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THE EFFECT OF SOME SOIL CONDITIONERS ON THE YIELD AND QUALITY OF SWEET PEPPER GROWN UNDER SALINE SOIL CONDITIONS USING TWO SOURCES OF ORGANIC NITROGEN FERTILIZERS

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ABSTRACT: Because of increased population worldwide in general and Egypt in particular , this may lead to a problem in the lack of food and fertile land area therefore, we resort to the expansion of the cultivation of salt soil. For that this experiment was carried out during two summer seasons of 2020 and 2021 at the Experimental Farm of El-Kassasein, Hort. Res. Station, Ismailia Governorate, Egypt, to study the effect of organic nitrogen sources (poultry manure and botanical compost) and some soil conditioners (magnetic iron at 25 and 50 kg /fed. and humic acid at 2 and 4 kg /fed.) on growth, yield and fruit quality of sweet pepper *cv* Top Star under sandy soil conditions. Fertilizing sweet pepper plants grown in sandy soil with 180 kg N as organic nitrogen in the form of poultry manure (5.521 ton /fed.) increased plant growth, N, P and K uptake by shoots, yield and its components , nitrogen use efficiency, dry matter, total soluble solids and Vit. C and decreased nitrate content in fruits compared to fertilizing with 180 kg N as organic nitrogen in the form of botanical compost (9.890 ton /fed.). Adding magnetic iron and humic acid as salt soil conditioners at different rates to sandy soil increased plant growth, N, P and K uptake by shoots, yield and its components, fruit traits, dry matter, total soluble solids and Vit. C and decreased nitrate content in fruits compared to control (without soil conditioners). Fertilizing with poultry manure at 5.521 ton /fed. and adding magnetic iron at 50 kg /fed. increased shoot dry weight, N, P and K contents and uptake by shoots, number of fruits/ plant, average fruit weight, yield / plant , total yield /fed. nitrogen use efficiency, dry matter and total soluble solids in fruits, whereas poultry manure at 5.521 ton/fed. and humic acid at 4 kg /fed. increased Vit. C and decreased nitrate contents in fruits.

Key words: Sweet pepper, poultry manure, botanical compost, magnetic iron, humic acid, growth, yield and nitrogen use efficiency.

INTRODUCTION

Sweet peppers (*Capsicum annuum* L.) are an important crop for local and exportation markets as well as can be consumed in many colours. Peppers are rich in vitamins, especially A and C, and is low in calories**.**

Salinity in the soil and / or the irrigation water is potentially classified as one of the most important soil reclamation problems in many parts of the world. The economic vegetable crops productivity is, generally, sharply reduced with increasing salinity. In the arid and semi-arid regions, salinity is one of the most important abiotic stresses and a serious threat to agricultural sustainability**.** The extent of salinity problem is about 10% of world land area and 50% of irrigated areas which results in 12 billion US$ loss of agricultural production (**Flowers *et al.*, 2010**).

Organic manure plays a direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization **(Nweke *et al.*, 2013**) and improves physical and chemical properties of soils **(Chaterjee *et al.*, 2005)**. **Adhikari *et al*. (2016)** revealed better growth and yield of sweet pepper performance by vermi-compost followed by poultry manure over control. **Atta Poku Snr *et al* (2020**) showed that 10 t/ha poultry manure recorded the highest plant height, number of leaves and leaf area per plant, number of fruits per plant, average fruit weight and fruit yield of sweet pepper, while control treatment recorded the least in all traits.

Magnetite (magnetic iron) is considered as one of the most saline soil amendment which enhances crop productivity. **Abd EL-Al (2003)** reported that the application of magnetite increased plant growth parameters and yield and its components as well as chemical composition of eggplant**. Ali *et al*. (2011**) proved plant growth, crop yield, fruit quality and some chemical contents of pepper (hybrid Bascar F1) grown under saline irrigation conditions increased with different doses of magnetic treatments compared to control. **Hafez and Soubeih (2012)** indicated that application either of magnetite or humic acids increased P and K and decreased NO_3 of eggplant fruits.

Humic acid (HA) is an organic substance in the soil and is important for soil fertility. It is a high-quality plant stimulant and soil conditioner and can be applied in all plants. Soil HA applications led to significantly higher average fruit weight, and early and total yield of pepper than for control (**Karakurat *et al* . 2009**).

Therefore the aim of this work was to study the effect of organic nitrogen sources and soil amendments as magnetic iron and humic acid on growth, yield and fruit quality of sweet pepper under sandy soil conditions.

MATERIALS AND METHODS

This experiment was carried out during two summer seasons of 2020 and 2021 at the Experimental Farm of El-Kassasein, Hort. Res. Station, Ismailia Governorate, Egypt, to study the effect of organic nitrogen sources and some soil conditioners (magnetic iron and humic acid) on growth, yield and fruit quality of sweet pepper *cv* Top Star under sandy soil conditions.

Table A. Physical and chemical properties of the experimental site pre planting and at the end of experiment (as average of the two seasons)

Soil properties	Pre planting	At the end of experiment
Physical properties		
Sand (%)	60.21	49.93
Silt (%)	25.00	30.43
Clay (%)	14.79	19.64
Chemical properties		
pH	8.89	8.82
EC (dSm^{-1})	3.90	2.46
Cations		
K^+	62.68	40.29
Na^+	392.6	260.43
Mg^{++}	1.08	1.10
Ca^{++}	2.17	2.16
Anions		
CO_3^-	0.0	0.0
HCO_3^-	0.0	0.0
Cl^-	2.01	1.08

The experiment included ten treatments, which were the combinations between two organic nitrogen sources (botanical compost and poultry manure) and five salt soil conditioners (magnetic iron at 25 and 50 kg/ fed. and humic acid at 2 and 4 kg/fed. as well as control).

These treatments were arranged in a split plot design with three replications. organic nitrogen sources were randomly distributed in the main plots, while some soil conditioners (magnetic iron and humic acid) were arranged in the sub plots. Plot area was 8.4 m^2, which consisted of two ridges of 6 m long and 70 cm width. Sweet pepper transplants were transplanted in the open field on 15th of April 2020 and 2021 at 25 cm apart in one side of the ridges. Botanical compost (1.82 % N) and poultry manure (3.26% N) were used as organic fertilizers at the rates of 9.890 and 5.521 ton/fed. , respectively (equal 180 kg N/fed.). The chemical properties of the botanical compost (BC) and poultry manure (PM) used are presented in Table B.

Table B. The chemical properties of the botanical compost and poultry manure as average of the two seasons

Elements	BC	PM
Macro elements %		
N	1.82	3.26
P	0.81	0.96
K	0.24	1.28
Micro elements (ppm)		
Fe	250	404
Mn	146	210
Zn	105	209
Cu	50	83
Organic matter (%)	35.90	37

Magnetite (Magnetic iron ore), contained 48.8% Fe_3O_4, 17.3% Fe O, 26.7% Fe_2O_3, 2.6% MgO, 4.3% SiO_2 and 0.3% CaO, obtained from "El- Ahram Company for Mining and Natural Fertilizers" (ECMNF), Giza, Egypt. Botanical compost (BC), poultry manure (PM) and magnetic iron (MI) were added at soil preparation. While, humic acid (HA) was added three times during transplanting and reaper after 15 days. The other cultural practices for sweet pepper commercial production were used according to the instruction laid down by the Ministry of Agriculture, Egypt.

Data recorded

Plant growth: Three plants from plot were randomly taken at 90 days after transplanting and the following data were recorded: Plant height (cm), both number of leaves and branches / plant and shoot dry weight/ plant (g).

Leaf Pigments content: A disc sample from the fourth outer leaf of sweet pepper plant was randomly taken from every experimental unit at 90 days after transplanting in both growing seasons to determine chlorophyll a, b and chlorophyll (a+b) as well as total carotenoides **(Wettestein ,1957).**

Plant Chemical Composition: Nitrogen, phosphorus and potassium contents in shoots at 90 days after transplanting in both growing seasons were determined according to the methods described by **Bremner and Mulvaney (1982), Olsen and Sommers (1982),** and **Jackson (1970),** respectively. Their uptakes of N, P and K per shoots were computed. Iron contents (ppm) in the shoots at was determined by atomic absorption spectrophotometer as described by **Evenhuis and De Waard (1980).**

Total yield: Twenty-eight harvesting were picked all over the season for all plots and the following data were calculated, average fruit weight (gm), average number of fruits/ plant, total yield / plant (kg) and total yield/ fed. (ton). Feddan(fed.) = 4200 m^2 = 0.42 Hectare (ha.)

Nitrogen Use Efficiency (NUE): It was determined by dividing the fruit yield/ fed., by the nitrogen quantity/ fed., and expressed as kg fruits /kg N according to **Clark, (1982).**

Fruits traits: five fruits were randomly taken from each plot of all pickings to study the morphological characters as fruits length (cm) and fruits diameter (cm) were measured using a caliper.

Fruit quality: Dry matter contents (%): 100 grams of the grated mixture were dried at 1050C till the constant weight and DM (%) was recorded, total soluble solids (T.S.S) were measured by hand Refractometer and ascorbic acid (Vitamin C) were assayed according to **A.O.A.C (1995).** Nitrate content (NO_3), it was determined according to the methods described by **Cafado *et al.* (1975).**

Statistical analysis: Recorded data were subjected to the statistical analysis of variance according to **Snedecor and Cochran (1967),** and means separation were done according to **Duncan (1955).**

RESULTS AND DISCUSSION

1. Plant growth

Effect of organic nitrogen sources

The obtained results in Table 1 show that fertilizing sweet pepper plants grown in sandy soil with poultry manure (PM) at 5.521 ton /fed. significantly increased plant height, number of leaves/ plant, number of branches/ plant and shoot dry weight at 90 days after transplanting . The increases in branching and shoot dry weight for poultry manure were about 1.11 and 0.69 branches and 5.95 and 10.3 g/ plant over the botanical compost (BC) at 9.890 ton /fed. in the 1st and 2nd seasons, respectively.

The critical part of N in plants, which found in nucleic acids, co-enzymes, and proteinsphosphorus, likewise has a part in N_2 fixation, and increment photosynthesis of plant, although phosphorus has a fundamental part in energy metabolism the high energy of hydrolysis of phosphate and different organic phosphate bonds being used to induce chemical reaction, while potassium activates some enzymes and K+ ions play an vital part in control leaves stomatal guard cells and as well increment photosynthesis**.**

Adhikari *et al.* (2016) revealed better growth sweet pepper performance by vermi-compost followed by poultry manure over control . Also, **Atta Poku Snr *et al*. (2020**) showed that 10 t/ha PM recorded the highest plant height, number of leaves and leaf area per plant of sweet pepper while the control treatment recorded the least in all traits.

Table 1. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on plant growth of sweet pepper (cv. top star) at 90 days after during 2020 and 2021 seasons

Treatments	Plant height (cm)		Number of leaves/ plant		Number of branches / plant		Shoot dry weight (g)	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
	Effect of organic nitrogen sources							
Botanical compost	44.58 b	45.60 b	103.98 b	104.01 b	5.72 b	5.74 b	77.96 b	78.07 b
Poultry manure	54.06 a	51.41 a	114.73 a	128.66 a	6.83 a	6.43 a	83.91 a	88.37 a
	Effect of magnetic iron and humic acid							
Untreated	42.85 e	44.35 d	91.59 e	104.61 d	5.10 d	5.10 d	69.01 e	73.40 e
MI at 25 kg /fed.	52.15 b	51.05 b	120.71 b	121.31 b	6.62 b	6.57 b	86.92 b	86.85 b
MI at 50 kg /fed.	53.84 a	52.44 a	128.19 a	127.15 a	7.15 a	7.00 a	91.42 a	92.79 a
HA at 2 kg /fed.	47.49 d	46.88 c	97.12 d	110.61 c	5.93 c	5.70 c	74.62 d	79.44 d
HA at 4 kg /fed.	50.26 c	47.81 c	109.18 c	118.01 b	6.59 b	6.06 c	82.73 c	83.65 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha) , Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Effect of magnetic iron(MI) and humic acid (HA)

Adding magnetic iron (MI) at 25 and 50 kg/fed. and humic acid (HA) at 2 and 4 kg/fed. to sweet pepper plants significantly increased plant height , number of leaves/ plant, number of branches/ plant and shoot dry weight at 90 days after transplanting compared to control (untreated) and MI at 50 kg /fed. gave the highest values followed by MI at 25 kg /fed. (Table 1). **Abd EL- Al (2003)** reported that the application of magnetite increased plant growth parameters of eggplant **. Ali *et al*. (2011**) proved plant growth of pepper (hybrid Bascar F_1) grown under saline irrigation conditions increased with different doses of magnetic treatments compared to control. These results may due to the magnetic iron and humic acid as soil conditioners decreased soil pH, EC, K, Na and Cl as shown in Table A, in turn, enhance absorption of available nutrients and increase plant growth of sweet pepper.

Effect of the interaction

Data in Table 2 show that adding MI and HA as soil conditioners with BC and PM increased plant growth of sweet pepper more than BC and PM only (without MI and HA). The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. gave the tallest plants and recorded maximum values of number of leaves/ plant , number of branches / plant and shoot dry weight/plant with no significant differences with the interaction between PM at 5.521ton/ fed. and MI at 25 kg /fed. with respect to plant height and number of branches / plant in both seasons. This means that the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. increased plant height and number of branches / plant , whereas the interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. increased number of branches / plant and shoot dry weight/ plant.

Table 2. Effect of the interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on plant growth of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments		Plant height (cm)		Number of leaves/ plant		Number of branches / plant		Shoot dry weight (g)	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	Untreated	40.07 h	41.60 f	87.90 h	94.03 f	4.91 e	4.91 e	65.74 g	71.20 h
	MI at 25 kg /fed.	46.83 e	48.33 cd	112.18 d	109.42 d	5.96 bcd	6.06 bc	84.64 c	80.38 e
	MI at 50 kg /fed.	49.08 d	49.71 bc	121.63 c	113.19 d	6.34 b	6.34 b	86.58 bc	85.82 d
	HA at 2 kg /fed.	42.41 g	42.94 f	95.04 g	99.15 ef	5.57 cde	5.57 cd	72.52 f	75.08 g
	HA at 4 kg /fed.	44.53 f	45.44 e	103.17 e	104.26 e	5.84 bcd	5.84 bcd	80.34 d	77.90 f
Poultry manure	Untreated	45.63 ef	47.11 de	95.28 g	115.19 d	5.29 de	5.29 de	72.28 f	75.60 fg
	MI at 25 kg /fed.	57.48 a	53.78 a	129.23 b	133.19 b	7.29 a	7.09 a	89.20 b	93.32 b
	MI at 50 kg /fed.	58.61 a	55.18 a	134.75 a	141.11 a	7.96 a	7.66 a	96.26 a	99.76 a
	HA at 2 kg /fed.	52.58 c	50.83 b	99.20 f	122.07 c	6.29 bc	5.84 bcd	76.72 e	83.80 d
	HA at 4 kg /fed.	56.00 b	50.18 bc	115.19 d	131.76 b	7.34 a	6.29 b	85.12 c	89.40 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha) , Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

2. Leaf pigments

Effect of organic nitrogen sources

The concentrations of chlorophyll a, b, total (a+b) and carotenoides in sweet pepper leaf tissues significantly increased with PM at 5.521 ton /fed. compared to BC at 9.890 ton /fed. at 90 days after transplanting in both seasons (Table 3)**.** The superiority of leaf pigments content by application of PM might be attributed that PM higher contains of P, K, microelements and organic matter than BC (Table B).

Effect of magnetic iron and humic acid

Magnetic iron and HA as soil conditioners increased the concentrations of chlorophyll a, b, total (a+b) and carotenoides in leaf tissues compared to control and MI at 50 and 25 kg /fed. gave the highest values with no significant differences between them (Table 3). This means that MI at 25 kg /fed. increased chlorophyll a, b, total (a+b) and carotenoides in leaf tissues.

Iron is an essential element for plants that plays a critical role in oxidizing and reducing systems. In addition, iron is a basic element in the synthesis of chlorophyll, which is essential for the maintenance of chloroplast structure and function (**Sawan *et al*., 2001**). Also, humic acid increased the antioxidant enzymes activity and caused the plant to absorb different nutrient elements, especially K, which is a major element in the synthesis of proteins and enzymes, and it was effective in coping with salinity stress and improving photosynthesis by helping the stomata to open more (**Mahmoudi *et al*., 2014**).

Effect of the interaction

The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. significantly increased the concentrations of chlorophyll a, b, total (a+b) and carotenoides in sweet pepper leaf tissues at 90 days after transplanting with no significant differences with the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. (Table 4). This means that the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. increased the concentrations of chlorophyll a, b, total (a+b) and carotenoides in sweet pepper leaf tissues.

3. N, P , K and Fe contents in shoots

Effect of organic nitrogen sources

Fertilizing with PM at 5.521 ton /fed. increased N, P K contents and Fe concentration in shoots of sweet at 90 days after transplanting in both seasons (Table 5). In this respect, the superiority of PM treatment on the nutritional status of sweet pepper plants might be due to their stimulating effect on plant growth rate and leaf pigments which in turn increase both N, P , K and Fe concentrations.

Table 3. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on leaf pigments (mg / g DW) of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments	Chlorophyll (a)		Chlorophyll (b)		Chlorophyll (a +b)		Carotenoids	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
	Effect of organic manure sources							
Botanical compost	2.63 b	2.92 b	1.69 b	1.41 b	4.32 b	4.34 b	1.56 b	1.78 b
Poultry manure	3.20 a	3.23 a	1.85 a	1.75 a	5.05 a	4.98 a	1.72 a	2.07 a
	Effect of magnetic iron and humic acid							
Untreated	2.52 c	2.70 d	1.32 e	1.42 c	3.84 d	4.13 d	1.37 c	1.61 d
MI at 25 kg /fed.	3.03 ab	3.26 a	1.96 b	1.65 a	4.99 ab	4.91 ab	1.81 a	2.06 ab
MI at 50 kg /fed.	3.18 a	3.40 a	2.14 a	1.73 a	5.32 a	5.13 a	1.92 a	2.11 a
HA at 2 kg /fed.	2.85 b	2.94 c	1.61 d	1.50 bc	4.46 c	4.44 c	1.46 c	1.86 c
HA at 4 kg /fed.	3.01 ab	3.09 b	1.82 c	1.60 ab	4.83 bc	4.70 bc	1.64 b	2.00 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Effect of magnetic iron and humic acid

Adding MI at 25 and 50 kg /fed. and HA at 2 and 4 kg /fed. as soil conditioners increased N, P , K and Fe contents in shoots compared to control and adding MI at 50 kg /fed. significantly increased , P , K and Fe contents in shoots with no significant differences with MI at 25 kg /fed. respecting N content in both seasons and Fe contents in the 2nd season (Table 5).

The positive impact of magnetic treated on absorption and movement of elements lead to increased nutrient content and higher rates of photosynthesis processes (**Marei *et al*., 2014**).

Effect of the interaction

Data in Table 6 indicate that the interaction between PM at 5.521 and MI at 50 kg /fed. significantly increased N, P, K contents and Fe concentration in shoots with no significant differences with the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. with respect to N content and Fe concentration in both seasons and with HA at 4 kg /fed. in the 2nd season regarding Fe concentration. This means that the interaction between PM at 5.521 and MI at 25 kg /fed. increased N content and Fe concentration, the interaction between PM at 5.521 and MI at 50 kg /fed. increased P and K contents in shoots of sweet pepper.

4. N, P and K uptake by shoots

Effect of organic nitrogen sources

The highest values of N, P and K uptake by shoots were obtained by fertilizing with PM at 5.521 ton /fed. compared to BC at 9.890 ton /fed. at 90 days after transplanting in both seasons (Table 7). In addition, applications of PM to sweet pepper plant promote the physiological, biochemical and metabolic processes, which in turn increased the mineral uptake by plant.

Effect of magnetic iron and humic acid

Soil application of sweet pepper plants with MI and HA at different rates increased N, P and K uptake by shoots compared to control treatment and MI at 50 kg /fed. significantly increased N, P and K uptake by shoots followed by MI at 25 kg /fed. in both seasons (Table 7). These results may be due to the magnetite and humic acid which reduced the harmful effect of salinity and decreased soil pH which, in turn, enhance absorption of available nutrients. The positive effect of magnetic therapy can be attributed to the paramagnetic properties of certain atoms in plant cells and certain pigments, such as chloroplasts. The magnetic properties of molecules influences their ability to attract and then change the magnetic field's energy to other energy types and to move it to other plant cell structures, thereby enabling them to be activated (**Aladjadjiyan, 2002**). These results are harmony with those reported by **Cimrin *et al.*(2010)** on pepper and **Ramadan, (2012)** on cabbage).

Table 4. Effect of the interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on leaf pigments (mg / g DW) of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments		Chlorophyll a		Chlorophyll b		Chlorophyll a +b		Carotenoids	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	Untreated	2.30 f	2.56 f	1.27 e	1.28 e	3.57 f	3.84 f	1.32 f	1.51 e
	MI at 25 kg /fed.	2.81 cde	3.13 cd	1.87 c	1.49 cd	4.68 b-e	4.62 cd	1.68 bcd	1.91 bc
	MI at 50 kg /fed.	2.84 cd	3.22 bc	2.03 b	1.54 cd	4.87 bc	4.76 bcd	1.83 ab	1.97 b
	HA at 2 kg /fed.	2.54 ef	2.79 e	1.58 d	1.35 de	4.12 def	4.14 ef	1.43 ef	1.73 d
	HA at 4 kg /fed.	2.67 de	2.94 de	1.72 d	1.42 de	4.39 cde	4.36 de	1.55 cde	1.82 cd
Poultry manure	Untreated	2.74 de	2.85 e	1.38 e	1.57 cd	4.12 ef	4.42 de	1.43 ef	1.72 d
	MI at 25 kg /fed.	3.25 ab	3.40 ab	2.05 b	1.81 ab	5.30 ab	5.21 ab	1.94 a	2.22 a
	MI at 50 kg /fed.	3.52 a	3.58 a	2.25 a	1.92 a	5.77 a	5.50 a	2.02 a	2.26 a
	HA at 2 kg /fed.	3.16 bc	3.09 cd	1.65 d	1.66 bc	4.81 bcd	4.75 cd	1.49 def	2.00 b
	HA at 4 kg /fed.	3.36 ab	3.25 bc	1.92 bc	1.79 ab	5.28 ab	5.04 bc	1.73 bc	2.19 a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 5. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on N, P, K and Fe contents in shoots of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments	N		P		K		Fe (ppm)	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
	Effect of organic manure sources							
Botanical compost	2.28 b	2.29 b	0.246 b	0.278 a	2.51 b	2.64 b	52.06 b	59.60 b
Poultry manure	2.42 a	2.55 a	0.299 a	0.291 a	2.87 a	3.02 a	57.40 a	69.26 a
	Effect of magnetic iron and humic acid							
Untreated	2.07 d	2.02 d	0.207 e	0.203 e	2.15 d	2.34 e	45.83 e	53.83 d
MI at 25 kg /fed.	2.48 a	2.65 a	0.304 b	0.315 b	2.96 a	3.07 b	60.33 b	68.83ab
MI at 50 kg /fed.	2.55 a	2.75 a	0.340 a	0.348 a	3.03 a	3.28 a	64.16 a	70.50 a
HA at 2 kg /fed.	2.25 c	2.23 c	0.247 d	0.267 d	2.57 c	2.55 d	48.67 d	62.17 c
HA at 4 kg /fed.	2.40 b	2.46 b	0.268 c	0.289 c	2.75 b	2.93 c	54.67 c	66.83 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical ompost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 6. Effect of interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on N, P, K and Fe contents in shoot of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments		N		P		K		Fe (ppm)	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	**Untreated**	1.99 g	1.90 f	0.192 f	0.208 h	2.09 f	2.20 f	44.00 g	50.33 e
	MI at 25 kg /fed.	2.40 cd	2.53 c	0.261 d	0.306cd	2.79 c	2.87 cd	56.00 d	63.67bc
	MI at 50 kg /fed.	2.50 abc	2.64 bc	0.295 c	0.335 b	2.82 c	3.05 c	61.00bc	65.67b
	HA at 2 kg /fed.	2.20 ef	2.13 e	0.233 e	0.259 g	2.32 e	2.33 ef	47.67 f	57.67d
	HA at 4 kg /fed.	2.33 d	2.28 de	0.252 d	0.282ef	2.54 d	2.78 d	51.67 e	60.67cd
Poultry manure	**Untreated**	2.16 f	2.14 e	0.222 e	0.198 h	2.22 ef	2.49 e	47.67fg	57.33 d
	MI at 25 kg /fed.	2.57 ab	2.77 ab	0.347 b	0.325bc	3.13 a	3.28 b	64.67ab	74.00 a
	MI at 50 kg /fed.	2.60 a	2.87 a	0.385 a	0.362 a	3.24 a	3.51 a	67.33 a	75.33 a
	HA at 2 kg /fed.	2.31 de	2.33 d	0.261 d	0.275fg	2.83 c	2.78 d	49.67 ef	66.67 b
	HA at 4 kg /fed.	2.47 bc	2.64 bc	0.284 c	0.296de	2.97 b	3.08 c	57.67cd	73.00 a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 7. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on N, P and K uptake (mg) of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments	N		P		K	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
			Effect of organic manure sources			
Botanical compost	1794.3 b	1798.8 b	194.79 b	219.14 b	1980.0 b	2081.2 b
Poultry manure	2046.2 a	2275.7 a	256.51 a	261.84 a	2442.9 a	2705.6 a
			Effect of magnetic iron and humic acid			
Untreated	1434.7 e	1468.7 e	143.34 e	148.89 e	1489.3 e	1724.4 e
MI at 25 kg /fed.	2161.9 b	2309.3 b	265.21 b	274.63 b	2576.7 b	2683.9 b
MI at 50 kg /fed.	2333.6 a	2564.4 a	313.01 a	324.31 a	2780.2 a	3059.5 a
HA at 2 kg /fed.	1683.8 d	1775.9 d	184.61 d	212.46 d	1926.8 d	2039.5 d
HA at 4 kg /fed.	1987.2 c	2068.1 c	222.10 c	242.15 c	2284.4 c	2459.6 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha) , Compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Effect of the interaction

Adding some conditioners as MI and HA to BC and PM increased N, P and K uptake by shoots compared to BC and PM only (without MI and HA) at 90 days after transplanting in both seasons (Table 8). The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. increased N, P and K uptake by shoots followed by the interaction between PM at 5.521 and MI at 25 kg /fed. in both seasons. The stimulative effect of the interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. on N, P and K uptake by shoots may be due to that the interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed increased shoot dry weight as shown in Table 2 .

Iron oxide minerals have the most reactive surface sites among inorganic minerals existing in the environment and are capable of binding natural inorganic and organic materials, including cations and anions. The electrostatic forces between metal ion and surface charge in the presence of Fe2+ of magnetite attributed to such an excellent adsorption behavior (**Ahmed *et al.*, 2013).**

Table 8. Effect of interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on N, P and K uptake (mg) of sweet pepper (cv. top star) at 90 days after transplanting during 2020 and 2021 seasons

Treatments		N		P		K	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	**Untreated**	1308.2 g	1319.5 i	126.22 g	148.10 g	1374.0 g	1566.4 f
	MI at 25 kg /fed.	2031.4 d	2033.6 e	220.91 d	245.96 cd	2361.5 d	2306.9 d
	MI at 50 kg /fed.	2164.5 bc	2265.7 d	255.41 c	287.50 b	2441.6 cd	2617.5 c
	HA at 2 kg /fed.	1595.4 f	1599.2 h	168.97 f	194.46 f	1682.5 f	1749.4 e
	HA at 4 kg /fed.	1871.9 e	1776.1 g	202.46 e	219.68 e	2040.6 e	2165.6 d
Poultry manure	**Untreated**	1561.3 f	1617.8 h	160.46 f	149.69 g	1604.6 f	1882.4 e
	MI at 25 kg /fed.	2292.4 b	2585.0 b	309.52 b	303.29 b	2792.0 b	3060.9 b
	MI at 50 kg /fed.	2502.8 a	2863.1 a	370.60 a	361.13 a	3118.8 a	3501.6 a
	HA 2 kg /fed.	1772.2 e	1952.5 f	200.24 e	230.45 de	2171.2 e	2329.6 d
	HA 4 kg /fed.	2102.5 cd	2360.2 c	241.74 c	264.62 c	2528.1 c	2753.5 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

5. Yield and its components and nitrogen use efficiency

Effect of organic nitrogen sources

Fertilizing sweet pepper plants with PM at 5.521 ton /fed. gave higher average fruit weight , yield / plant and total yield / fed. than BC at 9.890 ton /fed. in both seasons (Table 9). The increase in total yield for PM at 5.521 ton /fed. were about 0.499 and 0.794 ton /fed. over BC at 9.890 ton /fed. in the 1st and 2nd seasons, respectively.

PM higher contains of P and K , in addition to these, it is, also, contains micro nutrients. It is a good source of organic matter (Table B) than BC , which acts as a store house of all plant nutrients including trace elements might have released them gradually and steadily and this contributed towards the balanced nutrition of crop which resulted in maximum fruit yield**.**

Adhikari *et al*. (2016) revealed better yield of sweet pepper performance by vermi-compost followed by poultry manure over control. **Atta Pouk Snr *et al*. (2020**) showed that 10 t/ha PM recorded the highest average fruit weight and fruit yield of sweet pepper while the control treatment recorded the least in all traits. Respecting nitrogen use efficiency (NUE), data in Table 9 indicate that the highest NUE by sweet pepper plants (60.059 kg fruits/ 1 kg N as average of the two seasons) was obtained by fertilizing with N at 180 kg /fed. in the from of PM at 5.521 ton /fed. compared to N at 180 kg /fed. in the form of BC at 9.890 ton /fed. (56.468 kg fruits/ 1 kg N as average two seasons).

Effect of magnetic iron and humic acid

Adding MI at 25 and 50 kg /fed. and HA at 2 and 4 kg/fed. to sandy soil before planting significantly increased average fruit weight , yield / plant and total yield / fed. compared to control treatment (Table 9). MI at 50 kg /fed. increased average fruit weight , yield / plant and total yield / fed. followed by MI at 25 kg /fed. in both seasons. The increases in total yield/fed. were about 1.417 and 1.181 for MI at 25 kg /fed., 1.731 and 1.962 ton /fed. for MI at 50 kg /fed.,0.742 and 0.818 ton /fed. for HA at 2 kg /fed. and 1.259 and 1.110 ton /fed. for HA at 4 kg /fed. over the control treatment in the 1st and 2nd seasons, respectively. As for NUE, adding soil conditioners as MI and HA increased NUE by sweet pepper plants, where MI at 50 kg /fed. gave the highest NUE followed by MI at 25 kg /fed. in both seasons.

The favourable benefits of magnetic treatment are due to the paramagnetic properties of a small number of atoms in plant cells and a small number of pigments, such as chloroplasts. The ability of molecules to absorb magnetic field energy, transform it into other forms of energy, and convey it to other plant cell structures where it can activate other cell structures depends on their magnetic properties. **(Aladjadjiyan, 2002)**. Among the inorganic minerals found in the environment, iron oxide minerals have the most reactive surface sites and are capable of binding natural inorganic and organic substances, including cations and anions. In the presence of Fe^{++} from magnetite, electrostatic interactions between metal ions and surface charge contributed to the good adsorption behaviour. **(Ahmed *et al*., 2013)**.

In the same line , **Abd EL- Al (2003)** reported that the application of magnetite increased yield and its components of eggplant**.** Soil HA applications led to significantly higher mean fruit weight, and early and total yield of pepper than for control (**Karakurat *et al* . 2009**) .Crop yield of pepper (hybrid Bascar F1) grown under saline irrigation conditions increased with different doses of magnetic treatments compared to control **(Ali *et al*., 2011**).

Table 9. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on yield and its components of sweet pepper (cv. top star) during 2020 and 2021 seasons

Treatments	Average fruit weight (g)		Yield / plant (g)		Total yield (ton/fed.)		Nitrogen use efficiency (NUE) (kg fruit/ one unit of N)	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
	Effect of organic manure sources							
Botanical compost	24.59 b	25.66 b	516.56 b	508.79 b	10.241b	10.087 b	56.895 b	56.041 b
Poultry manure	25.63 a	26.23 a	544.86 a	547.91 a	10.740 a	10.881 a	59.669 a	60.449 a
	Effect of magnetic iron and humic acid							
Untreated	23.70 d	24.51 c	477.79 d	478.24 d	9.461 d	9.470 d	52.559 d	52.609 d
MI at 25 kg /fed.	25.44 b	25.80 b	547.74b	536.33 b	10.878 b	10.651 b	60.433 b	59.175 b
MI at 50 kg /fed.	26.05 a	26.90 a	563.85 a	575.90 a	11.192 a	11.432 a	62.181 a	63.508 a
HA at 2 kg /fed.	24.79 c	26.01 b	513.46 c	517.73 c	10.203 c	10.288 c	56.683 c	57.156 c
HA at 4 kg /fed.	25.58 b	26.50 a	550.71ab	533.57 b	10.720 b	10.580 b	59.556 b	58.778 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Effect of the interaction

Adding soil conditioners as MI and HA at different rates with BC and PM increased average fruit weight, yield / plant and total yield / fed. compared to adding BC and PM only (Table 10). Fertilizing sweet pepper plants with 180 kg N /fed. in the form of PM at 5.521 ton /fed. gave the highest average fruit weight , yield / plant and total yield / fed. under different rates of MI and HA than 180 kg N/fed. in the form of BC at 9.890 ton /fed. under the rates rates of MI and HA. The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. increased average fruit weight(26.83 g as average two seasons) , yield / plant (0.583 kg as average two seasons) and total yield / fed. (11.61 ton as average two seasons) followed by the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. in both seasons. The stimulative effect of the interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. on total yield may be due to that the interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. increased shoot dry weight (Table 2), N,P and K uptake (Table 3),average fruit weight and NUE (Table 10). Respecting NUE, fertilizing sweet pepper plants with 180 kg N/fed. in the form of PM at 5.521 ton /fed. and MI at 50 kg /fed. as soil conditioners gave the highest NUE (64.472 kg fruits/1 kg N as average two seasons) followed by PM at 5.521 ton /fed. and MI at 25 kg /fed. (61.005 kg fruits/1 kg N as average two seasons).

6. Fruit traits

Effect of organic nitrogen sources

There were no significant differences between BC and PM in number of fruits/ plant, while PM at 5.521 ton /fed. gave higher fruit length and fruit diameter than BC at 9.890 ton /fed. in both seasons (Table 11).

Effect of magnetic iron and humic acid

Adding MI and HA as soil conditioners significantly increased number of fruits/ plant, fruit length and fruit diameter compared to control treatment and MI at 50 kg /fed. gave the highest values followed by MI at 25 kg /fed. (Table 11). The increase in fruit length and diameter due to magnetite and humic acid applications is probably ascribed to improve the absorption of mineral nutrients under salt stress conditions. However, the possible hormone-like activity of the humic acid (i.e., auxin-, gibberellin and cytokinin-like activity), should also be taken into consideration (**El-Zaawely *et al.*, 2013**).

Table 10. Effect of interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on yield and its components of sweet pepper (cv. top star) during 2020 and 2021 seasons

Treatments		Average fruit weight (g) 2020 season	Average fruit weight (g) 2021 season	Yield / plant (g) 2020 season	Yield / plant (g) 2021 season	Total yield (ton/fed.) 2020 season	Total yield (ton/fed.) 2021 season	Nitrogen use efficiency (NUE) (kg fruit/ one unit of N) 2020 season	Nitrogen use efficiency (NUE) (kg fruit/ one unit of N) 2021 season
Botanical compost	**Untreated**	23.49 e	24.10 f	473.36 d	461.78 e	9.362 f	9.133 g	52.011 d	50.739 f
	MI at 25 kg /fed.	25.19 bc	25.28 de	544.17 bc	517.31 c	10.815 bc	10.282 d	60.083 b	57.122 d
	MI at 50 kg /fed.	25.47 b	26.74 ab	553.02 ab	558.60 b	10.964 bc	11.074 b	60.911 ab	61.522 bc
	HA at 2 kg /fed.	24.17 d	25.78 cd	486.80 d	496.28 d	9.688 e	9.876 f	53.822 d	54.867 e
	HA at 4 kg /fed.	24.67 cd	26.40 ab	525.43 c	509.99 cd	10.377 d	10.072 e	57.650 c	55.956 de
Poultry manure	**Untreated**	23.92 de	24.93 e	482.21 d	494.69 d	9.559 ef	9.806 f	53.106 d	54.478 e
	MI at 25 kg /fed.	25.69 b	26.32 bc	551.31 bc	555.35 b	10.941 bc	11.021 b	60.783 b	61.228 bc
	MI at 50 kg /fed.	26.64 a	27.06 a	574.67 a	593.20 a	11.421 a	11.789 a	63.450 a	65.494 a
	HA at 2 kg /fed.	25.42 bc	26.25 bc	540.11 bc	539.18 b	10.718 c	10.700 c	59.544 bc	59.444 c
	HA at 4 kg /fed.	26.50 a	26.61 ab	576.00 a	557.15 b	11.063 b	11.088 b	61.461 ab	61.600 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 11. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on fruit traits of sweet pepper (cv. top star) during 2020 and 2021 seasons

Treatments	Fruit No/ plant 2020 season	Fruit No/ plant 2021 season	Fruit length (cm) 2020 season	Fruit length (cm) 2021 season	Fruit diameter (cm) 2020 season	Fruit diameter (cm) 2021 season
	Effect of organic manure sources					
Botanical compost	20.98 a	19.81 a	7.77 b	8.41 b	4.78 b	5.05 b
Poultry manure	21.23 a	20.86 a	9.62 a	9.22 a	5.62 a	5.90 a
	Effect of magnetic iron and humic acid					
Untreated	20.15 c	19.50 e	7.81 c	6.87 d	4.46 e	5.03 e
MI at 25 kg /fed.	21.53 a	20.78 b	8.74 b	9.34 b	5.41 b	5.50 c
MI at 50 kg /fed.	21.64 a	21.40 a	9.56 a	9.87 a	5.69 a	5.85 a
HA at 2 kg /fed.	20.69 b	19.89 d	8.53 b	8.85 c	5.16 d	5.34 d
HA at 4 kg /fed.	21.52 a	20.13 c	8.84 b	9.18 bc	5.31 c	5.66 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Effect of the interaction

The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. significantly increased number of fruits/ plant(21.74 fruits as average two seasons) , fruit length and fruit diameter, followed by the interaction between PM at 5.521 ton /fed. and MI at 25 kg /fed. in both seasons (Table 12).

7. Fruit quality

Effect of organic nitrogen sources

Fertilizing sweet pepper plants with N in the form of PM at 5.521 ton /fed. significantly increased dry matter (%) TSS and Vit. C in fruits and significantly decreased nitrate contents in fruits as compared to BC at 9.890 ton /fed. (Table 13). The improvement in ascorbic acid content (Vit C) in pepper fruits with poultry manure perhaps this is due to the slow decomposition that leads to continuous supply of all major and micro-nutrients, which might have helped in the assimilation of carbohydrates and in turn synthesis of ascorbic acid (**Bade *et al*., 2017**). This results agree with those obtained with **Alkharpotly (2018)** on sweet pepper.

Effect of magnetic iron and humic acid

Adding MI and HA at different rates increased dry matter (%) , TSS and Vit. C in fruits and decreased nitrate contents in fruits compared to control treatment and MI at 50 kg /fed. significantly increased dry matter and TSS, whereas HA at 4 kg /fed. significantly increased Vit. C in fruits and decreased nitrate content in fruits (Table 13). Fruit quality of pepper (hybrid Bascar F_1) increased with different doses of magnetic treatments compared to control (**Ali *et al*., 2011**). In this regard**, Hafez and Soubeih (2012)** indicated that application either of magnetite or humic acids increased P and K and decreased NO_3 of eggplant fruits.

Effect of the interaction

The interaction between PM at 5.521 ton /fed. and MI at 50 kg /fed. increased dry matter (9.46 %) and TSS (6.65 Brix º) as average two seasons, whereas the interaction between PM at 5.521 ton /fed. and HA at 4 Kg /fed. increased Vit.C (134.57 mg/100 g FW) and decreased nitrate content (5.14 mg/kg FW) as average two seasons in fruits (Table 14).

Table 12. Effect of the interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid fruit traits of sweet pepper (cv. top star) during 2020 and 2021 seasons

Treatments		Fruit No/ plant		Fruit length (cm)		Fruit diameter) (cm)	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	Untreated	20.15 c	19.16 e	7.19 f	6.77 f	4.46 g	4.91 g
	MI at 25 kg /fed.	21.60 ab	20.46 c	7.40 f	9.00 cd	5.07 d	4.77 g
	MI at 50 kg /fed.	21.71 a	20.89 b	8.85 cd	9.58 ab	4.87 e	5.26 e
	HA at 2 kg /fed.	20.14 c	19.25 e	7.60 f	8.23 e	4.72 f	5.07 f
	HA at 4 kg /fed.	21.30 b	19.32 e	7.82 ef	8.51 de	4.82 ef	5.26 e
Poultry manure	Untreated	20.16 c	19.84 d	8.43 de	6.97 f	4.46 g	5.16 ef
	MI at 25 kg /fed.	21.46 ab	21.10 b	10.08 ab	9.68 ab	5.75 b	6.23 b
	MI at 50 kg /fed.	21.57 ab	21.92 a	10.28 a	10.16 a	6.51 a	6.44 a
	HA at 2 kg /fed.	21.25 b	20.54 c	9.46 bc	9.48 bc	5.61 c	5.61 d
	HA at 4 kg /fed.	21.74 a	20.94 b	9.87 ab	9.85 ab	5.80 b	6.06 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Boranical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 13. Effect of organic nitrogen sources and treated with magnetic iron and humic acid on fruit quality of sweet pepper during 2020 and 2021 seasons

Treatments	Dry matter (%)		TSS % (Brix)		Vit. C (mg/100 g FW)		Nitrate contents (mg/kg FW)	
	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
	Effect of organic manure sources							
Botanical compost	7.19 b	7.79 b	4.92 b	5.19 b	116.22b	112.77b	8.34 a	9.37 a
Poultry manure	8.91 a	8.54 a	5.78 a	6.06 a	122.00a	122.45a	6.23 b	6.23 b
	Effect of magnetic iron and humic acid							
Untreated	7.23 e	6.36 e	4.59 e	5.18 e	107.70d	101.88e	8.12 a	8.35 a
MI at 25 kg /fed.	8.09 c	8.64 b	5.56 b	5.66 c	113.90c	106.50d	7.74 b	8.18 b
MI at 50 kg /fed.	8.85 a	9.14 a	5.85 a	6.01 a	121.80b	122.67c	7.35 c	7.85 c
HA at 2 kg /fed.	7.90 d	8.20 d	5.31 d	5.49 d	122.75b	125.75b	6.93 d	7.51 d
HA at 4 kg /fed.	8.19 b	8.50 c	5.45 c	5.82 b	129.40a	131.25a	6.28 e	7.10 e

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Table 14. Effect of interaction between fertilizing with organic nitrogen sources and treated with magnetic iron and humic acid on fruit quality of sweet pepper during 2020 and 2021 seasons

Treatments		Dry matter (%)		TSS % (Brix)		Vit. C (mg/100 g FW)		Nitrate contents (mg/kg FW)	
		2020 season	2021 season	2020 season	2021 season	2020 season	2021 season	2020 season	2021 season
Botanical compost	**Untreated**	6.66 j	6.27 g	4.59 g	5.05 gh	105.10 f	100.25 g	9.10 a	9.75 a
	MI at 25 kg /fed.	6.85 i	8.33 d	5.21 d	4.91 h	112.20 e	102.00 g	8.83 b	9.52 b
	MI at 50 kg /fed.	8.19 e	8.87 c	5.01 e	5.41 e	116.20 d	116.58 e	8.42 c	9.32 c
	HA at 2 kg /fed.	7.04 h	7.62 f	4.85 f	5.21 fg	120.20 c	120.25 d	7.90 d	9.24 c
	HA at 4 kg /fed.	7.24 g	7.88 e	4.95 ef	5.41 e	127.40 b	124.75 c	7.47 e	9.02 d
Poultry manure	**Untreated**	7.81 f	6.45 g	4.59 g	5.31 ef	110.30 e	103.50 g	7.15 f	6.95 e
	MI at 25 kg /fed.	9.33 b	8.96 bc	5.92 b	6.41 b	115.60 d	111.00 f	6.65 g	6.85 e
	MI at 50 kg /fed.	9.52 a	9.41 a	6.69 a	6.62 a	127.40 b	128.75 b	6.29 h	6.38 f
	HA at 2 kg /fed.	8.76 d	8.78 c	5.77 c	5.77 d	125.30 b	131.25 b	5.97 i	5.79 g
	HA at 4 kg /fed.	9.14 c	9.12 b	5.96 b	6.23 c	131.40 a	137.75 a	5.10 j	5.18 h

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
Recommended rate , 180 kg N/fed. (0.42 ha), Botanical compost (1.86 % N) =.9.890 ton /fed. and poultry manure (3.26 % N) = 5.521 ton /fed. , MI= magnetic iron and HA= humic acid

Conclusion

From the foregoing results, it could be concluded that fertilizing sweet pepper cv Top Star grown in sandy soil during summer plantations with poultry manure at 5.521 ton /fed. (equal 180 kg N/fed.) and magnetic iron at 50 kg /fed. as soil amendments was the best treatment for increasing growth, yield, fruit quality and nitrogen use efficiency.

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RESEARCH ARTICLE

The effect of some soil conditioners on the yield and quality of sweet pepper grown under saline soil conditions using two sources of organic nitrogen fertilizers

Authors' contributions

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