadow. Two factors included the first: mixing of Black Tea wastes and orange peels with soil with three levels (0, 20 ,40 and 80 g/kg). Soil (before cultivation and treatment) , filled plastics with 10 kg dry soil and 3 replication per treatment .

The seeds were planted directly in the soil on 20\5\2023, in plastic pots, and 55 seeds were placed in each pot at a depth of 3 cm. After 20 days of emergence, the soil was repainted two days before the seed was planted. Then I planted the seeds.

the flowers were wrapped in complete bags to protect them from birds. The harvesting process was conducted 40–55 days after the crop reached full maturity.

Qualitative and Chemical Characteristics

Proportion and product of oil (M g.h^{1-})

The oil ratio in the seeds was estimated after grinding using organic alcohol (hexane) and at a temperature (45 C^{0}) using the sox let apparatus (Al-Yasssiry *et al*.2024).

Carbohydrate seed content (mg g^{-1})

The carbohydrates in the seeds are estimated in each transaction and only by method (Verma and Verma, 2000). These are as follows:

The material was taken 1g. of dry matter, placed in a chord and crushed well, after the end of the crushing, added to the material in the ceramic add of distilled water again and then transported to a test tube, placed the test tube inside the

centrifuge for 5 minutes at 1,500 cycles/minute, taken from the upper layer of the tube and added 1 ml of fennel concentrate 5% and 1 sulfate acid of the mixture for 30 minutes, then examined along the wave 490 as shown in the curve. The unit of measure has been converted to %.

Percentage of nitrogen

Estimated using Calder (Herbert *et al.*,1971).

Percentage of protein

Protein ratio capacity through the following equation: protein ratio % = (total nitrogen ratio x 25.6) (Herbert *et al.*,1971).

2. measure active compounds (Linalool mg gm^{-1}, Limonine mg gm^{-1}) for the basil (Al-Yasssiry *et al.*,2024).

Extract method: 50 g of plant fin powder were put in a thimble and extracted for 24h with 200 ml of 75% ether using a soxhelet apparatus in a flask of round volume (1000 ml). Using a rotating evaporation equipment, the extract was evaporated at 45 C^{O}. (AL-Ibrahemi *et al.*, 2022).

The Ministry of Science and Technology in Baghdad has completed an HPLC examination of volatile oil. at room temperature, with a column (C18-RP, 25 cm, 4.6 mm, ID 5.0 m, pore size). Isocratic and water made up the mobile phase, which was pH-adjusted to 3.0-3.5 using Tri Flour Acetic Acid (TFA): Acetonitrile (65:35) at a flow rate of 1.0 ml/min. with 250 nm detection. (AL-Ibrahemi *et al.*,2023).

Statistical Analysis

The tests were conducted using a Randomized Complete Block Design (RCBD) as factorial experiments with three replications, and the Least Significant difference (L.S.D.) at P 0.01.

Results

The results of table (1) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the percentage of oil in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg.Soil that gave the highest concentration (51.15%) compared to the control 44.12%. When treated with orange peels at 80 g/kg concentration level. that gave the highest concentration of 50.12% compared to the control 45.09%. The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the percentage of oil at 80 g/kg concentration. The gave the highest concentration was 54.86% and the lowest proportion was 42.54% when the control was treated.

Table 1. Effect of Black Tea Waste and Orange Peel on Proportion and Product of Oil (M $g.h^{1-}$)

black tea waste	orange peel				mean
	0	20	40	80	
0	42.54	43.76	44.35	45.84	44.12
20	44.75	45.74	46.83	47.94	46.32
40	45.73	47.84	48.93	51.84	48.585
80	47.36	49.71	52.67	54.86	51.15
Mean	45.09	46.76	48.20	50.12	
LSD 0.05 for orange peel 1.94	LSD 0.05 for intraction 1.73				LSD 0.05 for black tea waste 1.94

The results of table (2) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the Carbohydrate seed content (mg g^{-1}) in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. that gave the highest concentration (19.67(mg g^{-1})) compared to the control 13.23(mg g^{-1}). When treated with orange peels at 80 g/kg

concentration level. that gave the highest concentration of 18.39 (mg g^{-1}) compared to the control 14.16 (mg g^{-1}). The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the Carbohydrate seed content (mg g^{-1}) at 80 g/kg concentration. The gave the highest concentration was 22.78 (mg g-1) and the lowest proportion was 11.65 (mg g^{-1}) when the control was treated.

Table 2. Effect of Black Tea Waste and Orange Peel on Carbohydrate Seed Content (mg g^{-1})

black tea waste	orange peel				Mean
0	0	20	40	80	
	11.65	12.85	13.71	14.65	13.23
20	13.67	14.67	15.73	16.64	15.18
40	14.76	15.76	17.57	19.48	16.90
80	16.56	18.78	20.57	22.78	19.67
Mean	14.16	15.52	16.90	18.39	
LSD 0.05 for orange peel 1.74	LSD 0.05 for intraction 1.46				LSD 0.05 for black tea waste 1.74

The results of table (3) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the Percentage of nitrogen in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. that gave the highest concentration 1.59 (mg g^{-1}) compared to the control 1.22 (mg g^{-1}). When treated with orange peels at 80 g/kg concentration level. that gave the highest concentration of 1.66 (mg g^{-1}) compared to the control 1.12(mg g^{-1}). The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the Percentage of nitrogen (mg g^{-1}) at 80 g/kg concentration. The gave the highest concentration was 1.72 (mg g-1) and the lowest proportion was 0.81 (mg g^{-1}) when the control was treated.

Table 3. Effect of Black Tea Waste and Orange Peel on Percentage of Nitrogen

black tea waste	orange peel				
0	0	20	40	80	Mean
	0.81	1.04	1.48	1.56	1.22
20	0.99	1.12	1.69	1.71	1.38
40	1.23	1.33	1.49	1.68	1.43
80	1.46	1.53	1.63	1.72	1.59
Mean	1.12	1.26	1.57	1.66	
LSD 0.05 for orange peel 1.64	LSD 0.05 for interaction 2.87				LSD 0.05 for black teawaste 1.64

The results of table (4) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the Percentage of protein in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. that gave the highest concentration 20.15 (mg g^{-1}) compared to the control 14.95 (mg g^{-1}). When treated with orange peels at 80 g/kg concentration level. that gave the highest concentration of 21.43 (mg g^{-1}) compared to the control 14.22 (mg g^{-1}). The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the Percentage of protein (mg g^{-1}) at 80 g/kg concentration. The gave the highest

concentration was 24.97 (mg g-1) and the lowest proportion was 12.34 (mg g^{-1}) when the control was treated.

Table 4. Effect of Black Tea Waste and Orange Peel on Percentage of Protein

black tea waste	orange peel				
0	0	20	40	80	mean
	12.34	13.65	14.95	15.94	14.22
20	13.76	15.95	17.84	18.84	16.60
40	15.74	17.94	19.86	20.84	18.60
80	17.94	20.86	21.96	24.97	21.43
Mean	14.95	17.1	18.66	20.15	
LSD 0.05 for orange peel 1.76	LSD 0.05 for interaction 1.75				LSD 0.05 for black tea waste 1.76

The results of table (5) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the Linalool (mg gm^{-1}) in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. that gave the highest concentration 22.98 (mg g^{-1}) compared to the control 19.14 (mg g^{-1}). When treated with orange peels at 80 g/kg concentration level. that gave the highest concentration of 23.52 (mg g^{-1}) compared to the control 19.13 (mg g^{-1}). The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the Linalool (mg gm^{-1}) (mg g^{-1}) at 80 g/kg concentration. The gave the highest concentration was 25.87 (mg g-1) and the lowest proportion was 17.87 (mg g^{-1}) when the control was treated.

Table 5. Effect of Black Tea Waste and Orange Peel on Linalool (mg gm^{-1})

black tea waste	orange peel				
0	0	20	40	80	mean
	17.87	18.34	19.84	20.46	19.13
20	18.45	19.46	20.53	21.65	20.02
40	19.56	21.76	22.76	23.94	22.01
80	20.67	22.76	24.76	25.87	23.52
Mean	19.14	20.58	21.97	22.98	
LSD 0.05 for orange peel 1.67	LSD 0.05 for interaction 2.69				LSD 0.05 black tea waste 1.67

The results of table (6) indicated that there was a moral difference in the treatment of black tea waste and orange peels and the interaction between them in the Limonine (mg gm^{-1}) in basil. The results were found to have a moral effect in the treatment of black tea waste of the level of concentration of 80 g/kg. that gave the highest concentration 11.88 (mg g^{-1}) compared to the control 7.99 (mg g^{-1}). When treated with orange peels at 80 g/kg concentration level. that gave the highest concentration of 12.95 (mg g^{-1}) compared to the control 7.71 (mg g^{-1}). The interaction between the two coefficients (black tea waste and orange peels) found a moral effect on the Limonine (mg gm^{-1}) (mg g^{-1}) at 80 g/kg concentration. The gave the highest concentration was 14.39 (mg g-1) and the lowest proportion was 5.87(mg g^{-1}) when the control was treated.

Table 6. Effect of Black Tea Waste and Orange Peel on Limonine (mg gm^{-1})

black tea waste	orange peel				
0	0	20	40	80	mean
	5.87	6.87	8.64	9.45	7.71
20	6.48	7.84	9.84	10.94	8.78
40	8.85	9.74	11.94	12.75	10.82
80	10.76	12.87	13.76	14.39	12.95
Mean	7.99	9.33	11.05	11.88	
LSD 0.05 for orange peel 1.56	LSD 0.05 for interaction 1.87				LSD 0.05 for black tea waste 1.56

Discussion

Reference to tables (1, 2, 3,4,5,6) indicates that there is a moral effect in increasing the proportion of oil, carbohydrates, nitrogen, protein Linalool and Limonine when soil is treated with black tea wastes and orange peels, because domestic tea waste when mixed with soil increases humidity and soil fertility (Abeer , et al ,2023), which creates a series of chemical changes, degradation and enzyme oxidation, especially enzyme activity, such as Oxidase Phenol (Verma and Verma , 2000). Or because tea contains active chemical compounds, especially volatile oils, and also contains a number of amino acids and vitamins, such as K, B2 C, B1, A, H. Tea leaves contain 25-35% phenols and proteins and antioxidants that are important for different metabolic events (Ozdemir *et al.*, 2009). With regard to the treatment of orange peels at the above concentrations, there has been a moral increase in the concentration of oil, carbohydrates, protein and nitrogen, perhaps because it contains many active chemical compounds, particularly flavonides, carotin, vitamin E and C, and steric acid (Zewde, and Jembere 2012). And these active compounds work on free-reception, and they act as antioxidants, and these antioxidants protect plant cells from harmful free radicals, and they attack cells, so they oxidize chlorophyll, oxidize the fat, oxidize the proteins, oxidize the cellular membranes, as well as attack DNA, causing the early ageing and death of the plant (Boyd, 2011). Oranges protect plant tissues when exposed to inappropriate environmental factors such as heat, lighting, cold, and radiation. These factors affect the vegetative and metabolic effects of plants (Khaled Moustafa, 2018).

Conclusion

1- Tea waste and orange peels improve soil profiles and properties and increase nutrients in soil.

2- Tea waste and orange peels increase the proportion of chemical properties of basil.

References

Abdel-Hamid, A. N. (2020). Effect of benzyl adenine, indole acetic acid, and gibberellic acid on vegetative growth, chemical constituents, and volatile oil attributes of sweet basil plants. *Egyptian Journal of Horticulture, 47*(1), 41–56.

Abdulghani, E. T. (2012). Effect of black tea wastes on some soil properties and barley (*Hordeum vulgare L.*) growth and yield. *Journal of Tikrit University for Agricultural Sciences, 12*(3).

Al-Ibrahemi, N., Al-Laith, Z. N., Al-Yassiry, A., & Al-Masaoodi, N. H. (2022). Chemical analysis of phytochemicals for the *Anethum graveolens L.* fresh and commercial dry by gas chromatography-mass spectrometry. *IOP Conference Series: Earth and Environmental Science, 1060*, 012089. https://doi.org/10.1088/1755-1315/1060/1/012089

Al-Ibrahemi, N., Al-Yassiry, A., Al-Laith, Z. N., & Al-Musawi, B. H. (2023). Phytochemical study of volatile oils for the *Ocimum basilicum L.* and *Mentha spicata* by gas chromatography technique. *IOP Conference Series: Earth and Environmental*

Science, 1158, 062004. https://doi.org/10.1088/1755-1315/1158/6/062004

Al-Kaisi, W. A., Al-Hayani, E. H., & Mahmoo, R. W. (2015). Effect of orange (*Citrus sinensis*) peel extract and artificial lemon on the growth and yield of *Hordeum vulgare L. Journal of Islamic Education, 21*(88), 41–57.

Al-Yassiry, A. S., Aljenaby, H. K. A., Al-Masoody, I. H., & Al-Ibrahemi, N. (2024). Biofertilizers effect on the active compounds of sweet basil (*Ocimum basilicum L.*). *SABRO Journal of Breeding and Genetics, 56*(1).

Boyd, C. E. I. (2011). Effect of acetic or citric acid ultrafiltration recycle streams on coagulation processes (Master's thesis). University of Central Florida, Orlando, Florida, USA, pp. 7–8.

Hadi, S. T., & Thalij, K. M. (2016). Determine the microbial and chemical pollutions for tea samples in Iraqi markets. *Food Science Department, College of Agriculture, Tikrit University, 16*(14).

Herbert, D., Philips, P. J., & Strange, R. E. (1971). Methods in microbiology. In J. R. Norries & D. W. Robbins (Eds.), *Methods in Microbiology* (Vol. 5B, pp. 311–344). London: Academic Press.

Jiao, W., et al. (2012). Environmental risks of trace elements associated with long-term phosphate fertilizer applications: A review. *Environmental Pollution, 168*, 44–53. https://doi.org/10.1016/j.envpol.2012.03.052

Kadhim, A. Q., Kadhim, A. A., Metep, S. S., & Naser, N. K. (2023). Effect of tea compost and duration of irrigation on the content of clove flowers of medicinally active substances. *International Journal of Agricultural and Statistical Sciences*.

Kuo, S., Lai, M. S., & Lin, C. W. (2006). Influence of solution acidity and CaCl2 concentration on the removal of heavy metals from metal-contaminated rice soils. *Environmental Pollution, 144*(3), 918–925. https://doi.org/10.1016/j.envpol.2005.12.042

Moustafa, K. (2018). Chemical fertilizers in agriculture: Uses and misuses. *Arabic Science Archive*.

Ozdemir, N., Yakupoglu, T., & Dengiz, O. (2009). The effects of bio-solid and tea waste application into different levels of eroded soil on N, P, and K concentrations. *Environmental Monitoring and Assessment, 156*(1), 109–118. https://doi.org/10.1007/s10661-008-0472-4

Tsai, B. Y. (2008). Effect of peel of lemon, orange, and grapefruit against *Meloidogyne incognita*. *Plant Pathology Bulletin, 17*, 195–201.

Verma, S. K., & Verma, M. (2000). *A textbook of plant physiology, biochemistry, and biotechnology*. New Delhi, India: S. Chand and Company.

Zewde, D. K., & Jembere, B. (2012). Evaluation of orange peel (*Citrus sinensis L.*) as a source of repellent, toxicant, and protectant against *Zabrotes subfasciatus* (Coleoptera: Bruchidae). *Momona Ethiopian Journal of Science, 4*(1), 3–10. https://doi.org/10.4314/mejs.v4i1.74050