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Enhancing Performance of Growth, Yield and Quality in Wheat (*Triticum Aestivum* L) By Vermitea and Seaweed n Poor Nutrients Soil

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ABSTRACT

Aims of this study is to evaluate influence of the mixture of organic fertilizers (OF); vermicompost, bokashi EM1 and chicken manure at 33.3% from each of them was applied at R100% (7 tons fed-1) single and with seaweed liquid or vermitea as foliar spraying or soil fertigation; respectively (3, 5 and 7 times/season, respectively) to increase wheat production with minimizing of environmental pollution impacts. Two field experiments were carried out in the experimental farm of Nubaria Agricultural Research Station during the winter growing seasons of 2021/2022 and 2022/2023. Eight treatments were arranged in a randomized complete blocks design (RCBD) with 4 replicates used to study their effects on growth, yield and quality parameters. The highest significant values as an average in both two seasons were in grain yield (3.3 t/fed.), straw (4.8 t/fed.), biological yield (8.1 t/fed.), the percentage of proteins (16.2), carbohydrates (78.3) and starch (74.4) in grain; at T8 (OF + Vermitea at 7 times/season). However, the lowest significant values as an average in both of two seasons were (1.1, 1.7 and 2.8 t/ fed., 5.6, 35.4 and 34.7%, respectively) at T1 (control). Based on observed results, a combination of OF with vermitea at 7 times/season was recommended in poor nutrients soil to maximize wheat productivity and quality.

KEYWORDS: MOF, Vermitea, Seaweed, Wheat, Sustainable agriculture.

1. INTRODUCTION

Wheat (*Triticum aestivum* L) is the most of world significant strategic agricultural in commodities. At the same time, it plays the major part in international grain commerce. The most important crop in Egypt is wheat, increasing its productivity is a fundamental aim to close the gap between wheat consumption and its production. As well as it is critical to create adequate soil conditions to increase wheat crop expansion cultivation to achieve high production and quality in Egypt. The harvested area and grain yield production were 214.3 million ha and 734.04 million tons, respectively. The harvested area and grain yield production were 1.36 million ha and 8.80 million tons, respectively (FAOSTAT, 2023) in Egypt. Wheat (*Triticum*

aestivum L.) is the most important in all cereal used as a grain and flour in the world. Organic fertilizers play a pivotal role for increasing yield and quality of wheat production due to the application of P, K and N were resulted the significant increases in plant height, number of tillers/plant, number of grains / spike, 1000-grain weight g, total grain and straw yield tons/ha compared to inorganic N, P and K fertilizers. Wheat is a bread main part of diet of most Egyptian people; in addition, it is a strategic crop with an economic return for Egyptian farmer. Wheat cultivated area has arrived about 3.4 million fed. and its representing about 50.1% of the total crop of the Nubariya region. The cultivated area of wheat represents about 2.64% of total wheat cultivated in the year 2019/2020 (Nehra *et al*., 2001; Kizilkaya *et al*., 2012 and Al-Hasany *et al*., 2019). Wheat production improvement in Egypt became an obligation farmers to reduce import it and also increase export it to overcome the challenges like increase in the population and then need to horizontal and vertical agricultural production of wheat to achieve the food security and the agricultural sustainability (Nehra *et al*., 2001; Tahir *et al*., 2011; Shah *et al*., 2012; Hammad and Ali, 2014; EL-Guibali, 2016; Seleiman *et al*., 2021; Seema *et al*., 2021; Sahra *et al*., 2022; Hussein *et al*., 2023 and Zakharova and Zakharov, 2024).

OF is the mixture of different organic sources like chicken manure, vermicompost and bokashi EM1.Vermicompost was produced by using the worms in breakdown of organic residues (crop residues, animal waste, kitchen waste and industrial garbage). Earthworms (*Red wiggler*) break down the most of organic wastes to stimulate microbial activity, enzymes and increase their organic acids production, which lead to enhance the mineralization rates and turn them into organic fertilizer (vermicompost) with the lowest cost (Abou El Goud, 2020 a; b, c and d; Abou El Goud *et al*., 2021; Singh *et al*. 2023; Rehman *et al*., 2023; Essa *et al*., 2023 and Hajam *et al.,* 2023.). Benefit effects of vermicompost are used to increase the physicochemical and microbial properties and enhance nutrients availability of the soil. It is a high quality organic fertilizer was produced by red worms through the digestive system of earthstomac. It is no weed seeds in vermicompost; also riched in essential nutrients, vitamins, hormones, amino acids, plant regulators, antibiotic, organic matter and organic carbon content. In recent time, it has a favorite organic fertilizer due to its slow release of minerals, chemical, physical and microbial improvements in the soil used (Álvarez-Solís *et al*., 2016; Abou El Goud, 2020 a; b and d; Demirsoy *et al*., 2020; Abou El Goud *et al*., 2021; Çirka *et al*., 2022; Hajam *et al*., 2023; Rehman *et al*., 2023 and Gul and Gidik, 2024). Bokashi EM1 is the biological aerobic fermentation of organic residues with energy source (molasses); that accelerate organic matter oxidation through thermo and mesophilicphilic microbes (35 to 65 °C), which they liberate heat, water and carbon dioxide, thus the obtainment of product in a short time. The usage of organic fertilizers such as Bokashi EM1 and vermicompost to maintain soil fertility and good plant nutrition, improve the soil organic matter and carbon, nutrient availability, increase the microbial biomass, soil enzyme activity, number and diversity of soil bacteria, fungi, actinomycetes and protozoa (Gopinath *et al*., 2008; Shah, *et al*., 2015; Miceli, 2016; Abou El Goud, 2020 d; Abou El Goud *et al*., 2021; Essa *et al*., 2023; Hussein and El-Sayed, 2023 and Gul and Gidik, 2024). Positive effects on the soil quality are reflected on better nutrition, increase total yield and quality of crops. Chicken manure is rich in macro nutrients, organic acids and peptides, that help to increase soil fertility, plant growth, crop yield and quality (Nehra *et al*., 2001; Dikinya and Mufwanzala, 2010; Abou El Goud, 2020 c and d; and Altuntaş *et al*., 2022). It can promote soil aggregates formation and provide the activities and enzymes from different beneficial microbes. Mixture of these organic sources MOF (chicken manure, vermicompost and bokashi EM1) application can enrich mineralized N source and increase the soluble N, P and K content of the soil and free amino acids produced by soil microbial decomposition by cooperative and mutually beneficial relationships between soil microorganisms. It can be directly absorbed by plant roots compared to inorganic fertilizers that, quickly released of nutrients into

the soil and fast lost them. So that, the mixture of these organic fertilizers can continuously and slowly supply of essential nutrients, vitamins, hormones, plant regulators, phenols, antibiotics, enzymes and amino acids to decrease the soil pH and improve the soil structure, aggregates, promote nutrient cycling, their transformation and enhance soil health, crop productivity and sustainable agriculture (Tahir *et al*., 2011; Ndubuaku *et al*., 2015; Abou El Goud, 2020 a and b; Seleiman *et al*., 2021; Manogaran *et al*., 2022; Ning *et al*., 2022 and Soares and Gomes, 2024).

Seaweed has the fertilizing effect, dependent on their biochemical composition, mineralization of nutrients with the plant demand. It contains high amount of nitrogen 2.5%, vitamins and hormones as farmyard manure, high amount of potassium 1.8 – 2% and low phosphorus 0.87 - 1% content. Seaweed can act as a soil conditioner; improve the soil structure, stability and aeration. Seaweed spraying to grow, develop and provide the plant by nutrients, hormones and vitamins. Seaweed extract, is a common fertilizer used is a good source of vitamins, hormones like (auxin, cytokinine, gibberellic acid, ethylene and IAA), macro and micro elements for a good nutritional plant. When it sprays on whole plant, it increases the ability of roots to grow and absorb the most nutrients from soil. In addition, increase the stem thickness and strength of plant, increase the leaf area index and thus increase the growth and yield parameters. It lead to decrease the usage of inorganic fertilizers and pesticides to maintain environmental health, increase food health production, cheap cost and have no harmful effects (Abedi *et al*., 2010; Sher *et al*., 2013; Prakash *et al*., 2014; Al-Hasany *et al*., 2019; Demirsoy and Aydin, 2020; Seema *et al*., 2021; Bioforsk-konferansen, 2023; Choudhary *et al*., 2023; Sosa *et al*., 2023 and Mohammed and Alkobaisy, 2024).

VermiTea can be used as a liquid fertilizer, because 97 % of the nutritional elements from vermicompost is absorbable form its liquid (vermitea) and is riched in macro and micro elements, vitamins and hormones for a good nutritional plant. It has the positive impact on root and sprout growth and fruit. Vermitea was observed to exert positive effect on seed germination, seedling growth of plants. It is a necessary to combine soil with foliar organic fertilization to meet the nutritional requirements of plants to achieve high total yield and quality products, enhance the soil quality degradation and decrease the environmental pollution. Using mixed of organic fertilizers to reduce inorganic fertilizers input, mitigate environmental pollution hazard and maintaining on sustainable agriculture (Ibrahim *et al*., 2008; Tahir *et al*., 2011; Sher *et al*., 2013; Abaid-Ullah *et al*., 2015; Soliman *et al*., 2022; Hussein et al., 2023; Essa *et al*., 2023; Singh *et al*., 2024 and Gul and Gidik, 2024).The role of organic fertilization in reducing inorganic fertilizer application and increasing total yield and quality has been recognized at costs much lower than inorganic fertilizers. The nutrients may be supplied for good plant nutrition through the mixture of vermicompost, bokashi EM1 and chicken manure (OF) with seaweed liquid as a foliar spraying on whole plant and vermitea as a soil fertigation to feed and preserve them and improve total yield of wheat grains and straw (Alzamel *et al*., 2022; Singh *et al*., 2023 and Gul and Gidik, 2024).

The objective of this study was to assess the effect of the mixture of organic fertilizers OF like (the mixture of 33.3% chicken manure+ 33.3% vermicompost + 33.3% bokashi EM1) was applied at R100% with what better times of plant spraying by seaweed liquid and, also soil fertigation by vermitea to enhance wheat productivity and quality of grain and straw to increase organic production and activation of sustainable agriculture.

2. MATERIALS AND METHODS

Two field experiments were conducted in the experimental farm of the Nubaria Agricultural Research Station during the winter growing season of 2021/2022 and 2022/2023. The objective was to evaluate the effect of mixture organic fertilizers (OF) =33.3% of chicken manure + 33.3% of vermicompost + 33.3% of bokashi EM1 with better times of seaweed liquid as a foliar spraying on whole

plant and vermitea as a soil fertigation on growth, yield and quality parameters of wheat grains and straw in sandy clay loam soil. Samples of the soil surface layer (0-30 cm) were taken before cultivated on two seasons 2021/2022 and 2022/2023. As well as, samples of OF, vermitea were collected before adding into soil to determine their physical and chemical properties, following to the methods of Page *et al*. (1982), Klute (1986), Tandon *et al*. (2005) and Jones (2018) were shown in Tables 1 and 2. The soil was sandy clay loam, low in available nitrogen (40.2 mg/kg), phosphorus (3.1 mg/kg), and potassium (128.9 mg/kg) as an average of both two seasons. Seaweed powder was obtained from (ARC) the Agricultural Research Center, Eldoky, Giza- Egypt. It is worthy mention, considered to be a potentially good source for powerful nutritional plants, contains high amounts of proteins (9.7 % DW), carbohydrates (31.7 % DW); lipids (3.0% DW); moisture (89%); EC (9.7 dS/m); nitrate (24.6 µg/l); phosphate (2.1µg/l) and silicate (110 µg/l). It has significant amount of vitamins A, B 6 and 12, VC and essential fatty acids, amino acids and pigments (Sen *et al*., 2000 and Chakraborty and Santra, 2008). Seaweed is exposed to biotic and abiotic factors influence its metabolic responses (photosynthesis, level of proximate constituent and growth rate). Eight treatments as follows: T1= Inorganic N, P and K fertilizers at R 100% (Control), T2= OF (the mixture of Chicken manure 33.3% + Vermicompost 33.3% + Bokashi EM1 33.3%), T3 = OF + Seaweed as a foliar spraying on whole plant at three times/season, T4= OF + Seaweed as a foliar spraying on whole plant at five times/season, T5 = OF + Seaweed as a foliar spraying on whole plant at seven times/ season, T6= OF + Vermitea as a soil fertigation at three times/ season, T7= OF + Vermitea as a soil fertigation at five times/ season and T8= OF + Vermitea as a soil fertigation at seven times/ season. A randomized complete block design (RCBD) with 4 replicates was used for eight treatments. Organic fertilizer (OF) was added at rate R100= 7 tons/fed. within the surface soil about three weeks before sowing during both winter growing season of 2021/2022 and 2022/2023. The total number of experimental plots was 32 plots in every season, a plot size (3.5 m length × 3.0 m width =10.5 m²). The wheat variety 'Giza168' was sown on December 7th, 2021 and 11th, 2022; respectively and their harvested on May 1st, 2022 and 5 th , 2023 from both two seasons. The recommended amounts of inorganic N, P, and K fertilizers were applied as follows: Ammonium Nitrate (33.5%) = 200 kg /fed., Super Calcium Phosphate (15.5%) = 200 kg/fed. and Potassium Sulphate (48%) = 50 kg/fed. in T1 (control) untreated plant. The full dose of Super Calcium Phosphate and half doses of Ammonium Nitrate and Potassium Sulphate were applied at the soil surface before sowing. The remaining doses were added with the next irrigation after sowing, 22 days later. The total amount of organic fertilizers (OF) was applied prior to planting and thoroughly mixed into the surface soil during plowing, 22 days before sowing. Seaweed liquid in concentration of (7g /L water); was applied as a foliar spraying on whole plant at 3, 5 and 7 times per season at T3, T4 and T5, respectively. Vermitea was applied as a soil fertigation at 3, 5 and 7 times per season at T6, T7 and T8, respectively. All other operations on the wheat crop were performed according to the recommended practices. Grain and straw yield data were obtained from the central area (2.5 m length × 2.0 m width = 5.0 m²) of each experimental unit (plot) to avoid any border effects. Plant samples were taken from the central area per plot to determine the growth, yield and quality parameters of wheat grain and straw, including plant height (cm), number of tillers/plant, number of spikes/m², spike length (cm) and 1000-grain weight (g). Total grain and straw yield (tons/fed.), biological yield (tons/fed.) and Harvest Index (HI) % were calculated. The percentages of some components in the grains (N, proteins, P, K, carbohydrates and starch) and in straw (N, P, K, and proteins) were determined at the end of two growing seasons. Grain and straw samples were washed with distilled water, dried in an oven at 65°C for 72 hours, and then finely ground. They were wet-digested using the H2O2/H2SO4 method, as described by Chapman and Pratt (1978); Lowther (1980) and A.O.A.C. (2000) to determine the

Table 1. Physical and chemical properties of two field experimental before cultivation in both of two seasons, 2021/2022 and 2022/2023

Properties		First Season, 2021/2022	Second Season, 2022/2023
Mechanical analysis and texture	Sand	57.3	55.7
	Clay	22.5	21.8
	Silt	20.2	22.5
	Texture	Sandy clay loam	Sandy clay loam
Mechanical analysis	pH (1:2.5)	8.4	8.3
	E.C. dS/m	1.9	2.2
	O.C.%	0.30	0.33
	O.M.%	0.24	0.26
	C / N ratio	0.77 : 1	0.89 : 1
	CaCO3%	24.2	23.0
Available Macro-nutrients	Nitrogen (mg/kg)	39.0	41.3
	Phosphorus (mg/kg)	3.0	3.2
	Potassium (mg/kg)	126.0	131.7

Table 2. Some Chemical properties of the studied OF and vermitea before cultivation.

Parameters	MOF	Vermitea
PH (1:10)	8.4	7.9
E.C. (1:10, water extract) dS/m	3.7	2.6
O.M.%	15.9	23.7
O.C.%	12.6	13.2
C/N ratio	4.7 : 1	6.9 : 1
Total Nitrogen %	2.7	1.9
Total Phosphorus %	3.1	1.7
Total Potassium %	3.4	2.1

OF = Mixture of Organic Fertilizers (Chicken manure 33.3%, Vermicompost 33.3% and Bokashi EM1 33.3%).

above contents. Data were statistically analyzed using the SAS program (SAS, 2001) and the means of all treatments were compared using Duncan's Multiple Range Test at the 5% level of probability.

3. RESULTS AND DISCUSSION

3.1.Wheat growth and yield parameters

The yield parameters of wheat crop (grains and straw) in two seasons, 2021/2022 and 2022/2023 were shown in Tables 3 and 4. The results in Table 3 were indicated that, all organic treatments from (T2 to T8) were given significant values more than untreated plant (T1) in all growth parameters. The highest significant values in plant height cm, no. of litters/plant, no. of spikes/m^2, spike length cm and 1000 grains weight g were (116.2 cm, 5 litters/plant, 533.2 spikes/m^2, 12.8 cm and 57.9 g, respectively) as an average in both of two seasons, at T8 (MOF + Vermitea as a soil fertigation at seven times per season). However, the lowest significant values of above parameters were (54.1 cm, 2.1 litters/plant, 245.1 spikes/plant, 5.9 cm and 27.4 g, respectively) as an average in both of two seasons, at T1 (control = the recommended doses of inorganic N, P and K fertilizers) in Table 3.

Table 3. Effect of OF, seaweed and vermitea on growth parameters of wheat in both of two seasons, 2021/2022 and 2022/2023

T	Plant height (cm)		No. of litters /plant		No. of Spikes / m^2		Spike length cm		1000 grains weight g	
	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season
T1	51.6 h	56.7 h	2 h	2.2 h	231.0 h	277.2 h	5.5 h	6.3 h	25.8 h	28.9 h
T2	59.2 g	65.2 g	2.3 g	2.5 g	257.6 g	309.1 g	6.3 g	7.1 g	29.5 g	33.0 g
T3	65.6 f	72.1 f	2.8 f	3.1 f	286.5 f	343.8 f	7.2 f	8.2 f	32.3 f	37.2 e
T4	72.5 e	79.7 e	3.0 e	3.3 e	317.8 e	381.4 e	7.7 e	8.8 e	36.4 e	41.8 e
T5	91.3 c	100.5 c	3.8 c	4.2 c	391.7 c	470.0 c	9.9 c	11.2 c	44.5 c	51.2 c
T6	80.7 d	88.8 d	3.3 d	3.7 d	352.8 d	423.4 d	8.6 d	9.8 d	40.3 d	46.4 d
T7	100.7 b	110.7 b	4.3 b	4.7 b	434.7 b	521.8 b	10.8 b	12.1 b	49.6 b	57.0 b
T8	110.7 a	121.7 a	4.8 a	5.2 a	484.7 a	581.6 a	12.1 a	13.5 a	54.9 a	60.9 a
L.S.D.0.05	1.11	1.22	0.16	0.18	0.47	0.57	0.17	0.19	0.18	0.20

T1= Chemical N, P and K fertilizers R 100% (Control), T2= OF (The mixture of Chicken manure 33.3% + Vermicompost 33.3% + Bokashi EM1 33.3%) at the recommendation rate (7 tons/fed.), T3 = OF + Seaweed as a foliar spraying on whole plant at three times/ season, T4= OF + Seaweed as a foliar spraying on whole plant at five times/ season, T5 == OF + Seaweed as a foliar spraying on whole plant at seven times/ season, T6= OF + Vemitea as a soil fertigation at three times/ season, T7= OF + Vermitea as a soil fertigation at five times/ season, T8= OF + Vermitea as a soil fertigation at seven times/ season

Table 4. Effect of OF, seaweed and vermitea on yield parameters of wheat in both of two seasons, 2021/2022 and 2022/2023

T	Total grain yield (tons/fed.)		Total straw yield (tons/fed.)		Biological yield (tons/fed.)		Harvest Index % (HI)	
	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season
T1	1.1 h	1.2 h	1.6 h	1.8 h	2.6 h	2.9 h	40.5 a	45.8 a
T2	1.3 g	1.4 g	1.9 g	2.2 g	3.2 g	3.6 g	39.2 a	44.3 a
T3	1.7 f	1.9 f	2.4 f	2.7 f	4.0 f	4.5 f	41.3 a	46.7 a
T4	1.8 e	2.1 e	2.7 e	3.0 e	4.5 e	4.9 e	40.7 a	46.1 a
T5	2.4 c	2.7 c	3.7 c	4.1 c	6.0 c	6.7 c	39.2 a	44.3 a
T6	2.1 d	2.4 d	3.1 e	3.5 d	5.2 d	5.8 d	41.0 a	46.4 a
T7	2.7 b	2.9 b	4.1 b	4.6 b	6.7 b	7.7 b	39.6 a	44.7 a
T8	3.1 a	3.4 a	4.5 a	5.1 a	7.5 a	8.7 a	40.7 a	45.9 a
L.S.D.0.05	0.10	0.12	0.11	0.12	0.11	0.13	2.18	2.47

T1= Chemical N, P and K fertilizers R 100% (Control), T2= OF (The mixture of Chicken manure 33.3% + Vermicompost 33.3% + Bokashi EM1 33.3%) at the recommendation rate (7 tons/fed.), T3 = OF + Seaweed as a foliar spraying on whole plant at three times/ season, T4= OF + Seaweed as a foliar spraying on whole plant at five times/ season, T5 == OF + Seaweed as a foliar spraying on whole plant at seven times/ season, T6= OF + Vemitea as a soil fertigation at three times/ season, T7= OF + Vermitea as a soil fertigation at five times/ season, T8= OF + Vermitea as a soil fertigation at seven times/ season

Data in (Table 4) cleared that, the highest significant values were (3.3, 4.8 and 8.1 tons/fed.) as an average from both of two seasons, at T8 in total yield of grain, straw and biological yield (tons/fed.), respectively. The lowest significant values were (1.1, 1.7 and 2.8 tons/ fed., respectively) as an average from both of two seasons, at T1 (control) untreated plant. There are no significant differences between all treatments in harvest index (HI) % in both of two seasons (Table 4). The obtained results revealed that, the mixture of organic fertilizers (OF) application with vermitea at 7 or 5 times per season as soil fertigation achieved significant differences and gave significant increases in all growth and yield parameters of wheat production as compared to untreated plant (T1).These results might be due to the essential roles of the mixture of chicken manure, vermicompost and bokashi EM1with vermitea as a soil fertigation for enhancing the growth and yield of wheat grains and straw. These results were previously in agreement with Gopinath *et al*., 2008; Abedi *et al*., 2010; Dikinya and Mufwanzala, 2010; Abaid-Ullah *et al*., 2015; EL-Guibali, 2016; Al-Hasany *et al*., 2019; Seleiman *et al*., 2021; Alzamel *et al.*, 2022; Altuntaş *et al*., 2022 Essa *et al.*, 2023 and Gul and Gidik, 2024. They reported that, the interaction between vermtiea and organic fertilizers creates a favorable habitat for powerful growth to increase wheat grain and straw yield characters. These results were in conformity with those (Ibrahim *et al*., 2008; Kizilkaya *et al*., 2012; Manogaran *et al*., 2022; Hussein *et al*., 2023; Hajam *et al*., 2023 and Mohammed and Alkobaisy, 2024). They reported that, the mixture of organic sources is applied to improve the Plant's nutritive and increase the uptake of N, P and K under sandy soil conditions. Many investigators showed that, the positive effect of organic fertilizers on enhancing a favorable habitat to improve grain and straw yield parameters (Abedi *et al*., 2010; Sher *et al*., 2013; Dikinya and Mufwanzala, 2010; Shah *et al*., 2012; Seema *et al*., 2021; Ning *et al*., 2022; Sahra *et al*., 2022 and Singh *et al*., 2024); they caused significant increases and gave values higher more than using the recommendation rates of chemical N, P and K fertilizers alone. These results were congruent with many researchers that found the highest yield of grains and straw of wheat by using organic fertilization and vermicompost liquid to achieve elements absorption increased and also vitamins, hormones, plant regulators and their accumulation in all growth phases to obtain high yield and quality of wheat (grain, straw, biological yield and harvest index). Mixture of organic fertilizers (OF) with vemitea had having a positive impact on the chemical, physical and microbial parameters of soil, which reflected in a good nutritional plant by mineralization more amounts of elements, vitamins, plant hormones, phenols and lignins to prevent soil borne pathogens, stimulate the powerful growth and improve total yield and quality. These nutrients and plant growth substrates like gibberellins, auxin, cytokinine and humic acid were released to enhance soil properties and achieving high crop yields by using environment conscious methods to increase the agricultural productivity (Dikinya and Mufwanzala, 2010; Tahir *et al*., 2011; Shah *et al*., 2012; Seema *et al*., 2021; Ning *et al*., 2022; Soliman *et al*., 2022 and Singh *et al*., 2023). Vermicompost benefits were able to enhance the root growth for efficient absorption of water, macro and micro nutrients from soil due to the presence of organic acids, hormone in vermicompost. Results from this study were supported the hypothesis that, application of vermicompost liquid and mixed of organic fertilizers can improve the productivity of wheat (Tables 3 and 4). Similar results were reported by (Abedi *et al*., 2010; Sher *et al*., 2013; EL-Guibali, 2016; Ning *et al*., 2022; Soliman *et al*., 2022; Altuntaş *et al*., 2022; Essa *et al*., 2023 and Gul and Gidik, 2024) stated that, vermicompost has a positive effect on yield and quality properties of wheat in field by using vermitea to enrich the soil with elements, vitamins, hormones and organic matter to enhance the growth and yield parameters. Results were in the line with results of Altuntaş *et al*., 2022; Essa *et al*., 2023 and Gul and Gidik, 2024; they observed similar results, the increasing of growth and yield was confirmed by studies on different plants. Additionally, results of this study were partially in line with results of (Abedi *et al.*, 2010;

Dikinya and Mufwanzala, 2010; Abaid-Ullah *et al*., 2015; EL-Guibali, 2016; Al-Hasany *et al*., 2019; Seleiman *et al.,* 2021; Hussein *et al*., 2023; Hajam *et al*., 2023 and Mohammed and Alkobaisy, 2024).

3.2.Chemical components of wheat grains and straw

Results shown in table 5 indicated that, significantly differences between all treatments from T1 to T8 in the percentage of N, P, K, proteins, carbohydrates and starch in grains. The lowest significant values were (1.0, 0.28, 1.2, 5.6, 35.4 and 34.7%, respectively) as an average from both of two seasons, at T1 (control) untreated plant. Data in Table 5 refers the highest significantly values were recorded (2.7, 0.67, 3.1, 16.2, 78.3 and 74.4%%, respectively) as an average from both of two seasons, at T8 (OF combined with vermitea as a soil fertigation seven times per season). It had the highest significant effects compared to another treatment, followed by T7= OF + vermitea as a soil fertigation five times per season. While the lowest effects were the recommended doses of inorganic N, P and K fertilizers (T1) in Table 5. Results revealed that, all organic treatments (from T2 to T8), whether combined with vermitea or seaweed liquid, lead to significant increases in growth, yield and quality of wheat grains and straw in Tables 3, 4 and 5. Results in table (6) shown that, OF combined with vermitea as a soil fertigation (7 times/ season) at T8 scored; the highest significant values in the percentage of N, P, K and proteins of wheat straw were (1.9, 0.44, 2.0 and 9.4%, respectively) as an average from both of two seasons and followed by T7. While the inorganic treatment (T1) was recorded, the lowest values (0.1, 0.18, 0.7 and 1.4%, respectively) as an average from both of two seasons. Data in tables 5 and 6 indicated that, all organic treatments from T2 to T8 were significantly effects compared to inorganic treatment (T1) in the growth, yield and quality parameters of wheat grains and straw; but there were no significantly differences between treatments in harvest index (HI%). Results in tables 3, 4, 5 and 6 were shown; the highest significant effects in the growth, yield and quality parameters as the meaning from both of two seasons at OF combined with vermitea as a soil fertigation (7 times/ season) at T8 compared to inorganic fertilizer (T1).

The organic fertilization has been used since ancient times, to enhance soil health, supply plant nutrients and increase the growth, yield and quality of crops. Various sources of organic materials are being used in agriculture for sustainable organic production. Organic fertilizers provide positive production and quality from crops, organic waste disposal and environment friendly, (Abedi et al., 2010; Shah et al., 2012; Sher et al., 2013; Abaid-Ullah et al., 2015; EL-Guibali, 2016; Al-Hasany et al., 2019; Abou El Goud, 2020 a; b; c and d; Abou El Goud et al., 2021; Seema et al., 2021; Ning et al., 2022; Sahra et al., 2022; Essa et al., 2023; Gul and Gidik, 2024 and Singh et al., 2024) because it is environment friendly and more economic. These results might be due to decrease the cost of wastes recycling and organic fertilizers. Fermentation proces provides a sound way to manage the large volume of different wastes to produce organic fertilizers in various forms at diferent stages of microbial decomposition. It has used in the soil for improvement the physical, chemical and microbial characters and increase crop productivity. Therefore, this research was carried to examine the positive effect the mixture of chicken manure, vermicompost and bokashi EM1 (OF) in combination with vermitea as a soil fertigation or seaweed liquid as a spraying on whole plant on the parameters of growth, yield and quality of wheat grains and straw.

4. COCLUSION

Highlight the highest significant values resulting from both two seasons, 2021/2022 and 2022/2023; potential impacts of the mixture of organic fertilizers like (vermicompost 33.3%, chicken manure33.3% and bokashi EM1 33.3%) with vermitea as a soil fertigation (7 times/ season) to improve the growth, total yield, as well as quality of wheat grains and straw. Particularly noteworthy were enhanced effects observed in the combination treatment of OF (7 tons/ fed.) and vermitea as a soil fertigation

Table 5. Effect of OF, seaweed and vermitea on chemical components of wheat grains of both two seasons, 2021/2022 and 2022/2023

T	Wheat Grains											
	N%		Proteins%		P%		K%		Carbohydrates%		Starch %	
	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season
T1	0.9 h	1.0 h	5.2 h	5.9 h	0.27 h	0.29 h	1.1 g	1.3 f	33.5 h	37.2 h	33.2 h	36.2 h
T2	1.1 g	1.3 g	6.5 g	7.4 g	0.32 g	0.36 g	1.5 f	1.7 e	39.0 g	43.3 g	37.7 g	41.1 g
T3	1.3 f	1.5 e	7.7 f	8.8 f	0.36 f	0.41 f	1.8 e	1.9 d	43.2 f	48.8 f	41.7 f	47.5 f
T4	1.6 e	1.8 e	9.0 e	10.4 e	0.39 e	0.44 e	2.1 d	2.4 c	48.0 e	45.3 e	46.1 e	52.6 e
T5	2.1 c	2.4 c	12.3 c	14.0 c	0.49 c	0.56 c	2.4 c	2.7 b	59.5 c	67.78 c	56.9 c	64.3 c
T6	1.8 d	1.9 d	10.2 d	11.6 d	0.44 d	0.50 d	2.1 d	2.3 c	53.6 d	61.1 d	51.5 d	58.2 d
T7	2.4 b	2.7 b	13.6 b	15.5 b	0.54 b	0.61 b	2.7 b	2.9 b	65.9 b	75.2 b	63.3 b	71.5 b
T8	2.6 a	2.9 a	15.1 a	17.2 a	0.64 a	0.69 a	2.9 a	3.2 a	73.2 a	83.4 a	69.8 a	78.9 a
L.S.D.0.05	0.12	0.13	0.71	0.81	0.02	0.03	0.15	0.17	0.43	0.49	0.43	0.49

T1= Chemical N, P and K fertilizers R 100% (Control), T2= OF (The mixture of Chicken manure 33.3% + Vermicompost 33.3% + Bokashi EM1 33.3%) at the recommendation rate (7 tons/fed.), T3 = OF + Seaweed as a foliar spraying on whole plant at three times/ season, T4= OF + Seaweed as a foliar spraying on whole plant at five times/ season, T5 == OF + Seaweed as a foliar spraying on whole plant at seven times/ season, T6= OF + Vemitea as a soil fertigation at three times/ season, T7= OF + Vermitea as a soil fertigation at five times/ season, T8= OF + Vermitea as a soil fertigation at seven times/ season

Table 6. Effect of OF, seaweed and vermitea on chemical components of wheat straw of both two seasons, 2021/2022 and 2022/2023

T	Wheat Straw							
	N %		Protein %		P %		K %	
	First Season	Second season	First Season	Second season	First Season	Second season	First Season	Second season
T1	0.2 h	0.4 h	1.4 h	1.5 h	0.17 bc	0.19 bc	0.7 h	0.7 h
T2	0.4 g	0.6 g	2.5 g	2.8 g	0.22 abc	0.24 abc	0.9 g	1.0 g
T3	0.7 f	0.9 f	3.8 f	4.3 f	0.24 abc	0.27 abc	1.1 f	1.3 f
T4	0.9 e	1.1 e	5.0 e	5.6 e	0.26 abc	0.30 abc	1.3 e	1.4 e
T5	1.2 c	1.6 c	6.7 c	7.4 c	0.33 ab	0.38 ab	1.6 c	1.8 c
T6	1.0 d	1.4 d	5.9 d	6.6 d	0.09 c	011 c	1.5 d	1.7 d
T7	1.3 b	1.9 b	7.3 b	8.3 b	0.36 ab	0.40 ab	1.8 b	1.9 b
T8	1.5 a	2.2 a	8.8 a	10.0 a	0.42 a	0.46 a	1.9 a	2.2 a
L.S.D.0.05	0.09	0.11	0.6	0.63	0.21	0.24	0.09	0.10

T1= Chemical N, P and K fertilizers R 100% (Control), T2= OF (The mixture of Chicken manure 33.3% + Vermicompost 33.3% + Bokashi EM1 33.3%) at the recommendation rate (7 tons/fed.), T3 = OF + Seaweed as a foliar spraying on whole plant at three times/ season, T4= OF + Seaweed as a foliar spraying on whole plant at five times/ season, T5 == OF + Seaweed as a foliar spraying on whole plant at seven times/ season, T6= OF + Vemitea as a soil fertigation at three times/ season, T7= OF + Vermitea as a soil fertigation at five times/ season, T8= OF + Vermitea as a soil fertigation at seven times/ season

(7 times/ season), which resulted in highest significant values in all studied traits. These results underscore importance of integrated approaches in sustainable agriculture practices to maximize of wheat productivity and quality of grains and straw with the minimizing environmental dangerous impacts. Moving forward can be recommended exploration and adoption of OF (7 tons fed.$^{-1}$) and vermitea as a soil fertigation (7 times/ season) applying in wheat cultivation as well as a part of a strategy sustainable agriculture. By the benefits of this natural organic fertilization, we can not only enhance the agricultural productivity but also, environmental conservation and food security goal. Based on observed results, it can be recommended that, the using different sources of organic fertilizers like vermicompost, chicken manure and bokashi EM1 were an effective way for producing wheat grains and straw with quality compared with that, produced by the conventional inorganic fertilizers. Organic fertilization can be considered valuable sources of organic feeding and essential elements, hormones, vitamins and plant regulators for good nutritional plants. Results cleared that, the improving of soil properties, by addition of organic fertilizers lead to decrease the soil pH, enhance the electrical conductivity value (EC) and increase the availability of macro and micro nutrients.

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الملخص العربي

من مبررات هذه الدراسة هي زيادة ممارسات الزراعة المستدامة وتحسين نمو و إنتاج محصول القمح مع التقليل من الآثار البيئية السيئة. و لقد تم تطبيق خليط المصادر العضوية من روث الدجاج و السماد الدودي و بوكاشي بنسبة ٣٣,٣٪ من كل منهم بالمعدل الموصي بة (٧ طن فدان-١) مع سائل الأعشاب البحرية أو الفيرميتا كرش ورقي أو تسميد للتربة على التوالي في ٣ و ٥ و ٧ مرات خلال الموسم لكل منهما. ولقد كانت أكثر ثراءً بجميع العناصر الغذائية الأساسية والفيتامينات والهرمونات ومنظمات النبات والنشاط الميكروبي وتم تقديمها بشكل طبيعي وصديق للبيئة لإثراء التربة.

تناولت هذه الدراسة تأثير مخلوط الاسمدة العضوية مع الأعشاب البحرية أو الفيرميتا على صفات محصول وجودة حبوب و قش القمح. حيث يعتبر القمح أهم مصدر للخبز في العالم. و لهذا تم تنفيذ تجربتين حقليتين في المزرعة التجريبية لمحطة البحوث الزراعية النوبارية خلال الموسمين الزراعين الشتوي المتتاليين ٢٠٢١/٢٠٢٢ – ٢٠٢٢/٢٠٢٣ و تم استخدام تصميم القطاعات العشوائية (RCBD) الكاملة بأربعة مكررات لدراسة تأثيرها على مؤشرات النمو والمحصول الكلي وجودة التبن و حبوب القمح.

أشارت النتائج التي تم الحصول عليها إلى أن أعلى القيم المعنوية لارتفاع النبات، و عدد السنابل / النبات، عدد السنابل / م٢، طول السنبلة، وزن ١٠٠٠ بالحبة، المحصول الكلي للحبوب والقش، المحصول البيولوجي، مؤشر الحصاد، محتوياتN ، البروتينات ، P، Kفي الحبوب والقش؛ وكذلك تم تحليل الكربوهيدرات والنشا في الحبوب. كان النتائج إيجابية و أكثرإستجابة لتطبيق مخلوط الاسمدة العضوية مع الفيرميتي بمعدل ٧ مرات / مواسم مقارنة بالكنترول. وأخيرا، تؤكد النتائج فعالية مخلوط الاسمدة العضوية من مصادر متنوعة مع تطبيق الفيرميتي لتعزيز النمو والإنتاج الكلي وجودة محصول القمح من الحبوب و التبن. وبناءً على النتائج الملحوظة، تم دمج المصادر العضوية المختلفة بنسبة ٣٣,٣٪ من كلا منهم مع الفيرميتي ريا للتربة و يوصى بـ ٧ أو ٥ مرات على التوالي في الموسم الواحد لتحسين زراعة القمح في تربة فقيرة بالمغذيات و لزيادة إنتاجية وجودة حبوب القمح والقش وكذلك تقليل التأثيرات البيئية الخطيرة.