Impact of bio and organic adamants and per-sowing seeds magnetic field together with mineral nitrogen fertilizer on some soil physical and chemical properties and faba bean productivity under saline soil conditions.

ABSTRACT.

Two filed experiments were conducted at Sahl- El-Hussinia , agricultural research station, El-Sharkia Governorate, Egypt, 31^{o} - 8' – 12.461'' N and 31^{o} - 52' – 15.469 E. during two successive winter seasons 2020/2021 and 2021/ 2022 , for studying the effective of used bio-fertilizer (Rhizobium radiobacter Sp.strain**(**Salt Tolerant PGPR),humate potassium and pre-sowing seeds faba bean magnetic field different times (5, 10 and 15 min) combined with mineral N fertilizer at rates (15, 30 and 45 N kg/fed) on some soilchemical and physical properties and faba beanquality andproductivity .The studied treatments were arranged within the experimental units in a split split plot design in three replicates.Results indicated that the all treatments had improved soil properties decreased soil salinity and soil pH soil and EC values decreased related to different treatments using foliar applicationreporting EC decreased value from (11.88 to 11.28) dS/m,pHsoil decreased slightly this maybe inverted to the activity of microorganisms .were achievedincreased OM% from (0.57 to 0.54) related to application of bio fertilizer and humatesas compared mineral fertilizer and control,CEC from (43.92 to 41.84) Mol/kg, respectivelyapplication. the superior impact was increased the soil total porosity values compared to other treatments and control, moreover, the Data obtained that the values of drainable pores (DP) and water holding pores (WHP) were higher than the other pores in different treatments. The results also found that the effect of physical properties on magnetic field strength (MFS) has a marked influence on the magnetization effect, the optimal magnetizing condition was the magnetic field was maximized in a time of 15 minutes.The data explained that the application of all amendments decreased soil HC (cm h^{-1}) values when compared to the control. The improvement perwise the pronounced decrease in hydraulic conductivity of the studied soil may be attributed to the creation of QDP point, and the dominance of SDP point and QDP point compared with other pore sizes and the value of bulk density is decreased by adding the application of all amendments as Bio-fertilizer and humate potassium as compare with all treatments and control, while the total porosity and capillary porosity increased in the plow layer of soiland other yield components as affected with humate potassium combined with 45 kg mineral N fertilizers under magnetic field at 15 min compared other treatments.Finally, The superior influence faba bean quality was bio-fertilizer and potassium humate as will as presowing seed magnetic field at 15 min.

Word key: Soilchemical-physical properties, faba bean productivity, bio-fertilizer, mineral N fertilizer, pre-sowing seeds magnetic field.

INTRDUCTION

Fifty-five percent of the cultivated lands of the northern Delta region, 20% of the southern Delta and middle Egypt region, and 25% of the Upper Egypt regions are salt-affected soils. Port-Said area parallels to the Suez Canal is one of the newly reclaimed saline's that also faces salinity problems. Moreover, the northern regions are mainly saline or saline-sodic soils with heavy texture in Egypt**(Shaban *et al*, 2012).**

Faba bean (Vicia faba L.) has potential as a source of nutrition for human feed, and as a N_2 – fixing, legume can also play an essential role in enhancing soil fertility. The cultivated area of faba bean decreased in the last ten years in Egypt from 71445 to 32532/ha **FAOSTAT (2017).**

The magnetic fields for 10 min were increase of germination index, germination energy and final germination percentage with increase time **(Iqbal*et al*, 2012).** Treating of seeds with a magnetic field considerably increased the amount of indole-3-acetic acid and gibberellic acid in germinating seeds, above-ground parts and in roots of faba bean seedlings. The pre-sowing treatment with a magnetic field had favorable effects on the growth and development of seedlings **(Podleśna *et al*, 2019).**Magnetic treatments are assumed to enhance seed vigor by influencing of the involve free radicals' production, and by stimulating the activity of carbohydrate and proteins **(Michalak *et al*, 2019).** The treated with magnetic field led to increase concentration of secondary metabolites, enzymatic activity, and anti-oxidative capacity **(Konefal-Janoca*et al*, 2019).**

Egypt is considered to be a heavy user of chemical fertilizers especially nitrogen followed by phosphorous then potassium. The consumed amount of NPK in 2002 was 488 kg/ha. The production of chemical nitrogenous fertilizers in 2002 in thousand tons was 1645 Ammonia, 1865 Urea and 1070 Ammonium nitrate, since the production of phosphate fertilizers also in thousand tons was 1670 Rock phosphate, 20 phosphoric acids,940 single Super phosphate 15% P_2O_5 and 50 concentrated Super phosphate (37%P_2O_5), while the imported Potassium Sulfate (48% K_2O) was 80000 tons. The consumed, N: P_2O_5: K_2O ratio was 63:12:1 in 1981 and declined to 36:5:1 in 2002 due to the high consumed SOP in the last 20 years, **(Abd El-Hadi ,2004).**Nitrogen, phosphorus and potassium are key nutrients that play a major role in crop production on intensively cultivated soils. The soil fertility is directly influenced by the type of fertilizer inputs, **(Harleen *et al*,2017).**Sole utilization of chemical fertilizers frequently decays soil fertility and the resultant harvest efficiency because of supplement irregularity in the soil, which has been perceived as a standout amongst the most imperative factors that limit crop yield. Along these lines, the utilization of chemical fertilizer may not keep pace with time in support of soil well-being for maintaining the efficiency, **(Moreira *et al*, 2014).**

Biofertilizers are play an important role in increasing availability of nitrogen and phosphorus by improving biological fixation of atmospheric nitrogen as well as enhancing phosphorus availability to crop **(Bhat *et al*, 2013).**The application of Rhizobium Azotobacter and phosphate solubilizing bacteria (PSB) increased pea growth, yield, number of pods/ plant; number of seeds/pod, pod length and1000 grain compared untreated **(Rather *et al*, 2010).**

Potassium humate (HA) is important component produced by the chemical and biological decomposition of organic material through the help of micronutrients. Potassium humate is a vital component of soil organic matter which improves the growth of many plant species. It enhances soil fertility and improves physical and chemical characteristics of soil, like permeability, aeration, aggregation, water holding capacity, ion transport and availability through pH buffering **(Afifi *et al*, 2010).**Humic acid (HA) modifies the physical, chemical, and biological conditions in soil and affect the solubility of many nutrient elements by building complex forms or chelating with metal cations that improve the crop yield by forming aqueous complexes with micronutrients and enzymatically active complexes, which can be carrying on reactions that are usually assigned to the metabolic activity of living microorganisms. **(Verlinden*et al*,2009).** Potassium humate application, irrespective of the rate used, increased canopy dry weight and leaves area plant^{-1} over the control**(Barakat *et al* 2015).**The application of bio-fertilizers and humic acid were significant increase of available N, P, K,Fe, Mn and Zn in soil**(Alakdar *et al* 2020).**

MARTIALS AND METHODS

A Field experiment was conducted in clay saline soil at Sahl El-Hussinia, Agric. Res. Station, Centre in El-Sharkia Governorate, Egypt; during the two winter seasons 2020/2021 and 2021/2022 respectively to evaluation using humate potassium or bio-fertilizers and pre-sowing seeds faba bean magnetic field combined with or without mineral N fertilizers different rates on some soil properties and Faba bean (Vicia faba L.) productivity under saline soil conditions. The experimental site is located at Khaled ben El-Waled village, Sahl El-Hussinia 31^{o} - 8' – 12.461" N and 31^{o}- 52' – 15.469 E. The field experiments were arranged in a split split plot design with three replicates.

Some soil physical and chemical properties of studies soil before planting, Samples were air dried, crushed, sieved to pass through a 2.0mm sieve and analyzed for their chemical and physical properties were according to the standard methods outlined by **Page *et al*. (1982) and Klute (1986). andCottenie*et al* (1982).**

Table 1. Physical and chemical properties in soil study in Sahl El-Hussinia.

Coarse sand (%)	**Fin sand (%)**	**Silt (%)**	**Clay (%)**	**Texture**			**O.M (%)**	**$CaCO_3$ (%)**
5.62	**22.5**	**30.8**	**41.08**	**Clay**			**0.57**	**13.45**
	EC	**Cations (meq/l)**				**Anions (meq/l)**		
pH (1:2:5)	**(dS/m)**	**Ca^{++}**	**Mg^{++}**	**Na^{+}**	**K^{+}**	**HCO_3^{-}**	**Cl^{-}**	**SO_4^{--}**
8.16	**11.88**	**16.33**	**22.4**	**80.07**	**0.82**	**13.55**	**72.3**	**32.95**
Available macronutrients (mg/kg)			**Available micronutrients (mg/kg)**					
N	**P**	**K**	**Fe**	**Mn**	**Zn**			
36.77	**4.33**	**185**	**6.2**	**3.14**	**0.55**			

<u>*Physical Soil analysis</u>

***Bulk density** was determined using undisturbed soil samples according to **Klute (1986).**

****Soil moisture** characteristics curves were determined using the pressure cooker under 0.001, 0.10, 0.33, 0.66, 1.0, 3.0 and 15.0 atmosphere according to**Klute (1986).**

*****Hydraulic conductivity** was conducted according to **Black (1965) using falling head method, the governing equation is: -**

K=(al\At) In (H1\H2)

Where:

a= is the area of cross section of the stand pipe.

L=is the length of the sample.

A=is he cross sectional area of the sample

t= is the time for the hydraulic head difference to decrease from H1toH2.

****Soil chemical analysis**

Chemical characteristics were determined according to **Page *et al*. (1982)** as follows:

***** Total Soluble salts was determined as **EC** in the soil paste extract by electricalconductivity method.

*** Hydrogen ion activity (pH)** was measured in 1:2.5 soil: water suspension using **pH** meter.

*** Carbonate and bicarbonates**were determined in soil paste extract by titration against 0.01Msulphuric acid in presence of Phenolphthalein(phth)and methylorange (MO) indicators, respectively

*** Calcium and magnesuim**were determined in soil paste extract using the titration methods by versinate (0.01M) in presence of ammonium purpurate (murexide) and Erichrome black T (EBT), respectively.

*** Chloride concentration** was determined in soil paste extract using the silver nitrate (0.01M) in presence of potassium chromate as an indicator.

*** Sulphate** was calculated by subtracting total summation of total determined soluble anions from summation of total soluble cations.

*** Sodium and potassium** were determined in soil paste extract by using flame photometer.

*** The Organic matter** was determinate by the Walkely and Black methods.

* Cation Exchange Capacity **(CEC)** was determined using ammonium acetate (pH= 7) and sodium acetate (pH=8.2).

*** Exchangeable sodium** was determined using ammonium acetate.

The soil physical and chemical analyses of the experimental site are presented in Table (5,6,7,8,9). Physical parameters were determined according to the methods of **Haluschak (2006),** while chemical was according to **Reeuwijk (2002).** Organic fertilizer: potassium humate from Agricultural Research Center (ARC) at Giza governorate – Egypt.

Table 2.The chemical analyses of used k-humates were shown in Table as below.

Parameters	**Values**	**Parameters**	**values**
pH	**8.1**	**P mg L-1**	**9.6**
OC %	**0.63**	**Ca mg L-1**	**400**
OM %	**1.08**	**Mg mg L-1**	**336**
C/N	**1.21**	**Fe mg L-1**	**10.9**
N %	**0.52**	**Mn mg L-1**	**1.7**
K %	**4**	**Zn mg L-1**	**0.3**
Na %	**0.83**	**Cu mg L-1**	**0.5**

Table 3. The chemical analyses of used k-humatesasMacronutrients and Micronutrients were shown in Table as below.

pH	**EC (dsm^{-1})**	**O.M (%)**	**Macronutrients (%)**			**Micronutrients (mg/kg)**		
			N	**P**	**K**	**Fe**	**Mn**	**Zn**

7.6	**2.14**	**77.2**	**2.33**	**0.45**	**3.75**	**420**	**270**	**188**

*****Field plantation experiment: -**

Seeds of the faba bean (Vicia faba L.) varietyGiza 843 were supplemented from the Field Crop Research Intitule, Agricultural Research center, Giza, Egypt. Bio-fertilizers were *Rhizobium radiobacter* Sp strain **(**Salt Tolerant PGPR). The bio- fertilizers were obtained from Department of Microbiology, Soils, Water and Environment Research Institute, Agriculture Research center, Giza, Egypt.Seeds of fababean was inoculated with *Rhizobiumradiobacter* applied at a rate of 100 g for 30 kg seeds wetted with 400 ml of adhesive liquid (Arabic gum).They were added in the form of solution foliar application on soil and plant after planting in three application times at 21, 50 and 75 days from planting. Each application is 5 L diluted in 400 L water fed^{-1}.

Magnetically treated seeds (M) before sowing were prepared by placing about 30 kg seeds inside a metallic magnetic tube consisted of a permanent magnet surrounding an open-ended tube (70 cm Length × 2-inch diameter, magnetic field strength 1.50 T) for (0, 5, 10 and 15 min).

Potassium humate was applied on soil at rate 20 kg /fed in same day of planting. Chemical composition ofthe used potassium humate is shown in Table (2). Thepotassium humate analysis was added according to thestandard methods described by **Brunner and Wasmer (1978).**

The NPK fertilization was followed after the recommendation of Agricultural Extension Office – Ministry of Agriculture – Egypt, at rates ofMineral fertilizer was urea (46 % N) wasapplied as N fertilizer at rates of 15.30 and 45 kg N fed^{-1} onthree equal doses after 21, 42 and 62 days from sowing.Super phosphate calcium (15.5 % P_2O_5) was added at rate 31 kg/fed during tillage for soil. Potassium Sulphate was added at rate 75 kg/fed after 21, 45 and 65 days from planting.

Seeds sowing were carried out at 20 November 2020/2021 and 2021/2022. Three of coated seeds with were sown in hole with 25 cm and 2 cm depth. After 31 days from planting, the plant was thinned to one plant of each hole. Plant sample of three replicates were taken after 75 days from sowing at. A Sample of each experiment plot was prepared for vegetative growth parameters and some physiological determination.

At harvesting stage,the plants of the threereplicates were harvested. Each fresh plant sample wasseparated into plant height (cm), No. of branches /plant. No. of pods /plant, weight of 100 seeds (g), weight of pods / (g/plant), weight of seeds / (g/plant) weight of shoot yield /plant (ton/fed) and weight of seeds yield (ton/fed) werecounted. Both seeds and shoots were air-driedand oven dried at $70C^o$ for 48 hrs. Ether of oven-dried straw or seeds were ground andkept in plastic bags for chemical analysis. A 0.5 g ofeach oven dried ground plant sample was digestedusing $H_2SO^-_4$, $HCIO_4$ mixture according to the methoddescribed by **Chapman and Pratt (1961)**. The plant content of N, P, K, Fe, Mn, Zn and Cu was determined in plantdigestion using the methods described by **Cottenie et al (1982) andPage et al (1982).**

Total carbohydrates weredetermined in dry leaves using the methoddescribed by **Dubois *et al* (1956).** Total proline content wasestimated according to the methods described by**Bates et al (1963).** Proteinpercentage of seeds was calculated by multiplying thenitrogen percentage by the factor 6.25**.**

<u>Astatically analysis: -</u>

Statistical analysis procedure: All experiments and analytical determinations were replicated at least three times and the presented data are the mean values. The obtained results were subjected to one way **(ANOVA)** analysis of variance analysis (type of analysis depended on the factors affected the experiment) to determine the significance between treatments and **L.S.D.** test at the probability levels of 5% was calculated according to **Gomez and Gomez (1984)and** using **CoStat** software **(Stern, 1991**).

Results and Discussion

Influence of the applied treatmentson chemical and physical properties: -

1-Chemical properties: -

Soil pH: -

Soil pH is an important parameter which reflect all change of chemical properties

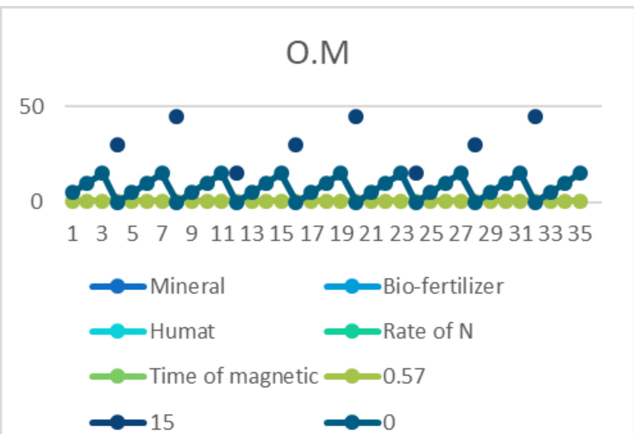
As results shown in Table (4) and fig(1)that, soil pH decreased slightly this due to the application of Mineralfertilizer, Bio fertilizer and Humates and 4 times of magnetic. The slightly decreased of soil pH values maybeinverted to the activity of microorganisms in decomposing organic matter and releasing organic acids. This is possibly due to organic matter oxidation (H^+ act as electron acceptor) and high content of free hydrogen ions **(Jiang *et al*, 2012).Shaban *et al*. (2006)** mentioned that, the effect of bio-fertilizer on soil pH is due to dehydrogenase activity and production of μ moles of H_2 in the rhizosphere of maize root media and its positive effect on increasing the hydrogen moles which react in root zone to form hydrocarbon acid which led to decrease soil pH.

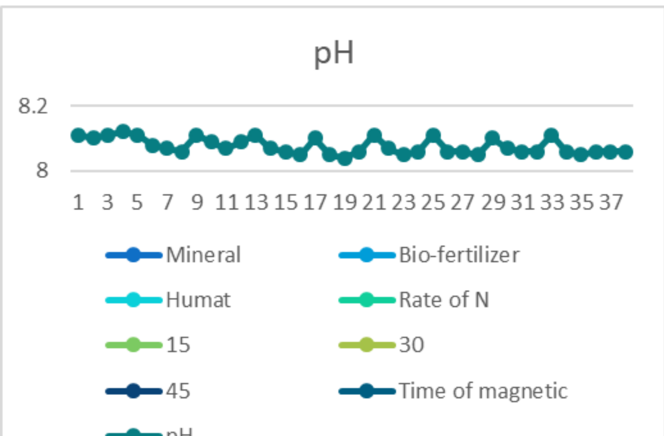
Although, electrical conductivity (EC) was slightly significant affected by the application of treatments showing increases after spreading in the treated soils compared with the controls. Nevertheless, EC values remained below the salinity threshold (4000 μS cm^{-1}), except for soil samples treated with 100 and 200 m^3 ha^{-1} in the upper layer. These results were consistent with previous works, reporting EC decreased value from (11.88 to 11.28) dS/m, respectively, were achieved due application of bio fertilizer and humates.OM% results obtained that from (0.57 to 0.54)% such as application of bio fertilizer and humates as comparedmineral fertilizer and control, CEC from (43.92 to 41.84) Mol/kg, respectively,the Similar results have been obtained by **El-Maze, *et***

al**(2016),** The lowest value of EC in soil reached (4.61 dSm-1)by applying humic acid as foliar application.The soil content of O.M increased in caseof bio-fertilizer, humic acid The CEC (molkg-1) valuewas affected by different fertilizer sources using soaking or foliar application. The high mean value of CEC was 41.42cmolkg-1 in case of humic acid foliar application compared with other treatments and control.**Aly*et.al* (2003)**, defeatedthat, the difference in relation to magnetic field were extremely but pH, CEC were which affected by magnetic field, on other hand,**Mahesh Wari*et al(*2009)**, As for soil properties after plant harvest, the use of magnetically treated irrigation water reduced pH but increased soil EC and available P in celery and snow pea .**El-Maze, *et al*(2016)**reported that ,The soil pH and EC values decreased due to different treatments using soaking or foliar application.The lowest value of EC in soil reached (4.61 dSm-1)by applying humic acid as foliar application. On other hand the results found that, the soil content of O.M increased in caseof bio-fertilizer, humic acid as compared with control using soaking or foliar application, but results found that, a high increase was attained by humic acid foliar application, as harmony results The CEC (cmolkg^{-1}) valuewas affected by different fertilizer sources using soaking or foliar application.

Table (4). Some Chemical properties of the studied soils (Fucia Faba).

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	pH 1:2.5	EC (dS/m^{-1})	OM%	CEC Mol/kg
Mineral fertilizers	15	0	8.11	11.88	0.57	43.90
		5	8.10	11.87	0.56	43.88
		10	8.11	11.86	0.55	43.86
		15	8.12	11.85	0.54	43.87
	30	0	8.11	11.88	0.57	43.90
		5	8.08	11.86	0.56	43.87
		10	8.07	11.85	0.55	43.84
		15	8.06	11.86	0.54	43.86
	45	0	8.11	11.88	0.57	43.90
		5	8.09	11.87	0.55	43.89
		10	8.07	11.85	0.55	43.84
		15	8.09	11.84	0.53	43.86
Bio-fertilizer	15	0	8.11	11.88	0.57	43.90
		5	8.07	11.27	0.56	43.89
		10	8.06	11.26	0.55	43.84
		15	8.05	11.24	0.54	43.86
	30	0	8.10	11.88	0.57	43.88
		5	8.05	11.28	0.56	43.86
		10	8.04	11.25	0.55	43.86
		15	8.06	11.23	0.54	43.85
	45	0	8.11	11.88	0.56	43.89
		5	8.07	11.26	0.55	43.88
		10	8.05	11.24	0.54	43.87
		15	8.06	11.21	0.54	43.89
Humate-K	15	0	8.11	11.88	0.57	42.90
		5	8.06	11.48	0.56	41.89
		10	8.06	11.47	0.55	41.86
		15	8.05	11.46	0.55	41.87
	30	0	8.10	11.88	0.57	43.89
		5	8.07	11.46	0.55	43.87
		10	8.06	11.45	0.55	43.86
		15	8.06	11.44	0.54	43.85
	45	0	8.11	11.88	0.57	43.90
		5	8.06	11.48	0.56	42.88
		10	8.05	11.46	0.55	41.85
		15	8.06	11.43	0.54	41.84
Mean			8.08	11.65	0.55	43.87



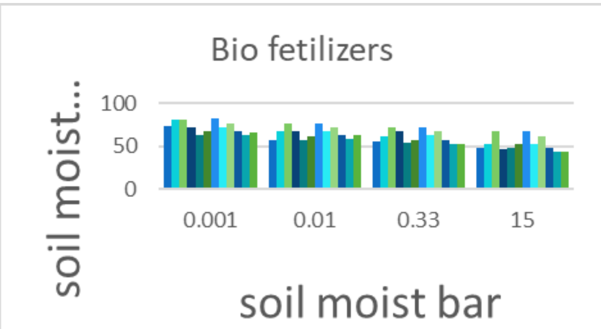


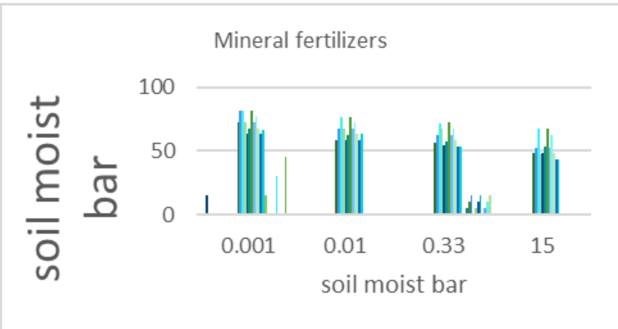
Fig(1) Some Chemical properties of the studied soils (Fucia Faba).

Table 5. Soil moisture contents (%)by the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

* Total porosity T.P% is point 0.001 soil tension(Bar).

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	Soil Tension (Bar)			
			0.001	0.01	0.33	15
Mineral fertilizers	15	0	72.87	57.87	55.87	47.87
		5	81.69	66.93	62.4	52.64
		10	81.22	76.46	71.84	66.93
		15	72.78	67.78	66.93	46.93
	30	0	62.87	57.87	53.87	47.87
		5	66.93	62.17	57.4	52.87
		10	81.93	76.93	71.93	66.93
		15	72.64	67.64	62.64	52.64
	45	0	77.17	72.17	67.17	62.17
		5	67.87	62.87	57.87	47.87
		10	63.11	58.11	53.11	43.11
		15	66.11	63.11	53.11	43.11
Bio-fertilizer	15	0	72.86	57.86	55.86	47.85
		5	81.66	66.92	62.38	52.62
		10	81.19	76.45	71.82	66.91
		15	72.75	67.77	66.91	46.9
	30	0	62.84	57.85	53.85	47.86
		5	66.92	62.16	57.37	52.84
		10	81.92	76.92	71.92	66.92
		15	72.63	67.62	62.62	52.61
	45	0	77.19	72.15	67.15	62.15
		5	67.86	62.86	57.86	47.86
		10	63.07	58.09	53.09	43.07
		15	66.09	63.07	53.09	43.07
Humate-K	15	0	72.85	57.85	55.84	47.84
		5	81.64	66.91	62.36	52.63
		10	81.09	76.43	71.81	66.92
		15	72.73	67.75	66.89	46.92
	30	0	62.82	57.84	53.86	47.85
		5	66.9	62.17	57.39	52.87
		10	72.27	76.93	71.93	66.93
		15	72.62	67.66	62.64	52.63
	45	0	77.16	72.13	67.17	62.16
		5	67.84	62.85	57.85	47.87
		10	63.05	58.1	53.1	43.09
		15	66.07	63.1	53.1	43.09
Mean						
LSD 0.05 time magnetic		1.977 ns				
LSD. 5 % rate of N		1.975 ns				
LSD. 5 % treatments		*** ns				
LSD. 5 % Treatment * Time magnetic		***ns				
LSD. 5 % Treatments * Rate		***ns				
LSD. 5 % Interaction		*** ns				





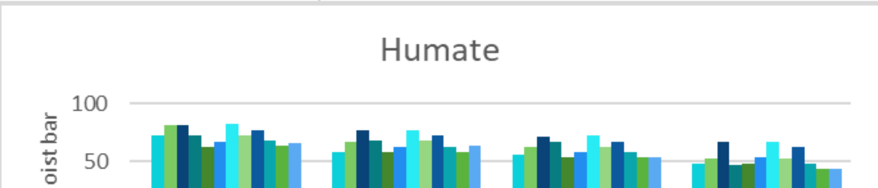


Fig 2.Soil moisture contents (%)by the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

Table 6. Pore size distributionby the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	QDP	SDP	WHP=A.W	FCP
Mineral fertilizers	15	0	15	2	8	47.87
		5	14.76	4.53	9.76	52.64
		10	4.76	4.62	4.91	66.93
		15	5	0.85	20	46.93
		0	5	4	6	47.87
	30	5	4.76	4.77	4.53	52.87
		10	5	5	5	66.93
		15	5	5	10	52.64
		0	5	5	5	62.17
	45	5	5	5	10	47.87
		10	5	5	10	43.11
		15	3	10	10	43.11
		0	15	2	8.01	47.85
Bio-fertilizer	15	5	14.74	4.54	9.76	52.62
		10	4.74	4.63	4.91	66.91
		15	4.98	0.86	20.01	46.9
		0	4.99	4	5.99	47.86
	30	5	4.76	4.79	4.53	52.84
		10	5	5	5	66.92
		15	5.01	5	10	52.61
		0	5.04	5	5	62.15
	45	5	5	5	10	47.86
		10	4.98	5	10.02	43.07
		15	3.02	9.98	10.02	43.07
		0	15	2.01	8	47.84
Humate-K	15	5	14.73	4.55	9.73	52.63
		10	4.66	4.62	4.89	66.92
		15	4.98	0.86	19.97	46.92
		0	15	2.01	8	47.84
	30	5	14.73	4.55	9.73	52.63
		10	4.66	4.62	4.89	66.92
		15	4.98	0.86	19.97	46.92
		0	5.03	4.96	5.01	62.16
	45	5	4.99	5	9.98	47.87
		10	4.95	5	10.01	43.09

		15	2.97	10	10.01	43.09
Mean						
LSD **LSD 0.05 time magnetic**			**0.8993 ns**			
LSD. 5 % rate of N			**0.8973 ns**			
LSD. 5 % treatments			***** ns**	***** ns**	***** ns**	***** ns**
LSD. 5 % Treatment * Time magnetic			*****ns**	*****ns**	*****ns**	*****ns**
LSD. 5 % Treatments * Rate			*****ns**	*****ns**	*****ns**	*****ns**
LSD. 5 % Interaction			***** ns**	***** ns**	***** ns**	***** ns**

QDP: Quickly drainable pores (> 28.8 u), SDP: Slowly drainable pores (28.8-8.62 u), WHP: Water holding pores (8.62 - 0.19 u), FCP: Fine capillary pores (<0.19 u).

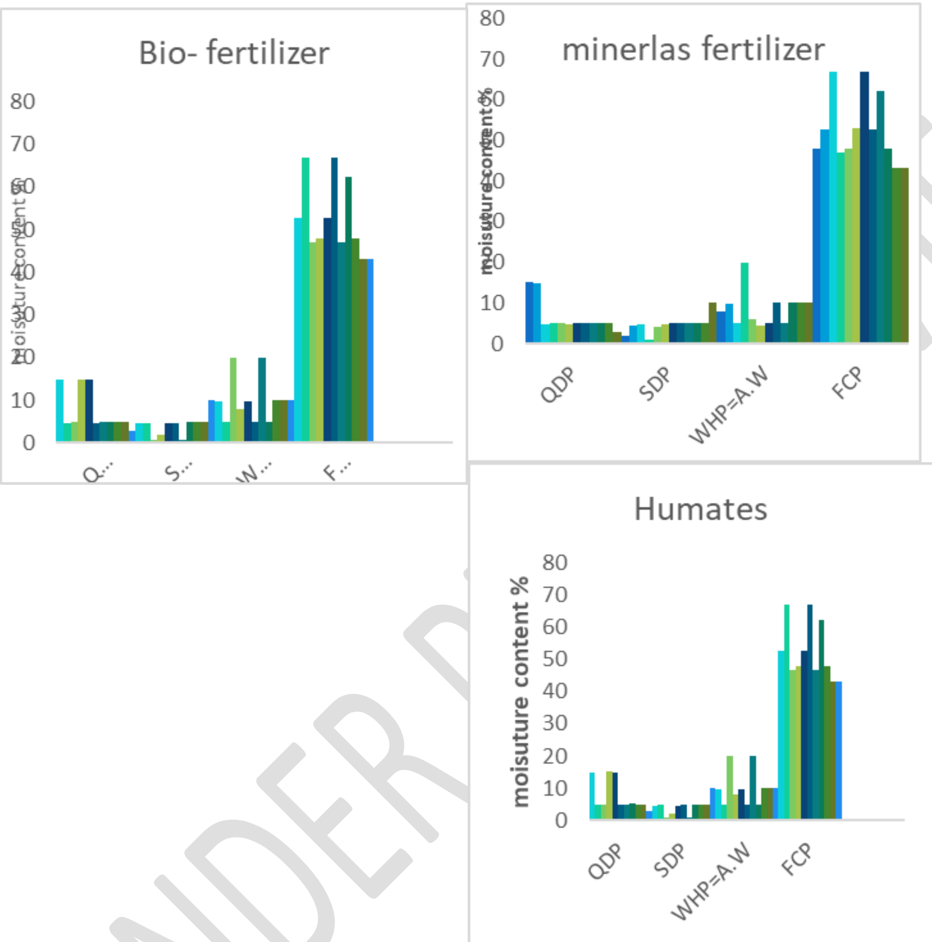


fig 3. Pore size distributionof by the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

2-Physical properties: -

Physical properties of the experimental soil after faba beanharvest for two seasons as affected by all treatments under study minerals metal, bio fertilizer, Humic acid and magnetic field will be discussed as follows**:**the obtained data for effect of soil amendments as follow by bio fertilizer and humate, respectively. the changes in studied physical properties soil as related to application of all amendments in table (5) and (6), results explained that,addinghumic acid, bio fertilizers as foliar application the superior impact was increased the soil total porosity values compared to other treatments and control, moreover, the Data obtained that the values of drainable pores (DP) and water holding pores (WHP) were higher than the other pores in different treatments. Furthermore,it was found that humic acid, bio fertilizers amendments and humates led to the aggregation of soil particles, which led to their adhesion to water molecules, which led to a reduction in water consumption compared to mineral fertilization, were affected by humic and bio fertilizers acid foliar application compared to other treatments and control. This results as harmony with according to **El-Maze,*et al* (2016,2021), Khalifa*et.al* (2019)**. The results also found that the effect of physical properties on magnetic field strength (MFS) has a marked influence on the magnetization effect, the optimal magnetizing condition was the magnetic field was maximized in a time of 15 minutes.so that, magnetic field strength (MFS) has been used mainly for agriculture, owing to the changes of physicochemical properties. For example, it can promote plant growth and prevent effect of saline soils and water. According to the studidies of **Liu B *et al*(2011), Wei H *et al* (2017).**

Table 7. Soil Hydraulic conductivity (cm h^{-1}) by the soil amendments and faba beans yield, in soil study in Sahl El-Hussinia.

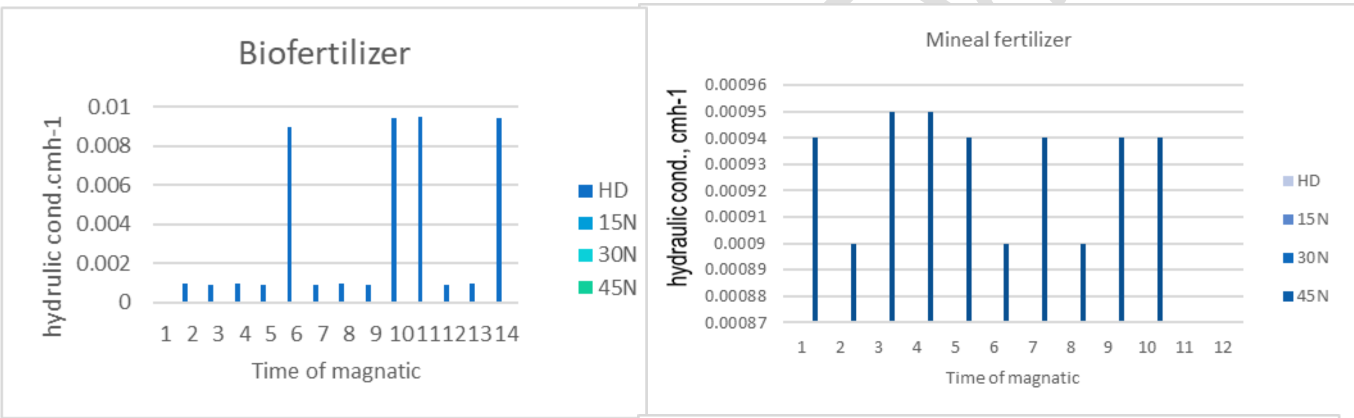
Treatments	Rate of N (kg/fed)	Time of magnetic (min)	H.D
Mineral fertilizers	15	0	0.00095
		5	0.00095
		10	0.00094
		15	0.00090
	30	0	0.000950
		5	0.00095
		10	0.00094
		15	0.00090
	45	0	0.00094
		5	0.00090
		10	0.00094
		15	0.00094
Bio-fertilizer	15	0	0.00100
		5	0.00094
		10	0.00096
		15	0.00091
	30	0	0.00898
		5	0.00094
		10	0.00095
		15	0.00090
	45	0	0.0094
		5	0.0095
		10	0.00094
		15	0.00095
Humate-K	15	0	0.0094
		5	0.00095
		10	0.00096
		15	0.00095
	30	0	0.00092
		5	0.00094
		10	0.00095
		15	0.00095
	45	0	0.0093
		5	0.0094
		10	0.00095
		15	0.00096
Mean			2.338 E-03
LSD 0.05 time magnetic			2.303E-03 ns

LSD. 5 % rate of N	**2.568E-03ns**
LSD. 5 % treatments	**2.558E-03 ns**
LSD. 5 % Treatment * Time magnetic	***** ns**
LSD. 5 % Treatments * Rate	*****ns**
LSD. 5 % Interaction	*****ns**

Values of soil hydraulic conductivity after harvested faba beans crop as impacted by different amendments are given in Table (7). The dataexplained that the application of all amendments decreased soil HC (cm h^{-1}) values when compared to the control. The improvementperwise the pronounced decrease in hydraulic conductivity of the studied soil may be attributed to the creation of QDP point, and the dominance of SDP point and QDP pointcompared with other pore sizes. These results are in agreement with those of **El-Fayoum and Ramadan (2002)**and **El-Maze, *et al*(2016) .** The best treatment in decreasing soil HC (cm h^{-1}) values was FYM compared to control and other treatments.

Concerning the magnitudes of the changes in available water range, field capacity and wilting point at different applied treatments, data presented in **Table (6,7)** in general, showed that the content (%) of available water in soil wasincreased.The soils treated with humic and bio fertilizers foliar application relatively high values of available water as compared to control and other treatmentsThis is due to the fact that organic substances attain a supremacy high content of active organic compounds that enhancing the water molecules to be chelated accordingto,**Moustafa*et al* (2005**). The highly magnitude of these results is saving a lot of irrigation water which can be used to reclaim, cultivate new areas and to enhance water use efficiency of most crops. These results are in harmony with the findings of **Usman *et al*. (2005) and Hassan and Abdel Wahab (2013), Khalifa *et.al* (2019)**.As harmony with**Ayman, A. T. (2022)**,reported that, the soil hydrophysico-chemical properties, morpho-physiological responses, yield, and quality were measured.HA addition amended the soil structure by allowing rapid macro aggregate formation, decreasing bulk density and pH, and increasing porosity and electrical conductivity, thereby improving soil hydraulic properties.Furthermore, the functional of Humic acid (HA) is a major component of humic substance, produced from the biodegradation of dead organic matter, containing carboxyl and phenolic so that it behaves functionally as dibasic acid or sometimes as a tribasic acid. Functional groups which most contribute to surface charge and reactivity. The presence of carboxylic groups and phenolic gives the ability to form a complex with HA ions such as Mg2+, Ca2+, Fe2+, and Fe3+. The ability of humic acid to adsorb cations follows the lipotropic sequence, i.e., Al 3+ = (H+) > Fe3+ > Fe2+ > Ca2+ > Mg2+ > K+ = NH4+ > Na+

Tan (1998). Sorption of NH4+ is similar to Na+ **Nursyamsi *et al*, (2009)**. Sorption and maximum buffering capacity of the NH4+ and Na+ are relatively different. Cation adsorption by HA occurs through the exchange of cations in solution or that adsorbed by clay humic. Adsorption of cations or metals by HA can be through (a) direct adsorption (Ca2+ that release PO4 3-), (b) complexation of Cu2+ or outer-sphere interactions for hydrated Mg2+, (c) serving as a cation bridge through direct or indirect chelation, and (d) interaction with Ca2+ -HA aggregates or with amine groups **Sharma and Kappler, (2011)**.Clay or humic materials have a strong affinity to weak acids containing phenolic hydroxyl, a carboxyl group, or amino sulfonyl. Alkaline cations (Na+, K+ , Ca2+, Mg2+) are primarily retained by simple cation exchange with COOH groups (RCOONa, RCOOK) **Zhang *et al*, (2013)**.



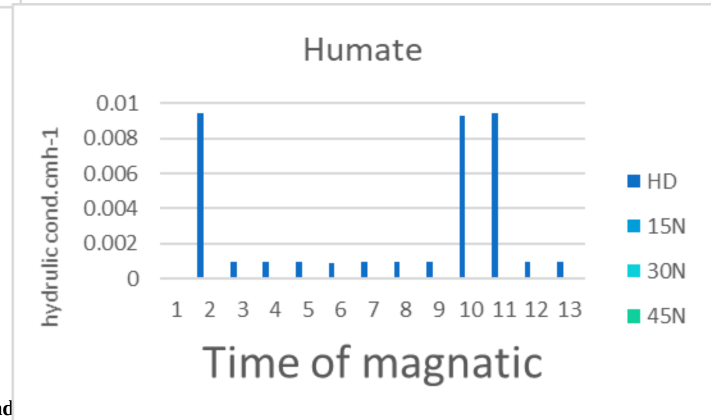


Fig 4. Soil Hydraulic conductivity (cm h-1) by the soil amend

Table 8. Soil Bulk density (Mg m-3) by the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	B.D

Mineral fertilizers	15	0	0.823
		5	0.734
		10	0.784
		15	0.900
	30	0	0.812
		5	0.745
		10	0.779
		15	0.901
	45	0	0.817
		5	0.739
		10	0.774
		15	0.901
Bio-fertilizer	15	0	0.822
		5	0.739
		10	0.779
		15	0.901
	30	0	0.818
		5	0.738
		10	0.776
		15	0.895
	45	0	0.822
		5	0.737
		10	0.783
		15	0.892 s
Humate-K	15	0	0.823 s
		5	0.736
		10	0.777
		15	0.905
	30	0	0.821
		5	0.737
		10	0.774
		15	0.895
	45	0	0.822
		5	0.735
		10	0.781
		15	0.895
Mean			0.802
LSD 0.05 time magnetic			1.6856
LSD. 5 % rate of N			1.6756
LSD. 5 % treatments			*** ns
LSD. 5 % Treatment * Time magnetic			***ns
LSD. 5 % Treatments * Rate			***ns
LSD. 5 % Interaction			*** ns

BC= Bulk density. Average of real density (g/cm3) = 2.65

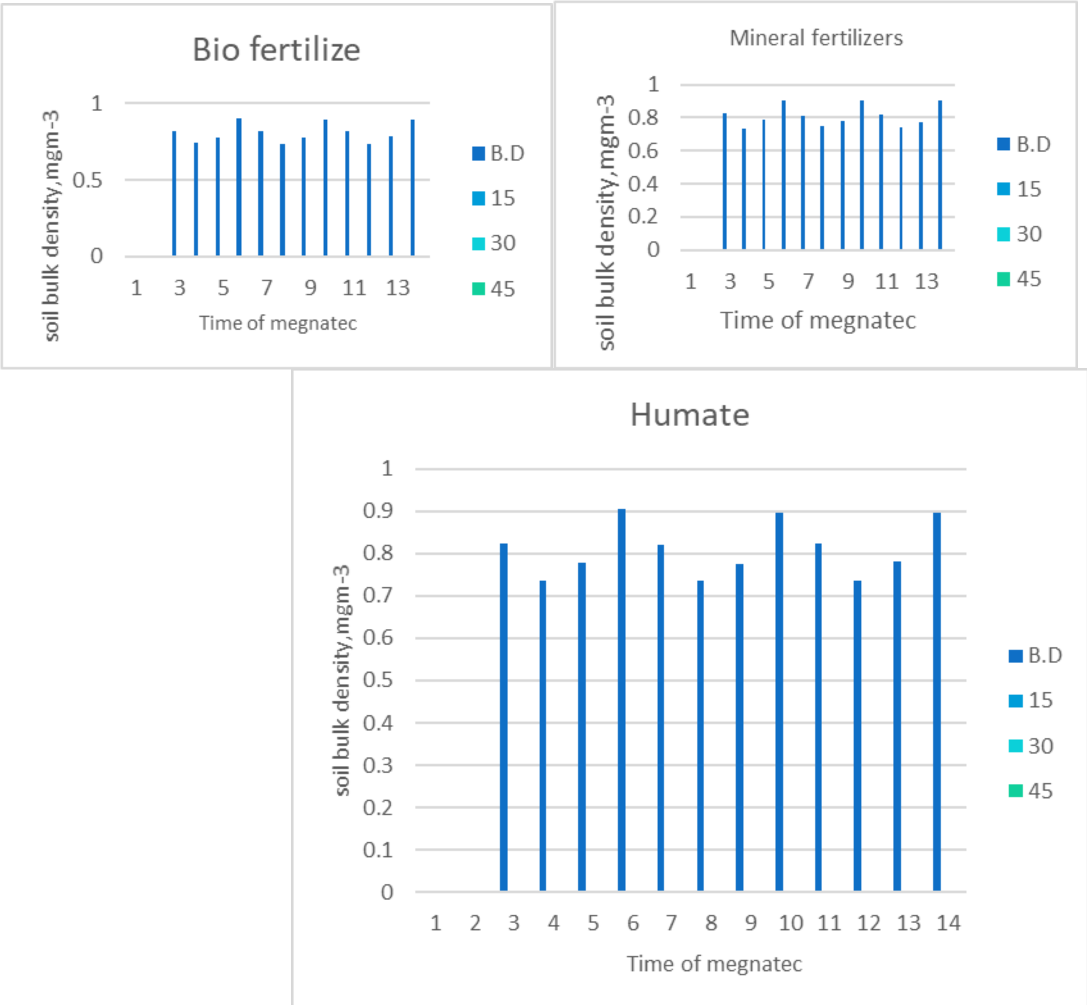


Fig 5. Soil Bulk density (Mg m-3) by the soil amendments and Fucia faba yield, in soil study in Sahl El-Hussinia.

The Data present in **Table and fig (5)obtained that**,the value of bulk density is decreased by adding the application of all amendments as Bio-fertilizer and humatepotassium as compare with all treatments and control,while the total porosity and capillary porosity increased in the plow layer of soil this may be due tothe biodegradation of dead organic matter, containing carboxyl and phenolic so that it behaves functionally such as phenomenon of organic acidification.These results are in harmony with,***El-Maze, et al(*2016),showed that**,the maximizevalue of bulk density low is decreased by Humic acid follier as compare all treatments and control ,**Munawar .A*et al*** **(2016),**reported that,the application of 100 -200ml H.A/0.12 m2 give a superior yield in improving the physical-chemical properties, so ,bulk density was decreased from range 1.1 - 0.97,**Khalifa *et.al* (2019),**mentioned that , the application of soil amendments Bulk density was decreased , on other hand ,results found increasedin total prosity of growing two season of wheat yield.Furthermore, The optimize of best value magnetic obtained in rate 15 min Bulk density was arranged from 0.895-0.822, The results agreement with **Molouk *et al***

(2010),who explained that, the biological treatment of water using magnetic force has a vital role in treating water and seeds,the magnetic flux density increases the values of physical, chemical and bacteriological properties.

Table (9). Morphology of faba bean after 75 days and harvest yield.

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	after 75 days from planting		After harvest		
			Plant length (cm)	No. of branches	Plant length (cm)	No. of branches	No. of pods/plant
Control	15	0	47.51	2	68.28	5	16
		5	53.41	3	72.84	5	17
		10	55.95	4	74.89	6	24
		15	57.43	5	77.85	7	21
	Mean		53.57	3.50	73.46	5.75	19.5
	30	0	48.89	3	72.00	6	18
		5	53.79	5	74.87	7	22
		10	57.58	6	77.44	7	26
		15	60.98	5	82.95	8	28
	Mean		55.31	4.75	73.78	6.43	21.37
	45	0	52.87	4	71.96	6	20
		5	56.69	3	76.58	7	22
		10	61.98	6	80.78	8	27
		15	63.98	5	84.96	8	26
	Mean		58.55	4.5	78.57	7.25	23.75
Bio-fertilizer	15	0	51.98	3	73.66	7	20
		5	62.00	6	77.47	8	25
		10	63.89	7	81.89	7	29
		15	64.98	6	85.66	8	24
	Mean		60.71	5.5	79.69	7.5	24.50
	30	0	56.87	4	78.65	7	24
		5	63.56	5	85.98	6	28
		10	66.98	6	92.98	8	33
		15	67.46	7	94.68	9	26
	Mean		63.71	5.5	88.07	7.5	27.75
	45	0	56.00	4	73.96	5	18
		5	60.97	5	75.98	6	24
		10	62.98	6	84.97	7	25
		15	64.51	7	82.86	7	31
	Mean		61.77	5.75	79.44	6.25	24.5
Humat potassium	15	0	51.00	3	70.96	6	22
		5	54.69	4	74.56	7	26
		10	56.74	5	79.86	7	31
		15	62.38	5	85.78	8	35
	Mean		56.20	4.25	77.79	7	29
	30	0	52.78	4	72.84	6	24
		5	58.97	5	81.93	7	31
		10	61.68	6	86.00	7	34
		15	64.76	6	87.59	8	36
	Mean		59.54	5.25	82.09	7	31.25
	45	0	53.76	6	76.89	5	21
		5	61.94	7	84.97	7	26
		10	64.27	8	88.99	8	31
		15	65.79	8	92.87	8	35
	Mean		61.44	7.25	85.93	7	28.25

LSD. 5 % time magnetic	**0.36**	**0.24**	**0.71**	**ns**	**ns**
LSD. 5 % rate of N	**0.75**	**0.22**	**0.71**	**ns**	**1.42**
LSD. 5 % treatments	**0.74**	**0.21**	**0.81**	**ns**	**ns**
LSD. 5 % Treatment * Time	***	***	***	**ns**	**ns**
LSD. 5 % Treatments * Rate of N	**ns**	***	***	**ns**	**ns**
LSD. 5 % Interaction	***	***	***	*	***

Balouchi *etal* (2009) reported that the pre-sowing seeds magnetic field influencesthe structures of cell membranes and in this way increases their permeability and the modification of binding properties of seed water and increased seed membrane integrity in magnetically exposed seeds might have enhanced the germination traits and early seedling growth of maize.**Alakhdar *et al* (2022)**indicated that the highest values of Plant length (cm) and No. of pods/ plant were achieved by seeds exposed to 30 min. magnetic field. **Montaser *et al* (2011)**showed that,the application of potassium humate on plant morphology and plant growth stimulant was increased cell division, as well as optimizing uptake of nutrients and water and stimulating soil microorganisms for enhancing natural resistance against plant diseases and pest infestations.moreover, they increase the permeability of plant membranes and enhance the uptake of nutrients that improve soil uptake of macro and microelements, making these nutrients more mobile and available to plant root systems.**Khalil *et al.* (2013)** the application of bio fertilizer*Azospirillum baselines* was increase in wheat growth parameters. **Awaad *et al* (2020)** mentioned that,the humate potassium application to faba bean plant led to increase of the growth parameters, such as,plant height, number of branches/plant, number of pods /plant and number of seeds /pod of faba bean plants, this due to, the application of humate potassium increased the synthesis and activity of IAA, which played a significant role in promoting the plant growth and application of potassium humate like organic fertilizers in the soil.

Yield Faba bean productivity and yield components after harvest.

Data show in Table (10) the maximum values of weight of 100 seeds (g); weight of pods /plant (g), weight of seeds /plant (g), weight of shoot yield (ton/fed) and weight of seeds yield (ton/fed) were 88.50 (g) , 145.20 (g), 136.40 (g), 136.40 (g) , 3.38(ton /fed) and 2.95 ton/fed as affected with humate potassium combined with 45 kg mineral N fertilizers under magnetic field at 15 min compared other treatments. These results are in agreement by **Nassar,*et al*,(2021)**found that the application of humate potassium to seed nutritive and biochemical contents were significantly increase of plant growthparameters , yield components as well as seed nutritive and biochemical contents .so ,The humic substances can directly or indirectly affect the physiological processes of plant growth ,furthermore that,the significant increase for weight of pods /plant (g) and weight of seeds /plant (g) , while the 100 seeds (g) , weight shoot yield (ton/fed) and seeds yield (ton/fed) respectively , were no significant as affected seeds with magnetic field at times. Results found that, the applied of mineral N fertilize different rates to faba bean plant was significant increase for weight of 100 seeds (g), weight of pods/plant (g), weight of seeds /plant (g) and weight of shoot yield (ton/fed) respectively, while the weight of seeds yield (ton/fed) was no significant. ,**Malik *et al* (2006)**,showed that,The interaction all treatments combined with mineral N fertilizer and magnetic field different time were significant increase of weight of 100 seeds (g), weight of pods /plant (g), weight of seeds /plant (g), weight of shoot yield (ton/fed) and weight of seeds yield (ton/fed), respectively.

Table (10). Faba bean productivity at harvest affected by PGP, N rate, magnetic time and interaction between them.

Treatments	Rate of N (kg/fed)	Time of magnetic (min)	Weight of 100 seeds (g)	Weight of pods/plant (g)	Weight of seeds /plant (g)	Weight of Shoot yield (ton/fed)	Weight of seeds yield (ton/fed)
Control	15	0	60.76	88.73	81.88	2.48	1.93
		5	66.85	97.96	94.54	2.65	2.05
		10	71.77	108.48	102.98	2.69	2.22
		15	75.88	112.78	104.85	2.85	2.28
	Mean		68.81	101.98	96.06	2.66	2.12
	30	0	71.81	93.92	87.99	2.62	2.06
		5	71.87	105.45	98.76	2.87	2.15
		10	75.78	114.49	110.21	3.08	2.22
		15	79.89	122.98	112.79	2.97	2.21
	Mean		74.83	109.21	102.43	2.88	2.16

	45	**0**	**64.77**	**97.74**	**92.76**	**2.68**	**2.11**
		5	**67.98**	**112.69**	**110.34**	**2.78**	**2.33**
		10	**73.96**	**117.98**	**114.75**	**3.05**	**2.42**
		15	**76.89**	**121.94**	**118.97**	**3.11**	**2.48**
	Mean		**70.09**	**112.58**	**109.20**	**2.90**	**2.33**
Bio-fertilizer	**15**	**0**	**71.97**	**104.97**	**77.98**	**2.77**	**2.09**
		5	**74.95**	**114.55**	**83.78**	**2.89**	**2.28**
		10	**76.87**	**120.38**	**104.86**	**3.07**	**2.50**
		15	**79.65**	**116.95**	**93.89**	**3.00**	**2.43**
	Mean		**75.86**	**114.21**	**90.12**	**2.93**	**2.32**
	30	**0**	**76.52**	**108.94**	**81.95**	**2.94**	**2.24**
		5	**82.93**	**121.77**	**91.08**	**3.09**	**2.53**
		10	**85.79**	**133.78**	**114.98**	**3.23**	**2.72**
		15	**81.98**	**126.96**	**109.76**	**3.04**	**2.65**
	Mean		**81.80**	**122.86**	**99.44**	**3.07**	**2.53**
	45	**0**	**80.15**	**105.78**	**80.45**	**2.86**	**2.26**
		5	**81.47**	**118.75**	**90.66**	**2.97**	**2.48**
		10	**84.44**	**123.66**	**107.98**	**3.13**	**2.58**
		15	**84.87**	**118.76**	**94.56**	**3.21**	**2.73**
	Mean		**82.73**	**116.73**	**93.41**	**3.03**	**2.51**
Humat potassium	**15**	**0**	**70.45**	**102.55**	**98.65**	**2.46**	**2.24**
		5	**74.75**	**111.89**	**105.94**	**2.87**	**2.47**
		10	**73.88**	**117.67**	**111.88**	**2.92**	**2.75**
		15	**80.45**	**124.86**	**118.32**	**3.09**	**2.83**
	Mean		**74.88**	**114.24**	**108.69**	**2.83**	**2.57**
	30	**0**	**66.47**	**104.93**	**103.87**	**2.54**	**2.32**
		5	**77.90**	**117.64**	**109.88**	**2.88**	**2.64**
		10	**78.95**	**122.74**	**112.86**	**3.18**	**2.78**
		15	**81.76**	**132.79**	**120.46**	**2.94**	**2.83**
	Mean		**76.27**	**119.52**	**111.76**	**2.88**	**2.64**
	45	**0**	**64.16**	**110.66**	**107.65**	**2.56**	**2.35**
		5	**70.09**	**124.76**	**118.97**	**2.86**	**2.67**
		10	**83.58**	**135.77**	**116.77**	**3.18**	**2.85**
		15	**87.48**	**144.16**	**135.78**	**3.34**	**2.93**
	Mean		**76.32**	**128.83**	**119.79**	**2.98**	**2.70**
LSD. 5 % time magnetic			**ns**	**1.09**	**1.51**	**ns**	**ns**
LSD. 5 % rate of N			**2.54**	**1.10**	**0.11**	**0.13**	**ns**
LSD. 5 % treatments			**ns**	**1.31**	**0.92**	**ns**	**ns**
LSD. 5 % Treatment * Time			**ns**	*******	******	**ns**	**ns**
LSD. 5 % Treatments * Rate of N			*****	*******	******	**ns**	**ns**
LSD. 5 % Interaction			*******	*******	*******	*****	*****

CONCLUSION

Treatment of soil and faba bean plants by bio-fertilizer (*Rhizobium radiobacter* Sp strain **(**Salt Tolerant PGPR)) and with humate potassium led to improvement of saline soil properties, the data found, increasedinsoil total porosity values ,the values of drainable pores (DP) and water holding pores (WHP) were higher than the other pores in different treatments,but found decreased soil HC (cm h-1) and the value of bulk density is decreased as compare all treatment and control , this due to the attributed to the creation of QDP point, and the dominance of SDP point and QDP point compared with other pore sizesin soil ,so that the superior the increase of faba bean productivity under increase of pre-sowing magnetic field time**.**the optimal magnetizing condition was the magnetic field was maximized in a time of 15 minutes.so that, magnetic field strength (MFS) has been used mainly for agriculture, owing to the changes of physicochemical properties in soil.

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