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Smart Agritechnique of Maize Production using Poultry and Vermiteas with Mixed of Algae and Yeast

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ABSTRACT

Challenges of safety food decreasing & chemical pollution were need to improve organic effective fertilizers. Two open field experiments were applied in Nubaria Agricultural-Research Station farm; in two seasons, 2023 and 2024 for evaluation influence poultry tea or vermitea with algae and seaweed mixed on maize growth & production parameters. Experiments were laid-out on split plot designs (RCBD) for nine-treatments, and 4 replications. Results cleared that, highest significantly values in vegetative, yield and quality parameters were produced at T_5 (poultry tea as a soil fertigation at 6 times with foliar spraying on leaf by seaweed and algae mixed at 3 times). While lowest significantly values in growth, yield and quality attributes were recorded in inorganic fertilizers (control) T_1. Organic fertilizers caused significantly increased in vegetative & production of maize plant. Among all organic treatments, lead to higher growth, yield and chemical components on grains & leaves were done by combination between as soil fertigation with foliar spraying together as compares to inorganic fertilizers (control). Thus, recommend the combination applying of organic and bio fertilizers treatment (T_5) as a sustainable agriculture for safety maize production under Smart Agritechnique.

Keyword: Poultry tea, Vermitea, Algae and yeast mixed; Smart Agritechnique & Maize production.

INTRODUCTION

Maize, (*Zea-mays* L.) is belongs on the family of *Poaceae* and cultivated broad as cereals crop of world. It has been recognized as a third crop after wheat and rice. Production of corn has globally a queen of cereals. Larger productions of corn is USA followed by others country. Nutritionally corn is enriched with high amounts of 72% starch, 4% fat and 10% proteins; it provides 373 Kcal per 100 g, of energy more than Wheat & Rice. Maize has the several uses like human food, animals feed, because of; it has hug nutritional values. So that, it entered on many process of manufacturing product like popcorn, corn oil, starch & fructose. Egypt's corn production in 2024/2025 (October-September), amount of Egyptian imports of *Zea mays*, was reached to 7.25 million metric tons (MMT) up approximate 3.6% from 2023/2024 production estimated 7.0 MMT. Enhancing of productions were increased by total area harvest—improved to arrive 951,000 hectares in 2024/2025, up 30,000 hectares from the previous-marketing years. So that, positive outlooks of consumption Poultry, animal and fish feeds able to support Egyptian Farmers for cultivating & increase total area of maize crop during summer, 2025/2026. Farmers have more experiences of Integrated Pest Managements program for managing all worms, corn pests in recent years. The current strategy to improve of corn yield and quality, enhance the extension service, use of higher-yielding hybrids to encourage growth of plant and improve its marketing. Egyptian's corn consumption in 2025-2026 at 15.8 MMT up from 2024-2025 from estimate 16.3 MMT of the account, because of; growing in Poultry, animal & fish available &improve their feeds. Import estimate of corn is 8.5 MMT at 2024/2025, due to available of the facilitations of imports, increasing allowing of corn and the livestock feed supplying. Yellow maize production was covered 41% from required need feed (Adelekan *et al*., 2010; Attia & El-Araby, 2016; Abd El-Gawad & Morsy, 2017 and Asfaw, 2022). Egypt was sourced maize from international market during five Marking Years were Ukraine (14.3 MMT, Brazil (16.0 mmt) & Argentina (11.2 MMT). Maize imports had increased by 46.36% at 2023-2024 by enhancing in poultry growthing and animal sectors. Maize crop both of white and yellow varieties are the most important strategic of grain crops in Egypt, because of its economic and nutritional significance, uses from both of non-human and human consumptions. It accounts up to 70% of dry feed production, serves in poultry feed and used as flour in bread production by 20 % (Ayeni & Adetunji, 2010; Adekiya *et al*., 2020; Aslam & Ahmad, 2020 and Asfaw, 2022). In addition, it yields different products; due to it contains high starch, carbohydrates, proteins, fructose and glucose syrups, and corn oils. It is utilized

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in manufacturing of many industrial products, paints, pharmaceuticals, fibers, plastics, dyes, paper and consumers. Furthermore, maize is converted into ethyl alcohol for biofuel production, which has impacted the global trade of maize (Adelekan *et al*., 2010; Abd El-Gawad & Morsy, 2017; Adekiya *et al*., 2020; Asfaw, 2022 and Rasool *et al*., 2023). In Egypt, the important both of yellow and white maize, so that; total area cultivated with them were increased from about 1.78 million ha. at 2007 to about 3.45 million ha. at 2025 (Ministry of Agriculture and Land Reclamation, 2025). Annual increases were 31,537 acres during a period from 2007 to 2025. Maize production was estimated 7.36 million tons and 9.31 million tons; respectively in this period. Maize is sources for energy and feeding animals & poultry; it used as raw materials on the industry to produce more substances like, syrup, starch, flour, corn oil and biofuel. Maize can able to grow in different climate zones in the world. Corn needs more nutrients, vitamins & hormones for nice growth. Elements have functions to be given nice growth and high reproduction. However, the efficiency usage in organic fertilizer for maintenance soil fertilization & health crops. Because of they have macro and micro-nutrients, organic matters, organic carbon, diver beneficial microbes, growth regulators, plant hormones and vitamins; which they lead to improve the productivity of sustainable agriculture in African. Organic fertilizers were improved soil aggregates, structure, elements uptake, soil pH, water hold and retention capacity, resistance to erosion, improve the beneficial micro-organisms numbers, protect plant roots from nematode and soil-bornes pathogens & provids hormones such as; *Auxins*, *Gibberellins* & *Cytokinine* to enhance cation exchange capacity. They have higher economic benefits compared to chemicals. Growing Popularity of Organic Food, we need for comparison, between vegetative & total yields & out product qualities than inorganic fertilizers (Hossain *et al*., 2012; Zhao *et al*., 2018; Yatoo *et al*., 2021 and Zhao *et al*., 2024). Vermitea is contains humic acids to increase root elongation and development of root hairs in maize (Ibrahim *et al.*, 2015). Vermitea able to increase elements uptake by plant, enhance plant cell membrane, improve the permeability of root cells, enhance the proliferation of root hairs and stimulate roots growth. Vermitea is contains all macro and micronutrients, hormones, vitamins, earthworm enzymes, promote vegetative, improve their resistances in plants to the disease, soil borne pathogens and pests. It contains nutrients, organic acids, earthworm mucus (Zhao *et al*., 2018; Abou El-Goud, 2020a,b,c; Yatoo *et al.*, 2021; Rasool *et al*., 2023; Tufa, 2023 and Sariñana-Aldaco *et al*., 2025). Vermitea has powerful impacts on plant vigor enhancing, the nutritive quality and total yield of crops. Moreover, vermitea application lead to increase the tap roots length and promote vegetative growth of crops. Poultry tea is high concentrated of microbial produced by beneficial microbes extracting from poultry manure (Seleem *et al.*, 2022). Poultry tea is produced by the mixing of chicken manure with water and incubating it for period under actively aeration (aerated tea) to increase diver microbial population density. It is sources of macro, micro-nutrients & chelates as soils fertigation to absorb by root hairs of plants, all nutrients were absorbed form in both of Plants & Beneficial Microbial uptakes. Efficiency poultry and vermiteas to enhance vegetative growth, biomass and oils percentage. The improvements in total yield and quality following by application of natural teas were based substances has been attributed to enhance the beneficial microbes community in soils, improve minerals absorbed, increase growth regulators, stimulate defense compounds, phytohormones in plants. Liquid organic is able to use primarily as the source from solubies plants elements, growth stimulants & disease suppressors. Several researches have reported that, positive impacts of poultry and vermiteas on suppression of certain plant diseases like, damping off caused by gray mold (*Botrytis cinerea*), *Phytium ultimum*, *Alternaria solani* and *Phytophthora infestans* (Okoroafor *et al*., 2013; Mahmood *et al*., 2017; Nambapana *et al*., 2021 and Zhao *et al*., 2024). Investigate impact of vermicompost or chicken manure teas on total yield, nutritional plant and quality products, metabolites' and antioxidant activities of crops. Impacts of natural fertilizers like poultry tea on maize morphology and physiology; it leads to soil modification by low C: N ratio. It provides huge amounts of macro and micro elements in available form into rhizosphere in soil. Also, it has high surface area for maintenance of microbial activities like bacteria, fungi, actinomycetes and mycorrhiza in rhizosphere. Alga is a large that lives in water or in high humidly environment. It is characterized like, photosynthesis activities more than plant. Carbon, nitrogen, phosphorus & potassium were importance nutrients for requirements of photosynthesis and growth. An alga is autotrophic organism, simple structure and thallophytes. Alga is individes into three groups such as brown, green and red. Algae is belonging to a group was added in food, bio-refinery, agricultures & others. It contains about 2200 *species* with 255 *genes*, such as *Fucus*, *Ascophyllum*, *Laminaria*, *Ecklonia*, *Sargassum* & *Stoecho-spermum* Spp. Algae is eukaryote in class of *Phaeophyceae*, the pigment that, give brown color, fucoxanthin is carotenoid, that is play important roles on the adaptation of organisms for environmental condition. Its cells walls are made of cellulose, sulphate, alginates & polysaccharides. Algae contains of fructose, glucose,

galactose, mannose & xylose. Brown algae contain phytohormones, carbohydrates, proteins, vitamins, phenolic compounds, carotenoids, amino acids and essential elements. It has importance impact in sustainable agricultural because of, their effective-ness for enhancing growth, increase total yield & quality in crops (Low, 1990; Kmeťová & Kováčik, 2013; Khattab *et al*., 2015; Mulyati *et al*., 2021 and López-Morales *et al*., 2022). Algae lead to increase growth & defense stresses *by* physiological and bio and chemical processes. It uses in sustainable agriculture for increasing crop production and quality. Algae extracts were used to allow produce bioactive compounds; however, direct applied organic fertilizers able to modify physical and chemical parameters of soil. Seaweed extract able to produce bio-stimulants when is applied on plants as a soil fertigation and a foliar spraying on leaves for bio-stimulation impacts on soil and plants; respectively. It is the most promising by modifying characteristics of soil fertility. However, seaweed and algae have bio-stimulants, nematicidal, antimicrobial, fungicidal & *insecticidal* characterizes agonists Pathogens in most of crops, so, can usage like bio-pesticides against diver's soil borne pathogens. They are important to concept of bio-stimulants (Boateng *et al*., 2006; Chaulagain *et al*., 2017 and Aslam & Ahmad, 2020). They are recent of bio-stimulants; which are applied to increase the efficiency nutrition, increase tolerances & improve crop qualities & production and nutrients and vitamins components. Agro-ecosystems for improving the growth demanded of food, applying on seaweed & algae on agricultures are feasibles to reduce chemicals usage & offered natural product free from chemicals residuses for consuming. Which, they are Beneficial's and important in environments, compositions, functions on plant & soils under sustainable crops production systems (Farhad *et al*., 2009, 2011; Hossain *et al*., 2012*;* Abd el Fatah *et al*., 2015; Kareem *et al*., 2017; Emam *et al*., 2020 and Kevin *et al*., 2023). These lead to amend growth related yields & qualities parameters. Vermitea has significantly impacts in improvements on vegetative & total production of crop. Therefore, purpose in these studies were to evaluate influences in both poultry tea & vermitea with algae and yeast mixed on vegetative, total yields & quality on *Zea mays* L. grains & leaf in sustainable agriculture system.

MATERIAL AND METHODS

Two open experiments, were carried out in Nubaria-Agricultural research- station farms on both of summers seasons, at 28th and 25th, June of 2023 and 2024; respectively to evaluate Smart Agritechnique of maize production using poultry tea or vermitea with the mixture of algae and yeast. Field experiments, were designed in Split-Plot Design on randomized complete block by four replicates. Soil Analysis sample was collected from the depth (0-30 cm) before cultivation to determine some physico-chemical characters of soils. It is sandy clay silt, was (53.6, 21.9 and 24.5%; respectively), and is low in macro elements availability like nitrogen, phosphorus and potassium were (40.8, 3.2 and 125.2 mg/kg; respectively) as averages from both of growing seasons at 2023 and 2024; respectively. Soils pH (1:2.5,), EC (1: 2, water extract), percentage of organic matter and $CaCO_3$ were (8.6, 2.21 dS/m, 0.33% and 22.7 %; respectively) as an average from both of two seasons, 2023 and 2024, respectively according to Jackson (1973); Lowther (1980); Page *et al*. (1982) and Klute (1989). Samples of vermitea and poultry tea were taken before added them into soils, in 2023 to determine some physico-chemical properties according to Jacksons (1973); Chapman & Pratt (1978); Evenhuis (1978) and Lowther (1980) (Table 1).

Table 1. Some physico-chemical properties of vermitea & poultry tea before added into soils, in 2023

Properties	Vermitea	Poultry tea
pH (1:10)	7.9	7.1
EC (1:10 water extracts) dSm^{-1}	9.9	10.4
Organic carbon%	12.3	13.7
Organic matter %	25.9	28.2
C/N ratio	4.9	4.0
Total Nitrogen%	2.5	3.4
Total Phosphorus %	0.93	1.90
Total Potassium%	0.83	1.7

Experimental unit (plot) area was (7.5 m²) as 2.5 m (Width) & 3.0 m (Length); it contains three rows with 25 cm distance between hills and it contained 36 plants per plot after thinning. Treatments were adopted in both of two seasons, in 2023 and 2024, respectively; as following: T_1= Control ($R_{100\%}$ of N., P. and K. as Chemicals Fertilizers), T_2= poultry tea (3 times) as a soil fertigation, T_3= poultry tea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_4= poultry tea (6- times) as a soil fertigation, T_5 = poultry tea (6- times) as a soil fertigation + the mixed of seaweed and algae (3 times) as foliar- spraying, T_6 = vermitea (3- times) as a soil fertigation, T_7 = vermitea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_8= vermitea (6 times) as a soil fertigation, T_9= vermitea (6 times) as a soil fertigation + mixed of seaweed and algae (3 times) as a foliar spraying on leaves. Inorganic fertilizers were added in recommended doses on control treatment (T_1)

on forms as follows: Ammonium - Nitrate (33.5 % N) = 288 kg fed^{-1}, was, added in twice equals at, 21 & 40 days, after sown and Super Calcium - Phosphates (15.5, % P_2O_5) = 250 kg fed^{-1}; was added on soils plowing for sowing. Potassium- Sulphate (48.0 % K_2O) = 100 kg fed^{-1} was applied with the second dose of nitrogen fertilization. Maize grains species of "third hybrid, 321" is approve in Agricultural-Researches-Center, the Agricultural Ministry; in Giza; Egypt, they were cultivated as two seeds per Hill and irrigated after sown directly for enough time. Maize grains were germinated 9 days after sowing and then, seedlings are thinned out to 1 Plant/ Hill at 20 days from sown. Hand-howling weekly was used to control the weeds after planting. Poultry tea and vermitea were applied as a soil fertigation by 21 days after sown, and the soil is watered at weekly intervals with poultry tea or vermitea, by rates (500 ml/plant) on the time. Teas of vermicompost and poultry manure were prepared by the mixture of tap water at rate in (1:5 v/v) in plastic containers of both of them, and then covered for 72 hr. under aerobic conditions using an aquarium pump by description method of Javanmardi and Ghorbani (2012). In both of two seasons, 2023 & 2024; respectively, five plant samples were random chosen per plot to measure some vegetative characters such as; plant length cm, fresh & dry shoots weights g/plant) & Yield parameters like (Ear Weight g, 100 grains weights g & total grains yield tons/fed.). Chemical components of maize grains and leaves such as (nitrogen, phosphorus, potassium & Proteins in both of them and the percentage of corn oils, carbohydrates and starch of grains) were measured. Samples of plants were washed by watered, bagged & dried, on Oven in heat (75˚C) until constant weights were recorded. Drying plant samples were powdered & also, they digested by "H_2SO_4 – H_2O_2 mixture" (Lowther, 1980) to determine some chemical components. Total macro-nutrients were measured by Calorimetrically-Nessler's Methods, VanadoMolybdo-Phosphoric Method & Flame Photometer; respectively, by Jackson (1973) and Chapman & Pratt (1978). Percentage of starch and carbohydrates of maize grains were measured by according to Holm *et al*. (1986) and Cronin & Smith (1979); respectively. Collectively grains were harvested from each plot to measure total grains yield (tons/fed). Percentage of corn oils were measured in presentation grains samples by Soxhlet method according to Low (1990). Using least's significant differences (LSD) test to compare between treatment means used Duncan's multiple range and conducted by usage S.A.S. (Statistical Analysis System, 2001), in the level 5 % in probability.

RESULTS AND DISCUSSION

Growth Parameters:

Analyses of variances were showed that, vegetative parameter, in maize including; plant height, shoot fresh & dry weights were significantly affected by poultry tea or vermitea as soil fertigation with foliar spraying on leaves by the algae and seaweed mix in T_2, T_3, T_4, T_5, T_6, T_7, T_8 & T_9 on (Table 2) more than controlled once (T_1). Highest significant value of plant length, shoots fresh & dry weights observed at poultry tea as a soil fertigation by 6 times with the mixed of seaweed and algae as foliars spray by 3- times (T_5) were (315.9 cm, 1426.4 and 435.9 g/plant) as an average from both of two seasons, at 2023 and 2024; respectively. But the lowest significantly values of them were observed at the controlled plants (T_1) were (135.4 cm, 602.7 and 177.6 g/plant) as an average from both of two seasons in 2023 and 2024; respectively. There are different significantly between treatments in both of two growing seasons. Promoting impacts of poultry tea and vermitea on growth, yield and quality due to their contents of macro and micro-nutrients, act and living of beneficial microbes' metabolites, which they able to stimulate plant growth and increase total yield. Shoot fresh and dry weights have increased attributed to available of macronutrients, especially nitrogen, phosphorus and potassium to improve soil water-holding capacity. Furthermore, they have diver beneficial microbe's activities, which release phytohormones, plant regulators to stimulate the growth and nutrients absorption of plants to enhance crop production and quality. The same increasing in the vegetative parameters; plant height, shoot fresh and dry weights of maize cultivated under poor nutrients soil. Sustainable agricultural practices like teas of poultry manure or vermicompost as soil fertigation and spraying on leaves by algae and seaweed mixed were needed to increase the vegetative growth, total grains yield, its components, and good nutritional qualities of grains and leaves of maize plant, which was cultivated in the soil has high in soil pH and low contents of organic matter, beneficial microbes, enzymes, hormones and nutrients deficient. Therefore, many crops cleared the positive responses to the soil amendments with different organic fertilizers to enhance its fertility, production and health food under sustainable agriculture. Teas of organic fertilizers like poultry manure and vermicompost were considered as rich sources of macro & micro-elements, vitamin, growth regulators, hormones, enzyme & beneficial microbes such as (*Actinomycetes*, *Azotobacter*, *Azospirrilium*, *Klebsiella*, *Mycorrhiza*, *Pseudomonas flourescences*, *Trichoderma* spp and *Bacillus subtillus*) to increase soils fertilities & enhance soil physico-chemicals characters & increase health crop production.

Table 2. Effect of poultry & vermiteas with algae and yeast mix on vegetative parameter of corn (*Zea mays* L.) plant

T	Plant Height cm		Shoot Fresh weight g/plant		Shoot Dry Weights g/plant	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
T_1	129.5 ^{i}	141.16 ^{i}	568.6 ^{i}	636.8 ^{i}	169.1 ^{i}	186.1 ^{i}
T_2	163.9 ^{g}	178.69 ^{g}	712.8 ^{g}	798.3 ^{g}	218.7 ^{g}	240.6 ^{g}
T_3	250.2 ^{c}	272.68 ^{c}	1088.0 ^{c}	1218.6 ^{c}	333.1 ^{c}	366.5 ^{c}
T_4	278.3 ^{b}	303.4 ^{b}	1206.0 ^{b}	1350.7 ^{b}	370.1 ^{b}	407.1 ^{b}
T_5	300.3 ^{a}	331.4 ^{a}	1339.3 ^{a}	1513.5 ^{a}	409.3 ^{a}	462.6 ^{a}
T_6	147.6 ^{h}	160.9 ^{h}	641.8 ^{h}	718.8 ^{h}	196.8 ^{h}	216.5 ^{h}
T_7	202.5 ^{e}	220.8 ^{e}	880.0 ^{e}	985.6 ^{e}	270.2 ^{e}	297.2 ^{e}
T_8	181.6 ^{f}	197.9 ^{f}	792.1 ^{f}	887.1 ^{f}	243.0 ^{f}	267.3 ^{f}
T_9	224.9 ^{d}	245.1 ^{d}	978.3 ^{d}	1095.7 ^{d}	299.6 ^{d}	329.6 ^{d}
L.S.D $_{0.05}$	1.452	3.780	2.102	2.362	1.4762	1.654

T_1=Controls (R 100 % of N., P. and K. as chemical fertilizations), T_2= Poultry Tea (3 times) as a soil fertigation, T_3= Poultry tea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_4= Poultry tea (6-times) as a soil fertigation, T_5 = Poultry tea (6-times) as soil fertigations + the mixed of seaweed and algae (3 times) as foliars spray, T_6 = Vermitea (3-times) as a soil fertigation, T_7 = Vermitea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_8= Vermitea (6 times) as a soil fertigation, T_9= Vermitea (6 times) as a soil fertigation + mixed of algae and seaweed (3 times) as a foliar spraying on leaves.

F.S. = First Season, from 28th June to 5th October, 2023. S.S. = Second Season, from 25th June to 3th October, 2024.

They are enriched sources of major macro-nutrients (nitrogen, potassium and phosphorus), they caused the powerful improvement of plant nutrition like potassium, nitrogen, phosphorous, zinc, iron, calcium, sulfur, magnesium, copper, boron, chlorine & molybdenum (Adelekan *et al*., 2010; Attia & El-Araby, 2016; Abd El-Gawad & Morsy, 2017; Adekiya *et al*., 2020; Abou El-Goud, 2020 a, b, c; Mulyati *et al*., 2021; López-Morales *et al*., 2022; Asfaw, 2022; Rasool *et al*., 2023 and Zhao *et al*., 2024). They are presented in poultry manure & vermicompost teas and algae and seaweed mix, which they able to utilize as nice fertilizers for fulfilling or portion in nutritional requirements of many crops. They have nice ratio of C/N, that is facilitates diver microorganisms, which ultimately improve physico-chemicals & microbial soil properties and powerful enhancement of plant productions. Teas of poultry manure or vermicompost with algae and seaweed mixed lead to investigate their impacts on quantities and qualities of plant.

Yield Parameters

Highest significantly results of ear weights, 100 grains- weight & total grains yields were observed in T_5 (poultry tea 6 times as soil fertigation with spraying 3 times on leaves by the mixture of seaweed and algae). There are, significant difference among others treatment from T_2 into T_9 and control (T_1) were cleared in (Table 3). Promoting impacts of poultry tea & vermitea as soil fertigation with algae and seaweed mixed as spraying on leaves lead to investigate their positive impacts on vegetative, yields and qualities of corn. Ear weight, 100 grains weight and grains yield were observed in Table (3), especially when organic fertilizers such as teas of poultry manure or vermicompost as soil fertigation were used combination with mixed of seaweed and algae as spraying on leaves more than controlled once. Highest significant value in ears weight, 100 grain weights & total grains yield were (757.2 g, 53.5 g and 4.3 tons/fed.; respectively) as an average of both of two growing seasons observed at T_5 (poultry tea 6 times as a soil fertigation with foliar spraying on leaves 3 times by seaweed and algae mixed). The lowest significant values of them were (315.7 g, 21.1 g and 1.6 tons/fed.; respectively) as an average of both of two growing seasons observed at T_1 (Recommended doses of N., P. and K. inorganic fertilizers) on Table (3). Yield parameters have the improvement attributed to the availability of micro and macro-nutrients to improve soils waters-holding capacity, soils pH & release vitamins and phyto-hormones and stimulate vegetative growth by nutrients absorption and grains yield of maize plant. Ear weight, 100 grains weights & total grains yields were significant increases impacted by studied treatments from T_2 to T_9 in both growing seasons, at 2023 and 2024; respectively in Table (4). Highest value of the studied yields parameter was recorded, in T_5 (poultry tea 6- times as a soil fertigation with foliar spraying on leaves 3 times by seaweed and algae mixed), followed by T_4 (Poultry tea 6 times as a soil fertigation during both of two growing seasons, 2023 and 2024; respectively. These positive results showed that, enhancing in plant photo-synthetic activities, in amounts from nitrogen & potassium supplying. They

are essential requirements to enhance ear growth, 100 grains weight and total grain yield (tons/fed) compared to inorganic fertilizers in both of two growing seasons (Table 4). On others hand, lowest significant value in same traits of vegetative growth & yields parameters were recorded in Tables (1 & 2) by using inorganic fertilizers in both of two growing seasons, at 2023 and 2024; respectively. These results might be due to organic fertilizations applied to enhance physico-chemicals & microbial characters & improve their availability from micro & major-elements, vitamin, hormons, growth regulators; then improving factors to enhance maize crop production. This result is in line with Hossain *et al*. (2012); Abd el Fatah *et al.* (2015); Kareem *et al.* (2017); Zhao *et al.* (2018); Abou El-Goud (2020 a,b, c); Emam *et al*. (2020); Yatoo *et al*. (2021); Rasool *et al*. (2023); Tufa (2023) and Sariñana-Aldaco *et al*. (2025). Results were presented in Table (2) shown positive impact of organic treatments more than inorganic once T_1 in the corresponding season. Noticed cleared that, organic applied improves vegetative & yields of corn compare to chemicals. Similar data was cleared by Kmeťová & Kováčik (2013); Khattab *et al*. (2015); Aslam & Ahmad (2020); Mulyati *et al*. (2021); Asfaw (2022); López-Morales *et al*. (2022); Sariñana-Aldaco *et al*. (2025) and Ssemugenze *et al*. (2025). Organic fertilization had reported to improve the soil healthy and fertility by providing macronutrients like (potassium, nitrogen and phosphorus), organic matter, beneficial microbes in rhizosphere, maintains the neutral soil pH and exchangeable cations level and enhance the soil-water holding capacity. Yield attributes like ear weight, 100 grains weight and total grain yield were increased in organic treatments due to enhance the photosynthetic and the stomata conductance, which they play significantly roles in vegetative growth and production. These attributes were sensitized for growth conditions like macro and micro-nutrients and the availability of water and beneficial microbes in rhizosphere and different environmental factors, which they have positive effects on the rate of photosynthetic and transpiration and stomata conductance were improved in maize grown in the soil amendment with poultry tea or vermitea as soil fertigation with spraying on leaves by seaweed and algae mixed as compared to inorganic fertilizers (T_1). Maize was responded to each organic treatment from T_2 to T_9 in morphological and physiological lead to significant increase in all growth and yield parameters more than controlled. They caused significantly increases in total economic yield and its components of maize plant under sustainable agriculture (Adelekan *et al*., 2010; Attia & El-Araby, 2016; Abd El-Gawad & Morsy, 2017; Abou El-Goud, 2020 a, b, c and Asfaw, 2022).

Table 3. Effect of poultry & vermiteas with algae and yeast mixed in yield parameter of corn (*Zea mays* L.) plant

T	Ear weight g		100 grains weight g		Total grain yield tons/fed.	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
T_1	299.2 ^{i}	332.1 ^{i}	19.9 ^{i}	22.3 ^{i}	1.5 ^{i}	1.6 ^{i}
T_2	378.9 ^{g}	420.6 ^{g}	27.2 ^{g}	30.4 ^{g}	2.2 ^{g}	2.4 ^{g}
T_3	577.9 ^{c}	641.4 ^{c}	41.6 ^{c}	46.6 ^{c}	3.5 ^{c}	3.9 ^{c}
T_4	641.9 ^{b}	712.6 ^{b}	45.7 ^{b}	51.2 ^{b}	3.8 ^{b}	4.2 ^{b}
T_5	711.0 ^{a}	803.4 ^{a}	50.5 ^{a}	56.7 ^{a}	4.1 ^{a}	4.6 ^{a}
T_6	341.3 ^{h}	378.9 ^{h}	23.9 ^{h}	26.8 ^{h}	1.9 ^{h}	2.1 ^{h}
T_7	467.9 ^{e}	519.4 ^{e}	33.8 ^{e}	37.9 ^{e}	2.7 ^{e}	3.0 ^{e}
T_8	421.6 ^{f}	467.9 ^{f}	30.7 ^{f}	34.4 ^{f}	2.5 ^{f}	2.7 ^{f}
T_9	520.0 ^{d}	577.2 ^{d}	37.4 ^{d}	41.9 ^{d}	3.3 ^{d}	3.6 ^{d}
L.S.D $_{0.05}$	1.355	1.523	0.575	0.675	0.135	0.151

T_1=Control (R100% of N, P and K as chemical fertilizers), T_2= Poultry Tea (3 times) as a soil fertigation, T_3= Poultry tea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_4= Poultry tea (6-times) as a soil fertigation, T_5 = Poultry tea (6-times) as soil fertigations + the mixed of seaweed and algae (3 times) as foliars spray, T_6 = Vermitea (3-times) as a soil fertigation, T_7 = Vermitea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_8= Vermitea (6 times) as a soil fertigation, T_9= Vermitea (6 times) as a soil fertigation + mixed of algae and seaweed (3 times) as a foliar spraying on leaves.

F.S. = First Season, from 28th June to 5th October, 2023. S.S. = Second Season, from 25th June to 3th October, 2024.

Quality Parameters:

Results of vegetative & yields attributes of corn is shows on Tables (2 & 3) cleared that, they were substantially impacted by various organic treatments as compared to inorganic once. Integrated uses of organic fertilizers such as poultry manure tea or vermitea as soil fertigation with foliar spraying on shoots by mixed of algae & seaweed for maximum increasing in the percentage of (proteins, P, K, corn oils, starch and carbohydrates) in maize grains on Table (4). Data on Table (4) cleared that; highest significant values from them were (26.7, 0.78, 5.34, 8.3, 83.0 and 81.5; respectively) as averages in both of two seasons, 2023 & 2024 at T_5 (poultry tea 6-times as soil fertigations with foliar spraying on leaves by the mixture of seaweed and algae 3 times). Inorganic fertilized was controlled once shown the lowest significantly values for all above chemical components of grains including (the percentage of proteins, P, K, corn oils, starch and carbohydrates) as compared to others treatment on Table (4). Results cleared that; lowest significantly data was (9.6, 0.14, 1.83, 3.3, 53.8 and 34.2; respectively) as averages in both of growing seasons, 2023 & 2024 in T_1 (inorganic fertilizers). This results caused enhance soil pH, availability from macro & micro-elements, total organic C and organic matter and improve the microbial communities in rhizosphere were highly significant impacted by organic teas with mixture of algae and seaweed application on soil and plant; respectively. Significant differences among all treatments of vegetative, yields and qualities of grains and leaves were shown in Tables (2, 3, 4 and 5). Results in Table (5) cleared that, highest significantly data of percentage of N., proteins, P. and K. in leaves were at T_5 (poultry tea as a soil fertigation 6 times with the mixed of seaweed and algae 3 times as a foliar spraying on leaves) in both of the corresponding seasons. They were (3.9, 24.9, 0.78 and 12.2 %; respectively) as the highest significantly values as averages in both of two seasons in 2023 & 2024. Application of poultry tea or vermitea in combination with the mixture of algae and seaweed have improved the overall soil organic matter and carbon, total K, P and N concentrations, hormones, vitamins and microbes, which they were reflected on plant growth enhancing, total yield and its quality increasing. Moreover, the other organic treatments from T_2 to T_9 also improved as compared to T_1 (inorganic fertilizers). Furthermore, the lowest significant values in the percentage of N., proteins, P. & K. in leaves was in T_1 (recommended doses from chemicals) in both of two growing seasons. They were recorded (1.40, 8.6, 0.10 and 2.62 %; respectively) as an average of both two seasons at 2023 and 2024. However, all organic treatments lead to improve the soil nutrient status more than inorganic treatment, which reflected on growth, yield and quality studied. Maize growth, yield and their components of grains & leaves were significantly correlated with the physical, chemical and microbial soil properties affected by organic fertilizers addition in the soil. Undoubtedly, cultivation using huge amounts of chemical fertilizers caused crop productivity increasing, but on the other hand, it leads to damage Agro-ecosystems and great environmental pollution. So that, better management using organic fertilizers such teas of poultry manure and vermicompost with algae and seaweed can be adopted to increase crop productivity without any natural damage. Here, we studied the integrative positive impacts in Organic Fertilization in growth, production & their qualities of grains and leaves of maize plant and soil properties for improvement (Tables 2, 3, 4 and 5). Combination of soil fertigation by organic fertilizers with foliar spraying on shoots by algae and seaweed mixed have increased organic matter, enhance the ratio of N/C to improve all soil parameters, usage of micro & macro nutrients efficiency, recovery and help in P and K solubilization and their uptakes by root hairs of plant to turn on powerful vegetative & yields of corn. Therefore, combined applying in soils fertigation and foliar spraying on shoots by organic and biofertilizers were considered a powerful option to enhance elements requirement to attain better vegetative & yields. Reported similar results with Hossain *et al*. (2012); Zhao *et al*. (2018); Abou El-Goud (2020 a, b, c); Yatoo *et al*. (2021); Rasool *et al*. (2023); Tufa (2023); Zhao *et al*. (2024) and Sariñana-Aldaco *et al*. (2025). Moreover, combination of both of soil fertigation and spraying on leaves by organic and biofertilizers were applied to induce alterations in physico-chemicals & microbial characters on soils to enhance vegetative & crops productions. Similar results were also reported by Boateng *et al*. (2006); Farhad *et al*. (2009); Hossain *et al*. (2012); Chaulagain *et al*. (2017); Kareem *et al*. (2017); Aslam & Ahmad (2020); Emam *et al*. (2020); Kevin *et al*. (2023) and Freyer *et al*. (2024). Organic amendment was significantly enhanced in soil and plant, thus have considerable impact on beneficial microbes and elements availability and their uptakes, and thus may be belter the C: N ratio and soil pH. However, high amounts of organic matter with high ratio of carbon to nitrogen, may be induce accelerate the mineralization of highly organic matters; thereby release nitrogen was trapped on highly organic matter as priming effect for enhancing the plant growth and production.

Table 4. Effects of poultry & vermiteas with algae and yeast mix on chemical components in grains of corn (*Zea mays*, L.) plant

T	Maize Grains											
	Proteins%		P%		K%		Corn Oils%		Starch%		Carbohydrates%	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
T_1	9.2 ^{i}	10.2 ^{i}	0.13 ^{c}	0.15 ^{c}	1.73 ^{i}	1.94 ^{i}	3.1 ^{i}	3.5 ^{i}	49.8 ^{i}	55.8 ^{g}	32.3 ^{i}	36.0 ^{i}
T_2	12.9 ^{g}	14.3 ^{g}	0.86 ^{a}	0.98 ^{a}	2.66 ^{g}	2.99 ^{g}	4.1 ^{g}	4.6 ^{g}	54.6 ^{f}	61.2 ^{f}	41.2 ^{g}	46.2 ^{g}
T_3	20.4 ^{c}	22.7 ^{c}	0.56 ^{abc}	0.64 ^{abc}	4.17 ^{c}	4.67 ^{c}	6.4 ^{c}	7.2 ^{c}	70.8 ^{c}	79.3 ^{c}	63.3 ^{c}	70.9 ^{c}
T_4	22.7 ^{b}	25.7 ^{b}	0.66 ^{abc}	0.75 ^{abc}	4.57 ^{b}	5.12 ^{b}	7.11 ^{b}	7.91 ^{b}	74.6 ^{b}	83.5 ^{b}	70.6 ^{b}	79.1 ^{b}
T_5	25.0 ^{a}	28.3 ^{a}	0.73 ^{ab}	0.82 ^{ab}	5.03 ^{a}	5.64 ^{a}	7.8 ^{a}	8.7 ^{a}	78.1 ^{a}	88.3 ^{a}	76.9 ^{a}	86.1 ^{a}
T_6	11.5 ^{h}	12.8 ^{h}	0.23 ^{bc}	0.26 ^{bc}	2.36 ^{h}	2.65 ^{h}	3.6 ^{h}	4.1 ^{h}	54.9 ^{f}	61.5 ^{f}	37.6 ^{h}	42.2 ^{h}
T_7	16.0 ^{e}	17.9 ^{e}	0.43 ^{abc}	0.49 ^{abc}	3.36 ^{e}	3.77 ^{e}	5.1 ^{e}	5.8 ^{e}	64.0 ^{de}	71.6 ^{de}	51.2 ^{e}	57.3 ^{e}
T_8	13.9 ^{f}	15.6 ^{f}	0.33 ^{abc}	0.38 ^{abc}	3.03 ^{f}	3.39 ^{f}	4.5 ^{f}	5.0 ^{f}	60.9 ^{e}	68.2 ^{e}	46.3 ^{f}	51.8 ^{f}
T_9	17.7 d	19.8 ^{d}	0.47 ^{abc}	0.53 ^{abc}	3.73 ^{d}	4.18 ^{d}	5.8 ^{d}	6.5 ^{d}	67.1 ^{d}	75.2 ^{d}	56.5 ^{d}	63.3 ^{d}
L.S.D $_{0.05}$	0.650	0.751	0.589	0.665	0.105	0.118	0.18	0.22	3.409	3.819	1.11	1.17

T_1= The Control (R 100 % of N., P. and K. as chemicals), T_2= Poultry Tea (3 times) as a soil fertigation, T_3= Poultry tea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as foliars spray, T_4= Poultry tea (6- times) as a soil fertigation, T_5 = Poultry tea (6- times) as soils fertigations + the mixed of seaweed and algae (3-times) as foliars spray, T_6 = Vermitea (3-times) as a soil fertigation, T_7 = Vermitea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_8= Vermitea (6 times) as a soil fertigation, T_9 = Vermitea (6 times) as a soil fertigation + mixed of algae and seaweed (3 times) as a foliar spraying on leaves.
F.S. = First Season, from 28th June to 5th October, 2023. S.S. = Second Season, from 25th June to 3th October, 2024.

Table 5. Effect of poultry and vermiteas and algae & yeast mix in chemicals components on leaf of corn (*Zea mays* L.) plant

T	Maize Leaves							
	N%		Proteins%		P%		K%	
	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.	F.S.	S.S.
T_1	1.33 ^{i}	1.45 ^{i}	8.33 ^{i}	9.08 ^{i}	0.10 ^{f}	0.11 ^{f}	2.47 ^{i}	2.76 ^{i}
T_2	1.97 ^{g}	2.14 ^{g}	12.29 ^{g}	13.39 ^{g}	0.33 ^{d}	0.38 ^{d}	6.00 ^{g}	6.72 ^{g}
T_3	3.03 ^{c}	3.31 ^{c}	18.96 ^{c}	20.67 ^{c}	0.57 ^{b}	0.64 ^{b}	9.40 ^{c}	10.53 ^{c}
T_4	3.37 ^{b}	3.80 ^{b}	21.04 ^{b}	23.78 ^{b}	0.67 ^{a}	0.75 ^{a}	10.50 ^{b}	11.87 ^{b}
T_5	3.73 ^{a}	4.22 ^{a}	23.33 ^{a}	26.37 ^{a}	0.73 ^{a}	0.83 ^{a}	11.37 ^{a}	12.84 ^{a}
T_6	1.83 ^{h}	1.99 ^{h}	11.46 ^{h}	12.49 ^{h}	0.23 ^{e}	0.26 ^{e}	5.43 ^{h}	6.09 ^{h}
T_7	2.47 ^{e}	2.69 ^{e}	15.42 ^{e}	16.80 ^{e}	0.43 ^{c}	0.49 ^{c}	7.57 ^{e}	8.478 ^{e}
T_8	2.17 ^{f}	2.36 ^{f}	13.54 ^{f}	14.76 ^{f}	0.44 ^{c}	0.48 ^{c}	6.83 ^{f}	7.65 ^{f}
T_9	2.77 ^{d}	3.02 ^{d}	17.29 ^{d}	18.85 ^{d}	0.53 ^{b}	0.60 ^{b}	8.43 ^{d}	9.45 ^{d}
L.S.D $^{0.05}$	0.097	0.107	0.607	0.669	0.095	0.107	0.169	0.190

T_1=Control (R100% of N, P and K as chemical fertilizers), T_2= Poultry Tea (3 times) as a soil fertigation, T_3= Poultry tea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_4= Poultry tea (6-times) as a soil fertigation, T_5 = Poultry tea (6-times) as soil fertigations + the mixed of seaweed and algae (3 times) as foliars spray, T_6 = Vermitea (3- times) as a soil fertigation, T_7 = Vermitea (3 times) as a soil fertigation + the mixed of seaweed and algae (3 times) as a foliar spraying on leaves, T_8= Vermitea (6 times) as a soil fertigation, T_9 = Vermitea (6 times) as a soil fertigation + mixed of algae and seaweed (3 times) as a foliar spraying on leaves.
F.S. = First Season, from 28th June to 5th October, 2023. S.S. = Second Season, from 25th June to 3th October, 2024.

Hence, using organic and biofertilizers weekly as soil fertigation and spraying on leaves were applied to feed the soil microfloura, supply plant nutrients, retention cycling of applied fertilizers; which they able to expect that, increasing soil healthy & fertility and improve of corn vegetative, yields & qualities. Applying organic fertilizers were showed to change the acid soil pH to neutral, which is would influence elements available & enhance soils fertility. Organic fertilization is an important to sustainability soil fertility, essential nutrients of plant for sustainable production. Overall,

this study confirmed that, strategies were done for prevention loss from macro-nutrients of air, water lost and soils and enhance local microorganisms. These seem that, to improve soils fertility & sustain corn productions & qualities components in sandy clay silt soil. Poultry manure, vermicompost, and tea extracts (poultry tea, vermitea) can all enhance maize production by improving soil properties and nutrient availability. Algae or yeast additions to these materials can further enhance the effects by providing additional nutrients and promoting beneficial microbial activity. Poultry manure, can improve soil properties like structure, water-holding capacity, and aeration. It is enriching soil with essentials elements, promoting vegetative and yields. It can increase plant height and stem girth in maize. Vermitea products from vermicompost, can improve soil health and nutrient availability, increase root and shoots biomass; they were contributing to stronger plant growth. Vermitea can enhance plant growth and yield, their potentially complementing effects of vermitea or poultry tea when used in combination with algae and yeast; they can be added to poultry tea and vermitea to create "bio-fertilizers". These additions can provide additional nutrients, boost microbial activity, and improve the overall effectiveness of the tea extracts. Yeast and algae foliar applications have been shown to increase plant height and yield in maize. In summary, poultry tea, vermitea, and their associated with algae and yeast additions, able to enhance maize production, improve soil health and nutrient availability (Farhad *et al*., 2011; Abd el Fatah *et al*., 2015; Freyer *et al*., 2024 and Ssemugenze *et al*., 2025).

CONCLUSION

Findings of study clear that, usage of organic teas of poultry manure or vermicompost as a soil fertigation with foliar spraying by mixed of algae and seaweed to improve the soil fertility, thereby to increase vegetative growth, yield and its components of maize grains and leaves. Application of organic fertilizers as soil fertigation with foliar spraying together lead to vigor increases on plant length, weights of fresh & dry shoots as growth parameters on corn cultivar as compared to inorganic fertilizers (control). Results indicated that, the double organic fertilizations by soil fertigation of poultry tea or vermitea with spraying on leaves by mixed of algae and seaweed together to enhance ear length, 100 grains weight and total grain yield and increase the percentage of (N, proteins, P, K, corn oil, starch and carbohydrates) in grains & leaves; respectively, on both of two Seasons, at 2023 and 2024. Results were pointed to the beneficial impacts of poultry tea as a soil fertigation by 6 times with foliar spraying of algae and seaweed mixed by 3 times as possible nutritional sources on growth, production and its quality parameters. Organic nutritional system has the environmental advantages including; beneficial impacts on physical, chemical and microbial soil properties, safe crop production and their qualities with a sustainable agriculture gain. Plants were treated with poultry tea 6 times as a soil fertigation with the mixture of seaweed and algae 3 times as a foliar spraying on leaves (T_5) produced highest significantly values in all growth, yield and quality parameters studied more than other treatments. Organic production system is dependent on organic and bio fertilizers, whether to eradicate weeds, nourish crops, soil borne pathogenic and insect pests. In accordance with these in formations, seaweed, algae and teas of poultry manure or vermicompost are viable options to decrease the chemicals usage that, cause the environmental deterioration and sustainable crops production. They can act as the growth stimulants of poultry tea as direct soil fertigation with foliar spraying by mixed of algae and seaweed use has positive impacts on vegetative growth and crop development under sustainable agriculture.

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الملخص العربي

تقنية الزراعية الذكية لإنتاج الذرة بإستخدام شاي الدواجن والفيرميتي مع خليط الطحالب والخميرة

أمال كرم أبو الجود

كانت تحديات انخفاض سلامة الغذاء والتلوث البيئي الكيميائي مطلوبة لتحسين سلامة الغذاء واختيار الأسمدة العضوية الفعالة. حيث تم تطبيق تجربتين ميدانيتين في مزرعة محطة بحوث النوبارية الزراعية في موسمين علي التوالي لعامي، ٢٠٢٣ و ٢٠٢٤ لتقييم كفاءة ري التربة ب شاي الدواجن أو الفيرميتيا مع الرش الورقي لخليط الطحالب والأعشاب البحرية معا على نمو وإنتاج محصول الذرة ومعايير الجودة. تم وضع التجارب في تصميم قطعة منقسمة (RCBD) لتسع معاملات مع أربع مكررات. أوضحت النتائج أن أعلى القيم المعنوية في معايير النمو والمحصول والجودة تم إنتاجها في T_5 (إستخدام شاي الدواجن كتسميد للتربة في ٦ مرات مع الرش الورقي بمزيج من الأعشاب البحرية والطحالب في ٣ مرات). بينما تم تسجيل أقل القيم المعنوية في سمات النمو والمحصول والجودة في الأسمدة غير العضوية (المجموعة الضابطة) T_1. تسببت الأسمدة العضوية في زيادة كبيرة في النمو الخضري وإنتاج نبات الذرة وجودة المنتج. ومن بين جميع المعالجات العضوية، سُجِّلت زيادة في نمو وإنتاجية والمكونات الكيميائية لحبوب وأوراق الذرة عند استخدام خليط من تسميد التربة بشاي الدواجن أو الديدان مع الرش الورقي بمزيج من الطحالب والأعشاب البحرية، مقارنةً بالأسمدة غير العضوية (الشاهد). لذا، يُوصى باستخدام مزيج من الأسمدة العضوية والحيوية (T_5) كزراعة مستدامة لإنتاج محصول الذرة الآمن وفقًا لتقنية الزراعة الذكية.

الكلمات المفتاحية: شاي الدواجن، الفيرميتي، مخلوط الطحالب والخميرة معا؛ تقنية الزراعة الذكية؛ الإنتاج المستدام لمحصول الذرة.