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EFFECT OF ORGANIC FERTILIZER SOURCES AND APPLICATION METHODS ON QUALITATIVE AND QUANTITATIVE APRICOT (*PRUNUS ARMENIACA* L.) FRUIT CHARACTERISTICS

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Abstract

Experimental trials were carried out in the apricot orchard of the University of Baghdad, College of Agricultural Engineering Sciences on six year old trees grafted upon apricot seed rootstocks in objective to study the effect of organic fertilizer sources and application methods on fruit qualitative and quantitative characteristics using NPK fertilizer as a comparison. A factorial experiment involving two factors was applied using a Randomized complete block design. The first factor included five organic fertilizer sources, Humic acid, Poultry manure, Cow manure, sheep manure and NPK as a comparison, the second factor involved three application methods, Ground applications, foliar applications and both ground and foliar applications combined. Notable results indicated the highest yield and fruit weight was recorded by NPK treatments reaching 43.89 kg 30.44 g respectively followed up by Humic and poultry treatments recording the highest yield means 36.44 kg, 34.66 kg and highest fruit weight 28.11 g, 25.56 g, respectively. The lowest nitrate levels were recorded by cow manure reaching %0.0118 and the highest levels were recorded by NPK treatments reaching %0.0431, the leading application method used was (ground+foliar)and the leading interaction treatment was recorded by ground Humic+foliar application as well as poultry ground+foliar fertilizer treatment.

Key words : *Prunus armeniaca* L., NPK fertilizer, humic acid, fruit weight.

Introduction

Apricot *Prunus armeniaca* L. are stone fruit belonging to the Rosacea family, an economically and nutritionally important fruit in Iraq as fruit is not only consumed fresh but dried and is used to make jams. In the last few years apricot production has decreased as statistics indicate Iraq's apricot production for the year 2000 reached 27000 tons and for 2010 18926 tons, recording a 29% decrease and for the year 2016 production recorded 13871 with a 48.6% decrease (FAO, 2016). This drop in production is due to the lack of tree management especially fertilization, which increases tree growth and yield quantity and quality.

Application of chemical fertilizers to plants as well as trees improves vegetative growthflowering and fruit growth (Ibrahim, 1998). These fertilizers are considered costly as well as their negative impact on human health and the environment causing air, soil, and water pollution (Al-Hadad, 1998). On the contrary, organic fertilizers are of lower costs and safer to use on the environment, while improving soil chemical and physical properties as well as providing nutrients to plants for a longer period of time. Organic fertilizers have been used for many years by farmers to improve soil properties and improve plant growth;Organic fertilizers are rich in Nitrogen and nutrient elementsand can be applied directlyto plants avoiding harm as long as soluble salts are low (Kuepper, 2003) applying the right amount of decomposed animal remnants before or after planting can achieve a suitable amount of macro elements for trees (Granatstein, 2004; Kessel, 2003; Maar *et al*., 1998). Best results were achieved with Organic fertilizers when mixed with soil in order to decrease loss of Nitrogen during decomposition and help mobilize nutrients into rhizospheres in preparation for absorption and utilization (Rosen and Biermank, 2007; Ibrahim,

1998).

Continuous application of organic fertilizers increases soil acidity levels as a result of organic acid release accompanying decomposition of these fertilizers, which increases element availability and benefit to the plant (AL-Shahaat, 2007). Due to what was mentioned the objective of this research was to increase apricot tree growth and yield using different organic fertilizer sources and to determinate the most preferableapplication method as well as defining what can be compensated when using organic fertilizers in comparison with recommended chemical fertilizer doses.

Materials and Methods

The experiment was carried out in the apricot orchard of the University of Baghdad/ college of agriculture on six year old trees grafted upon apricot seed rootstocks in objective to study the effect of organic fertilizer sources including Humic acid, Poultry, manure, cow manure, sheep manure and NPK as a comparison and application methods included ground applications, foliar applications and both ground and foliar applications combined on yield and fruit quality. A factorial experiment was applied using a Randomized complete block design including three replicates, ditches were dug around trees at the beginning of the experiment (mid-march) at a depth of 20 cm and 50 cm away from the treetrunk. Decomposed poultry, sheep and cow manure fertilizers were applied with soil. Another amount of the fertilizers was taken and in a plastic container water which had been previously exposed to air in order to expel chlorine was addedat a ratio of 1:10 (Kilogram remnants: liters of water). Remnants were placed inside a cloth bag to increase water penetration while turning the mixture 2-3 times for 10 minutes each to achieve homogeneity and ventilation was done using an air pump to prepare aerobic circumstances for aerobic microorganisms to grow and reproduce for an interrupted half hour each day. Mixing and extracting the solution was carried out for a weeks' time then filtered using a cloth filter. The solutionleached was placed in a container and was presumed as a concentration of 100% (Al-Shahat, 2007) each fertilizer was applied in three different ways as follows: T1 = NPK ground 150-150-300 gm, T2 = NPK foliar 5gm.L^{-1}, T3=NPK ground 150-150-300 gm +foliar 5gm.L^{-1}, T4 = Humic Acid ground 10ml.L^{-1}, T5 = Humic Acid foliar 2ml.L^{-1}, T6 = Humic Acid ground 10ml.L^{-1}+foliar 2ml.L^{-1}, T7 = Poultry ground 20kg/tree, T8= Poultry foliar 20%,T9= Poultry ground 20kg/tree + foliar 20%, T10 = Sheep ground 20kg/tree, T11 = Sheep foliar 20%, T12 = Sheep ground 20kg/tree+foliar 20%, T13 = Cow ground 20kg/tree, T14 = Cow foliar 20%, T15 = Cow ground 20kg/tree +foliar 20%.

Nitrogen was applied according to the method mentioned by Kessel (2003) as P and K were applied as a full dose while two thirds the quantity of N was added during the beginning of March and the left over third during the beginning of April (Radi *et al*., 2003). Foliar applications were repeated four times with one month intervals. Means were tested using LSD at a 5% probability.

Studied parameters

Yield quantity per tree: Yield quantity was taken after Harvest in mid-march for each experimental unit and weighed using a large capacity scale (150 kg), means were calculated.

Fruit weight : 30 fruits were weighed using a normal scale for each experimental unit, means were then calculated.

Table 1 : Analyzing orchard soil sample.

Parameters		Units	Values
Ec		Decisiemens.m^{-1}	1.83
pH		—	7.21
Texture (silty clay)	**Sand**	g.kg^{-1}	134
	Silt	g.kg^{-1}	412
	Clay	g.kg^{-1}	456
$CaCO_3$		g.kg^{-1}	22.3
$CaSO_4$		g.kg^{-1}	0.0033
Organic matter		%	1.294
Total nitrogen		g.kg^{-1}	0.76
Available phosphorus		Centimole.kg^{-1}	0.18
Available Potassium		ppm	400.3
Sodium		ppm	2.72

Nitrate percentage in fruits % : Samples were washed by distilled water and 100 gram of each sample was selected and placed in specified containers, samples were then placed in an oven at 70^0C for 48 hours. Samples were grinded to powder after parching and extracted by 0.2 percent citric acid solution. 1 gram was taken per sample and 100 CC of solution was added to samples and placed in shaker device for 20- 30 minutes to combine samples and solutions.Extraction was done by filter paper and juice was kept in specified bottles. Nitrate readings werethen done usinga spectrophotometer and Palin test (photometer 7100).

TSS percentage in fruits% : This parameter was measured using a Hand Refractometer and was estimated according to A.O.A.C. (1985).

Total Acidity percentage % : Fruit titratable acidity (malic acid (g)/100ml of juice was estimated according to A.O.A.C (1985).

Results and Discussion

It can be noticed from table (2) that fertilizer source significantly affected tree yield. NPK treatments gave the highest average yield reaching 43.89 kg/tree followed by Humic acid treatments recording 36.44 kg/tree followed by Poultry fertilizer reaching 34.33 kg/tree which did not differ significantly from Humic treatments, followed by Sheep manure recording 30.00 kg/tree, while Cow manure gave the lowest average reaching 26.89 kg/ tree. Application method had a significant effect on yield. Ground applied + foliar fertilizers combined gave the highest average yield reaching 39.60 kg/tree followed by ground applied treatments recording an average of 33.39 kg/tree. Foliar applied treatments gave the lowest average yield reaching 29.40 kg/tree. As for the interaction treatments between fertilizer sources and application methods a significant effect was recorded. The interaction treatment (NPK ground+ foliar) recorded the highest average yield reaching 51.00 kg/tree followed by (Humic ground+ foliar) which recorded an average of 44.0 kg/tree, next (Poultryground+foliar) reaching 42.33 kg/tree and cow foliar applied fertilizer gave the lowest average reaching 23.67 kg/tree.

It can be noticed from table 3 that fertilizer source had a significant effect on fruit weight. NPK treatments gave the highest fruit weight reaching 30.44 gm followed by Humic treatments recording an average of 28.11 gm followed by poultry fertilizer which recorded a mean of 25.56 gm. Sheep and cow manure treatments recording the lowest averages reaching 24.11 and 22.33 gm, respectively. As for Application methods which recorded a significant effect on fruit weight, as ground applied treatments+ foliar applied gave the highest fruit weight reaching 29.67 gm followed by ground treatments recording an average of 25.67 gm, the lowest average fruit weight was recorded by foliar treatments reaching 23.00 gm. As for the interaction treatments the highest fruit weight was recorded by NPK fertilizer ground+ foliar applications reaching 36.00 gm followed by Humic ground+ foliar applied treatments recording an average of 31.67 gm, Poultry ground and foliar applied treatments (28.67) gm and the comparison treatment reaching 28.67 gm. The lowest average fruit weight was recorded by cow manure foliar treatments reaching 20.00 gm.

Table (4) clarifies that a few fertilizer sources increased Nitrate levels while others decreased them, NPK fertilizer treatments resulted in the highest nitrate levels

Table 2 : Effect of fertilizer source and application method on Apricot tree yield (kg/tree).

Source of fertilizer	Application Methods			Average
	Ground	Spray	Ground+Spray	
NPK	41.30	39.33	51.00	43.89
Humic acid	35.67	29.67	44.00	36.44
Poultry	32.33	28.33	42.33	34.33
Sheep	31.00	26.00	33.00	30.00
Cow	29.33	23.67	27.67	26.89
Average	33.39	29.40	39.60	
LSD	A=1.82	F=2.35	A*F=4.08	

Table 3 : Effect of fertilizer source and application method on apricot fruit weight (gm).

Source of fertilizer	Application Methods			Average
	Ground	Spray	Ground+Spray	
NPK	28.67	26.67	36.00	30.44
Humic Acid	27.67	25.00	31.67	28.11
Poultry	25.67	22.33	28.67	25.56
Sheep	24.00	21.00	27.33	24.11
Cow	22.33	20.00	24.67	22.33
Average	25.67	23.00	29.67	
LSD	A=1.60	F=2.07	A*F=3.58	

reaching 0.0431% and was followed up by poultry fertilizer treatmentrecording an average of 0.026%, while sheep and cow manure decreased nitrate levels recording averages of 0.0122% and 0.0118%, respectively. Application method had an effect on nitrate levels; the highest average was recorded by ground + foliar treatments reaching 0.0234% followed by ground treatments reaching 0.0215% while foliar applications gave the lowest nitrate levels reaching 0.0185%. As for interaction treatments NPK ground + foliar, ground (comparison treatment) and foliar treatments gave the highest nitrate levels reaching 0.0486%, 0.0426% and 0.0380 % respectively followed by poultry ground + foliar treatments recording an average of 0.0320% while cow and sheep manure foliar applied treatments gave the lowest levels reaching 0.0113% and 0.0113%, respectively.

From table 5 results refer to a significant effect from fertilizer source on TSS%. NPK treatments gave the highest percentage reaching 16.10% followed by Humic treatments 13.88% and poultry treatment reaching 13.35%, while sheep and cow fertilizers gave the lowest TSS percentages reaching 13.00% and 12.55% respectively, application methods also affected TSS percentages, ground + foliar treatments gave the highest percentages reaching 14.49% followed by ground applied treatments recording an average of 13.71%, foliar

Table 4 : Effect of fertilizer source and application method on fruit NO_3 content (%).

Source of fertilizer	Application Methods			Average
	Ground	Spray	Ground+Spray	
NPK	0.0426	0.0380	0.0486	0.0431
Humic Acid	0.0120	0.0123	0.0126	0.0123
Poultry	0.0270	0.0196	0.0320	0.0262
Sheep	0.0130	0.0113	0.0123	0.0122
Cow	0.0130	0.0113	0.0113	0.0118
Average	0.0215	0.0185	0.0234	
LSD	A=0.0015	F=0.0019	A*F=0.0034	

Table 5 : Effect of fertilizer source and application method on TSS%.

Source of fertilizer	Application Methods			Average
	Ground	Spray	Ground+Spray	
NPK	16.03	15.03	17.23	16.10
Humic Acid	13.66	13.30	14.70	13.88
Poultry	13.33	12.66	14.06	13.35
Sheep	13.03	12.50	13.46	13.00
Cow	12.50	12.16	13.00	12.55
Average	13.71	13.13	14.49	
LSD	A=0.41	F=0.53	A*F=0.93	

Table 6 : Effect of fertilizer sources and application methods on total acidity %.

Source of fertilizer	Application Methods			Average
	Ground	Spray	Ground+Spray	
NPK	1.083	1.083	1.076	1.081
Humic Acid	1.073	1.086	1.033	1.064
Poultry	1.066	1.093	1.066	1.075
Sheep	1.063	1.083	1.050	1.065
Cow	1.073	1.093	1.060	1.075
Average	1.072	1.088	1.057	
LSD	A=0.0117	F=0.0151	A*F=0.0262	

application treatments gave the lowest levels reaching 13.13%, interaction treatment also effected TSS levels; NPK Ground + foliar, Ground (comparison treatment), and foliar treatments gave the highest TSS averages reaching 17.23%, 16.03% and 15.03 respectively, followed by Humic ground + foliar reaching 14.70%, cow manure treatments foliar applied gave the lowest percentage reaching 12.16%.

Results from table 6 confirm that fertilizer source had a significant effect ontotal acidity percentage, NPK treatments recorded the highest levels reaching 1.081 % followed by poultry and cow treatments recording averages of 1.075%, 1.075% respectively, Humic treatments recorded the lowest average at 1.064%. Application method also significantly affectedthe studied parameter, foliar applied treatments gave the highest acidity levels reaching 1.088% followed by ground applied treatments 1.072%, while ground + foliar treatment gave the lowest acidity levels reaching 1.057%, interaction treatment results refer to the highest total acidity levels recorded by poultry foliar and cow foliar treatments reaching 1.093%, 1.093% respectively followed by humic foliar treatment recording an average of 1.086%, while humic ground treatments recorded the lowest acidity percentage reaching 1.033%.

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