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Effect of spraying extracts concentration of three organic fertilizers on growth and yield of maize (Zeamayze L.)

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Abstract

Field experiment was conducted for the season of 2013on the extension farm in Almhnawiya,Babylonin silt clay loam soil to study the effect of spraying three concentrations :control (spray water only), 0.50% and 100% of the extracts of three types of organic fertilizer(waste Poultry, wheat residue, remnants of palm fronds) on growth and yield of maize. Maize compositional variety 5028 were planted in 15/7on ridges width of 75 cm and a distance of 25 cm between plants. Randomized complete block design with three replications was used. Plants were sprayed three times(in the sixth leafs stage , when the first appearance of the male flowers, and in the beginning of the grain filling), the most important results are summarized as follows:Spraying organic fertilizer extracts led to increase the number of leaves ,leaf areaindexandchlorophyll content, also led toreducethe number of daysuntil flowering male and female significantly compared to control.The extract of poultry waste fertilizer was superior compared to residues of wheat and palm fronds. Extract fertilizer spraying led to increase yield components (cob rows number , row grains number , cob grains number , weight of 500 grains , weight of grim, ear grain weight) and grain yield significantly compared with control, and the extract of poultry waste fertilizer was superior compared to the other both extracts.

Key words: maize, organic fertilizers type, fertilizer extract concentration , foliar fertilizer

INTRODUCTION

Maize(Zea mays L.) is the most importantcereal cropsthat is grownona very large scalein the world, coming in importanceafterwheat and ricein terms of areaand production, because oftheir versatilityinhuman nutrition, animal, and its entryin the areas ofmany industrial[1].The averageyieldper hectareinIraqwas up to2t.ha^{-1},while the world productionrate was 5-5.2t.ha^{-1}and in USA10.34t.ha^{-1}[2].Theproblem of lowproductivityper unit areain Iraq is duetomany reasons, including the failure in addingthe right amountoffertilizer,which playsan important roleinincreasing the amount ofyieldandimproving its quality, which is reflected in growth andyieldof plant[3,4].The addition of organic fertilizers received considerable attention in recent years because of its benefits in improving soil properties and increase production.

Treated organic fertilizer (compost) is more effective and environmental friendly, in addition to being an effective way to get rid of the waste, more concentrated nutrients , less content of C/N and free of other undesirable qualities [5]. Organic fertilizer extractisa new trendforquickly fertilizingresponses , which has beendescribed byIngham [6] as theaqueous extract, thatcontains solublenutrients withthe diversityofmicroorganisms. The effect ofthe extractdepends on thetype of fertilizer, the amount of water, ventilation, duration ofsoakingand environmental conditions[7]. Its foliarsprayinghelpsto processplants with nutrients[6], and if it was available in nutrient-rich liquid formulations that involve the use of less quantity, and easier application [8]. [9] found that the addition ofpoultry manureextract to corn plants which were fertilizedwith phosphorusimprovedplant uptakeofphosphorusand led to increase plant height , dry matterandgrain yield . AsaduandIgboka[10]found that the addition ofthe aqueous extractofpoultry manure(soaked fortwo weeks)led to improvedgrowthand yieldsignificantlycomparedto control andother organic fertilizers extracts.

MATERIALS AND MRTHODS

A field experiment was carried out in autumn 2013 in Almhnawia , 8 km north-west of Hilla, within the latitude 32.31 north and longitude 44.21 east in loam-clay-silt soil (Table1) . Factorial experiment was conducted according torandomized complete block design(RCBD)with threereplicationsto study the effect of three type of organic fertilizer(poultry waste compost, wheatresidue compost, date palm residue compost) and three extract concentrations of each compost(control, 50% extractconcentration , 100%extractconcentration) on maize (cv. 5018) adopted by the Agriculture Research Center at Abu Ghraib, Iraq.Plants were sprayed four times during the growing season with the extracts that had been prepared the day before of spraying (by adding 5 kg of compost to 5 liters of water on magnetic stirrer for 24 hours and then nominated) to prepare focus 100% .

Table 1 : Some physical and chemical characteristic of farm soil before planting

Texture	g.km^{-1} of soil			NH_4	No_3	K	P	EC	PH
Loam-clay-silt	clay	silt	sand	mg.km^{-1}	mg.km^{-1}	mg.km^{-1}	mg.km^{-1}	dSm.m^{-1}	
	340	484	176	0.89	0.53	31.7	9.52	3	7.14

RESULTS

Table(2) shows that the addition ofextractsled toa significant increasein leafs number compared to control,and the influence increasedpositivelywithincreasing the concentration with a percentage increase of (7%) and (10%), respectively for the focus of 50% and 100% comparedto control.The table also showsthat theextract ofpoultry wastecompost was superior compared to the extract of other composts . The interaction had a significant effectand the largest numberofleafs resulted from spray 100%extractconcentration ofpoultry manure(14.8) , while control treatment gavethe lowestnumberofleaves(12.8).

Table 2: Effect of foliar extract concentrations of different composts on corn leafs number

Consent. / **Compost type**	**control**	**50%**	**100%**	**Average of compost type**
poultry wastecompost	12.833	14.167	14.800	13.933
wheatresidue compost	13.033	13.833	14.200	13.689
date palm residue compost	13.133	13.800	14.300	13.744
Average of consent.	13.000	13.933	14.433	
$LSD_{0.05}$	**A** =0.1821 **C** =0.1821 **A*C** =0.3154			

AppearsfromTable (3) that sprayof compost extractsled to significant increasein leaf areaindex comparedwith thecontrol treatment, andthe increase wasproportionalwith the increase infocus, which thefocus100% gave higher valuewith a percentage increase of (7%) and (18%) comparedto focus50%and control, respectively. Poultry waste compostgavethe highestleaf area index with a percentage increaseof (8%) and (6%) compared towheatresidue compost and date palm residue compost extract, respectively.The interaction had a significant effectand the highest leaf area index resulted from 100%extractconcentration ofpoultry(3.487) , while control treatment gavethe lowestleaf area index (2.653).

Table 3: Effect of foliar extract concentrations of different composts on corn leafs area index

Consent. / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	2.673	3.190	3.487	3.117
wheatresidue compost	2.653	2.920	3.067	2.880
date palm residue compost	2.653	2.957	3.170	2.927
Average of consent.	2.660	3.022	3.241	
$LSD_{0.05}$	A =0.0735 C= 0.0735 A*C = 0.1274			

Table (4) shows that spraying extracts of organic fertilizers led to a significant increase in leaf chlorophyll content with the increase in extract concentration , in which the high focus 100% gave the higher value (42.33) with a percentage increase of (6%) and (14%) compared to 50% concentration and control respectively. The type of compost had a significant effect in leaf chlorophyll content ,and poultry wastecompost gave the highest value (40.56) with a percentage increase of (5%) and (3%) compared towheatresidue compost and date palm residue compost, respectively. The interaction had a significant effectand the highest leaf chlorophyll contentresulted from spray 100%extractconcentration ofpoultry wastecompost(40.56) , while control treatment gavethe lowestleaf chlorophyll content(36.00).

Table 4:Effect of foliar extract concentrations of different composts on leaf chlorophyll content

Consent. / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	36.67	41.00	44.00	40.56
wheatresidue compost	36.00	38.67	41.00	38.56
date palm residue compost	36.33	39.33	42.00	39.22
Average of consent.	36.33	39.67	42.33	
$LSD_{0.05}$	**A =** 0.781 **C=** 0.781 **A*C**=1.353			

Tables(5 and 6) shows that spraying extractsof organic fertilizersled toreduce the numberof days requiredfor the emergence of50% of male and femaleflowers significantly compared to control treatment,and that theeffectincreased with increasing concentration. High extract concentration(100%)gave the highest reduction percentage (3%and 6%) compared to50%andcontrol treatment, respectively. Poultry wastecompost was superior compared to wheatresidue compost and date palm residue compost.The interaction had a significant effect in reducing thenumber of days requiredtofloweringandreacheda minimumto male (53 days) andfemale(56.33 days)flowering whensprayinghigh concentration extract (100%) of poultrywaste compostwhilecontroltreatmentgavelongerperiod (59.0 and 64.3 days).

Table 5:Effect of foliar extract concentrations of different composts on days no. to male flower

~~Concentration~~	control	50%	100%	Average of compost

Compost type				type
poultry wastecompost	58.00	55.67	53.00	55.56
wheatresidue compost	59.00	56.67	56.33	57.33
date palm residue compost	58.00	56.67	55.33	56.67
Average of concentration	58.33	56.33	54.89	
$LSD_{0.05}$	**A** =0.830 **C**=0.830**A*C**=1.438			

Table 6:Effect of foliar extract concentrations of different composts on days no. to female flower

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	63.00	60.67	56.33	60.00
wheatresidue compost	64.33	61.67	60.33	62.11
date palm residue compost	63.33	61.00	59.67	61.33
Average of concentration	63.56	61.11	58.78	
$LSD_{0.05}$	**A** =0.983**C** =0.983**A*C**=1.703			

Table (7)shows that spraying compost extractsled toa significant increaseinrows no. per earcompared to control , and theeffectincreased with increasing extract concentration. High extract concentration gave a percentage increasing of (2%) and (5%) compared toconcentration of 50%and control, respectively. Poultry waste compost was superior in increasing the number of rowscomparedto other two compost. Theinteraction between the extract concentration andtype of compost had a significant effectin increasingthe number of rowsandreached high value (13.767 row)whensprayinghigh concentration (100%) of the poultry wastecompostextract,whilecontroltreatmentgave thelowest (12.8).

Table 7:Effect of foliar extract concentrations of different composts on rows no. per ear

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	12.900	13.333	13.767	13.333
wheatresidue compost	12.800	13.200	13.400	13.133
date palm residue compost	12.867	13.267	13.500	13.211
Average of concentration	12.856	13.267	13.556	
$LSD_{0.05}$	**A** =0.0947**C** =0.0947**A*C**=0.1640			

Tables(8 and 9) show thatsprayingextractsof organic fertilizers led toa significant increasein the number ofgrains.row^{-1}andnumber of grains.ear^{-1}compared to control treatment , and that theeffect increased with increasing the concentration. Sprayinghigh concentrationofthe extract , gave increasing percentage(6%) and (16%)in the number ofgrain.row^{-1}, and (8%) and (17%), in the number of grains.ear^{-1}compared toconcentration of 50%andcontrol, respectively. Poultrywaste compost was superior in increasing the number of rowscomparedto other two composts. Theinteractionbetween theconcentration andtype ofextracthad a significant effectin increasingthe number of grains.row^{-1}andgrains.ear^{-1}(36and 486.9 grains ,respectively) whensprayinghigh concentration (100%) of the poultry wastecompostextract,whilethe controltreatmentgavethe lowest number.

Table 8:Effect of foliar extract concentrations of different composts on number of grains.rows^{-1}

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	28.67	33.67	36.00	32.78
wheatresidue compost	28.33	30.00	32.33	30.22
date palm residue compost	29.00	32.33	33.67	31.67
Average of concentration	28.67	32.00	34.00	
$LSD_{0.05}$	A = 0.881C =0.881A*C =1.527			

Table 9:Effect of foliar extract concentrations of different composts on number of grains.earn^{-1}

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	400.7	454.0	486.9	447.2
wheatresidue compost	388.2	422.2	467.2	425.9
date palm residue compost	390.3	427.1	460.2	425.8
Average of concentration	393.1	434.4	471.4	
$LSD_{0.05}$	**A** = 6.01**C**=6.01**A*C**=10.41			

Tables(10and 11) show that sprayingextractsof organic fertilizersled toa significant increaseinthe weight ofthe grain.ear^{-1}and 500grains weight compared to the control,and that theeffectincreased significantlywith increasingextract concentration.High concentration extract gave a percentageincreasing of (11%) and (23%) in the weight ofthe grain.ear^{-1} , and (5%) and (9%) in the 500grainweightcompared toconcentration 50%andcontroltreatment, respectively. Poultrywaste compost was superior in increasinggrain weight.ear^{-1}and the 500grainsweight comparedto other composts . Theinteractionbetween theconcentration andtype ofextracthad a significant effectin increasing theweight ofthe grain.earn^{-1}and weight of500grains, whichreached highest value(117.67 g) and (130.17 g), respectively, whensprayinghigh extract concentration (100%) ofpoultry wastecompost , whilecontrol gavelessweight.

Table 10:Effect of foliar extract concentrations of different composts on grain weight.earn^{-1}

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	86.33	103.67	117.67	102.56
wheatresidue compost	85.67	96.00	108.00	96.56
date palm residue compost	86.00	98.00	110.00	98.00
Average of concentration	86.00	99.22	111.89	
$LSD_{0.05}$	**A** =2.199**C**= 2.199**A*C**=3.809			

Table 11:Effect of foliar extract concentrations of different composts on 500 grains weight

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	115.40	121.27	130.17	122.28
wheatresidue compost	112.10	118.43	123.80	118.11
date palm residue compost	115.87	117.53	122.30	118.57
Average of concentration	114.46	119.08	125.42	
$LSD_{0.05}$	**A**=2.239**C**=2.239**A*C** =3.877			

Table (12)shows thatsprayextractsof organic fertilizers led toa significant increasein grain protein content compared to control,and that theeffectincreased significantly with increasingextract concentration. High extract concentrationcaused a percentageincreaseof(4%) and (6%) comparedto low concentration(50%) andcontrol,respectively. Poultry waste compost was superior in increasing the proportion ofproteincomparedother composts. Theinteractionbetween theconcentration andtype ofextract had a

significant effectinincreasing proportion ofproteinin grain, which reached (11.017) whensprayinghigh extract concentration (100%) of poultry wastecompost,whilecontrol gave lowest rate.

Table 12:Effect of foliar extract concentrations of different composts on grain protein content

Concentration / Compost type	control	50%	100%	Average of compost type
poultry wastecompost	9.977	10.433	11.017	10.476
wheatresidue compost	9.873	10.100	10.310	10.094
date palm residue compost	9.830	9.997	10.373	10.067
Average of concentration	9.893	10.177	10.567	
$LSD_{0.05}$	**A** = 0.145**C**= 0.145	**A*C**= 0.251		

DISCUSSION

Tables2-3showsthat spraying ofpoultry wastecompostextractled toa significant increasein thenumber of leaves andleaf areaindexcompared toother composts, and that theeffectincreased significantlywithincreasing the concentrationto100%, this may be duetothe reasonthatthe extractcontains morenutrientsavailable[10], andincreasing extract concentration meansincreasing the concentration ofnutrientsand thus increasethe positive effectin thegrowth traits[11] Especially since thesoil analysis(Table1)shows that it was in low contentof available essential minerals, and needs additionalfertilizer, hence the response has beengreat. Thesame effectwas observedin thechlorophyllcontentofthe leaves(Table4)andthismay be duetotheextract ofpoultry wasteis rich inits contentofmagnesiumin addition toother elementsandthereby increase thechlorophyll[12]. As shown intables5 and 6tosprayingextractof poultry wastehas led toreducethe number of daystomale and femalefloweringsignificantly compared tothe other compost, and that theextractconcentration of100%wasmore effectivecompared tothe control orthe low concentration (50%).Thereason isthat sprayingextract of poultryled toan abundanceof nutrientsresulting in increasingefficiency ofthe process ofphotosynthesis, as well as physiological and biological processesand so the plant completeitsperiod requiredforfloweringat the lowestperiod as opposed tothe control treatment whichdecreasedthe role ofphysiologicalevents and vitalityinthe plantand thereforeneed to continuegrowthtocompletegrowth period, which led to an increasefromagriculturetoflowering[12]. Tables7-11showthat sprayingpoultry waste compost extractled toa significantimprovementin yield qualities compared tothe other compost, and that theconcentration of100%wasmore effectivecompared tothe control and low concentration (50%). This can be attributedtothe abundance ofnutrientsthat have led toincreasevegetative growth(Table2 , 3and 4)and thusincrease the efficiency ofthe photosynthesis process, as well as physiological and biological processeswhich is reflectedin increasing yield components [9,10,13].Table12also showsthatsprayingpoultry wastecompostextractled toincrease the proportion ofprotein in thegraincomparedthe other compost, and that highconcentration(100%) wasmore effectivecompared tocontrol or low concentration (50%). It is due toincrease thecontentofnitrogen, which entersin the synthesis ofamino acidsand thusincrease the proportion ofprotein in thegrain.

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