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Research Paper

Effect of Sheep Manure, Ascorbic Acid and Sulphur On Some Growth Characteristics of Apricot (*Prunus armeniaca* L.) cv. Royal

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***ABSTRACT*:** *This study was carried out during (2010-2011) and (2011-2012) seasons to investigate the effect of soil application of four levels of sheep manure (0, 15 , 30 and 45 kg /tree), foliar application of ascorbic acid at four concentrations (0, 100 , 200 and 300 mg.L^{-1}) and four levels of sulphur (0, 150, 300 and 450 g/tree) on some growth characteristics of apricot trees (Prunus armeniaca L.) cv. " Royal" for two growing seasons 2011 and 2012, A factorial experiment with four replicates was carried out in a Randomized Complete Block Design (R.C.B.D). Results indicated that the leaf area, leaf dry weight and total chlorophyll content in the apricot leaves significantly increased by increasing the application of sheep manure, ascorbic acid and sulphur levels at both seasons.*

KEYWORDS: *- Apricot, Ascorbic acid, Sheep manure, Sulphur*

I. INTRODUCTION

Apricot (*Prunus armeniaca* L.) belongs to *Rosaceae* family, subfamily *Prunoideae*, tribe *Prunea*e and the genus *Prunus* [1] and the section *armeniaca* that is commercially grown world-wide [2-5].

Apricot fruits are rich in carbohydrates, fibers, proteins, sugars, vitamins (A, B1, B2 and C) minerals (Ca, P, Fe and K) [5]. The apricot is considered to be one of the most delicious of temperate fruit trees [3] bearing delicious multipurpose fruits. The uses of apricot are multiple and diverse: fresh fruit, processed fruit for drying, canning, jam, juice, sauce , preserved, vinegar and also medicinally used [6]. Additionally, the seed of some cultivars are edible, tasting like almonds, while the tree can be used as an ornamental plant[3,5].

The application of sheep manure as an organic fertilizer to fruit trees leads to significant effects on trees growth. The positive effect of most commonly used sheep manures on the tree groth and soil fertility are dependent on the quality, rate, timing and method of application. The amount of nutrients and the type of elements available from the sheep manure used is again dependent on the age of fruit tree, type of soil origin as well as climatic conditions such as temperature, rainfall and cultural practices being followed [7-9], the that the application of sheep manure at 450 g of N /tree/annually to fig trees caused a significant increase of leaf area and total chlorophyll for two seasons as compared with control [10].

Nowadays, there is a widespread use of antioxidants especially ascorbic acid as natural and organic antioxidant compound. Ascorbic acid is an essential compound for plant tissues since it has antioxidant functions, and acts as co-enzyme in an enzymatic cofactor and plant growth regulator[11]. It has synergistic effect on improving growth, flowering, yield and fruit quality of fruit crops [12-15]. The foliar application of ascorbic acid at 250, 500 and 1000 mg.L-1 to " Canino" apricot for two seasons caused significant increase of leaf area as compared with untreated trees [14].

Sulphur element plays a great role in plant metabolism and application of sulphur to the soil caused reduction in the soil pH, consequently enhancing the solubility and availability of many elements, also sulphur addition improved plants growth and their yields[8], sulphur is an important component of amino acids such as , cysteine, cystine and methionine, which are essential for protein formations, It plays an important role in enzyme synthesis and activation, also it is required in chlorophyll formation, and sulphur is a component of sulfur-containing sulfolipids, and it has a number of oxidising functions in plant nutrition and a constituent of Fe-S proteins called Ferridoxin, responsible for transfer of electrons in photosynthesis [16-19]. The sulphur

application at a rate of 200 g/tree caused significant increase in total chlorophyll and leaf area in peach trees cv" Dixired" [20].Therefore, this study was carried out for the following objects:

1. To utilize the natural sources such as organic material resources and sulphur, which do not affect the human health, and also conserving the natural resources, as well as improving soil fertility and soil physical properties.
2. To study the effects of sheep manure, ascorbic acid and sulphur on some growth parameters, of apricot trees, as ascorbic acid is widely used for enhancing growth of fruit trees.

II. MATERIAL METHODS

2.1 Location:

This study was conducted during (2010 -2011) and (2011-2012) seasons at Grdarash field, College of Agriculture, University of Salahadin, Erbil governorate, Iraq. which is situated at latitude (36° $07'$ $14.36''$ N), and longitude (44° $00'$ $48.33''$ E) and at an altitude of 410 m above the mean sea level which has silty clay vertisol order [21] , to investigate the effect of different levels of sheep manure, ascorbic acid and sulphur on some vegetative growth characteristics of apricot tree cv."Royal". A composite soil sample (to a depth of 0-75 cm) was drawn from the experimental area before applying the sheep manure in December 25,2010, and it was analyzed for physical and chemical properties table (1).

2.2 Apricot trees selection and cultural practices

Trees of apricot cv. "Royal" were planted in March 2005. The trees were raised from budding on seedling rootstocks and they have been planted at 4x5 m a part, the trees have been trained on open central method, the orchard is being irrigated by drip irrigation system. Tree pruning was done during winter, all broken, dried and infected branches have been removed, weed control was done by hand and the spaces between the lines were ploughed by tractor. The trees were chosen for the study on the basis of age, uniformity, shape, healthy state and vigor.

Table (1): Some physical and chemical properties of the orchard soil

Properties	Value
pH	7.98
Electrical conductivity (ds/m)	0.28
Organic matter	0.89 %
Clay (g /kg)	442.5
Silt (g/kg)	425.0
Sand (g/kg)	132.5
Soil texture	Silty clay
Total N (%)	0.119
Available P (mg/kg)	2.1
Available K (mg/kg)	140
Available SO^{-}_{4} (mg/kg)	33

2.3 Treatments and experimental design:

The experiment consisted of three factors:

First factor: Sheep manure at four levels (0, 15, 30 and 45 kg /tree), the sheep manure was applied at both seasons, it incorporated to the soil around the basis of trees during last week of December of 2010 and 2011. Some chemical and physical properties for the sheep manure as presented in table (2).

Second factor: Foliar application of ascorbic acid at four concentrations (0,100, 200 and 300 $mg.L^{-1}$). The ascorbic acid was sprayed twice a season; the first spray was done two weeks after full bloom, and repeated after one month of that for the two seasons. The full bloom for the first season occurred on 22 March 2011 and the harvest started on 29 May 2011, while the full bloom for the second season occurred on 9 March 2012 and the harvest started on 20 May 2012.

Third factor: Soil application of agricultural sulphur (95% S) at four levels of (0, 150, 300 and 450 g S / tree). The sulphur was applied to the soil around the basis of trees at the first week of January for the two seasons.

Table (2): Some chemical and physical properties of the sheep manure

Properties	Value
pH	**8.3**
Electrical conductivity (ds/m)	**5.68**
Total N (%)	**2.10**
Available P (%)	**0.256**
Available K (%)	**0.47**
Available SO^{-}_{4} (%)	**0.0231**
Organic matter (%)	**44.37**
C/N ratio	**12.24**

The experiment was consisted of 64 treatments with three replications, with one individual tree for each experimental unite and as a factorial experiment using RCBD Design [22]. The total number of trees used for each season was 192 trees.

2.4 Measurements:

2.4.1 Growth Characteristics:

2.4.1.1 Leaf area (cm^2):

On 1st of August of the two seasons, 10 full expanded leaves were taken randomly from all sides of each tree to determine the leaf area through photographing the leaves on previously weighed A_4 white papers then the photograph area was cut out and weighed to obtain the corresponding area for each g of A_4 paper then the leaf area for a single leaf was calculated according to the following equation [23].

$$\text{Leaf area } (cm^2) = \frac{\text{Area of } A_4 \text{ paper } (cm^2) \times \text{cut part weighed (g) (plant leaf)}}{\text{Wight of (A4) paper (g)}}$$

2.4.1.2 Leaf dry weight (g):

The same leaves used for determination of leaf area were used for the determination of dry weight of the leaves for both seasons [24, 25], then the leaves were washed with tap water, and treated with 0.1 HCl for twenty minutes. Leaves were rewashed with distilled water and oven dried at 70 c◦ for 72 hours or until constant the weight, finally leaves were weighted with four decimal places decates electrical balance to record their dry weight.

2.4.2 Total chlorophyll content (mg/ g fresh weight):

Total chlorophyll was determined in leaf extractions with acetone (80%), filtered with centrifuge for five minutes at 3000 $C.h^{-1}$, then light absorption determination with spectrophotometer at 663 and 645 nm were measured. The total chlorophyll was determined according to the following equations[26,27].

Total chlorophyll = 20.20 A645 + 8.02 A663

A663 and A645 was the reading of spectrophotometer at 663 and 645 nanometer respectively.

2.5 Statistical analysis:

All the obtained data were tabulated and statistically analyzed with computer using SAS system (2002). The differences between various treatment means were tested with Duncun Multiple range test at 5% level.

III. RESULTS AND DISCUTION

3.1 Growth characteristics:

3.1.1 Leaf area (cm^2)

Table (3) shows the effect of sheep manure, ascorbic acid, sulphur and their interactions on the single leaf area for seasons 2011 and 2012 respectively. Data from the mentioned table clearly showed that the application of sheep manure at a rate of 45 kg/tree gave the highest significant values for both seasons and the lowest values were recorded in control for both seasons. The same table also illustrates that foliar application of

ascorbic acid at levels of 300 and 200 mg.L^{-1} significantly increased leaf area for the two seasons, and the highest values were recorded at 300 mg.L^{-1} for both seasons, however the lowest values were recorded in control for the two seasons.

Data from the same table indicated that the application of sulphur caused significant increase in leaf area for the two seasons, in which the highest values of leaf area were recorded at the application of sulphur at 450g/tree for the both seasons, while the lowest values were recorded in control at both seasons.

It is clear from the same table that the interaction between sheep manure and ascorbic acid caused significant effect in leaf area, the highest significant value was recorded with the application of sheep manure at 45 kg/tree + 300 mg.L^{-1} of ascorbic acid for both seasons, and lowest values were found in control at both seasons.

Data obtained from the same table showed that the interaction effect of sheep manure and sulphur also resulted in significant increase in leaf area, and the application of sheep manure at a rate of 45 kg/tree + application of sulphur at a rate of 450 g/tree gave the highest significant value for the first season, while in the second season, the application of sheep manure at 45 kg/tree + application of sulphur at 450 and 300 g/tree resulted in significant superior values, and lowest values were found in control for the both seasons.

Regarding the interaction effect of foliar application of ascorbic acid and sulphur on leaf area, the highest significant value for the first season was recorded at 200 mg.L^{-1} of ascorbic acid + 450 g/tree of sulphur, whereas the application of 300 mg.L^{-1} ascorbic acid + 300 and 450 g/tree of sulphur for the second season gave the highest value of leaf area, however in the first season , the lowest value was obtained in 0 mg.L^{-1} ascorbic acid + 150 g/tree of sulphur and in treatments of 0 mg.L^{-1} ascorbic acid + 150 g/tree of sulphur and control in the second season .

The interaction of sheep manure, ascorbic acid and sulphur also resulted in significant increase in leaf area. The highest significant value was obtained with the application of sheep manure at 45 kg/tree + 300 mg.L^{-1} of ascorbic acid + sulphur application at 300 and 150 g/tree for the first season and for the second season, the treatment of 45 kg/tree sheep manure + 300 mg.L^{-1} ascorbic acid + sulphur at 300 and 450 g/tree gave the highest significant, while the lowest value in the first season was recorded in control and in the second season the lowest value was recorded in the treatments of 0 kg/tree sheep manure + 0 mg.L-1 of ascorbic acid + 150 g/tree sulphur and control .

Table (3): Effect of sheep manure, ascorbic acid, sulphur and their interactions on the leaf area (cm^2) of apricot trees cv"Royal" for 2011 and 2012 seasons

ASCORBIC ACID (mg.L^{-1})	SULPHUR (g/tree)	SHEEP MANURE (kg/tree)				ASA x S	Means of Ascorbic Acid
		0	15	30	45		
2011							
0	**0**	32.51 m	34.92 i-k	35.75 h-j	37.83 f	35.26 d	**35.45 c**
	150	32.84 lm	34.92 i-k	35.75 h-j	37.00 f-h	35.13 d	
	300	33.26 k-m	34.92 i-k	35.75 h-j	37.00 f-h	35.23 d	
	450	33.68 k-m	34.92 i-k	36.17 g-i	39.91 e	36.17 c	
100	**0**	33.68 k-m	34.92 i-k	36.17 g-i	40.33 de	36.27 c	**36.87 b**
	150	34.09 j-l	34.92 i-k	37.83 f	40.33 de	36.79 bc	
	300	34.51 i-k	34.92 i-k	37.83 f	41.58 cd	37.21 ab	
	450	34.09 j-l	34.92 i-k	37.83 f	41.99 c	37.21 ab	
200	**0**	34.09 j-l	34.92 i-k	37.83 f	42.41 bc	37.31 ab	**37.42 a**
	150	34.09 j-l	34.92 i-k	37.83 f	41.99 c	37.21 ab	
	300	34.09 j-l	34.92 i-k	37.83 f	42.41 bc	37.31 ab	
	450	34.51 i-k	34.92 i-k	37.83 f	44.07 a	37.83 a	
300	**0**	34.51 i-k	34.92 i-k	37.42 fg	43.65 ab	37.63 a	**37.62 a**
	150	34.51 i-k	34.92 i-k	36.17 g-i	44.28 a	37.47 ab	
	300	34.51 i-k	34.92 i-k	37.42 fg	44.28 a	37.78 a	
	450	34.51 i-k	35.75 h-j	36.11 g-i	44.07 a	37.61 a	

SHM x ASA	**0**	33.07 j	34.92 gh	35.86 f	37.94 d	**Means of Sulphur**
	100	34.09 i	34.92 gh	37.42 de	41.06 c	
	200	34.20 hi	34.92 gh	37.83 d	42.72 b	
	300	34.51 g-i	35.13 g	36.78 e	44.07 a	
SHM x S	**0**	33.70 e	34.92 d	36.79 c	41.06 b	**36.62 b**
	150	33.88 e	34.92 d	36.90 c	40.90 b	**36.65 b**
	300	34.09 e	34.92 d	37.21 c	41.32 b	**36.88 ab**
	450	34.20 e	35.13 d	36.99 c	42.51 a	**37.21 a**
Effect of Sheep manure		**33.97 d**	**34.97 c**	**36.97 b**	**41.45 a**	

2012

0	**0**	31.18 k	32.01 jk	33.68 i-k	37.83 e-g	33.68 e	**33.93 c**
	150	31.18 k	32.01 jk	33.68 i-k	37.83 e-g	33.68 e	
	300	31.60 jk	31.54 k	34.51 h-k	38.26 d-f	33.98 e	
	450	31.60 jk	32.01 jk	34.92 h-k	39.08 d-f	34.40 de	
100	**0**	31.18 k	32.43 jk	34.51 h-k	39.91 c-e	34.51 c-e	**35.26 b**
	150	31.60 jk	32.43 jk	36.17 f-i	39.91 c-e	35.03 b-e	
	300	31.60 jk	32.84 jk	37.00 e-h	42.41 a-c	35.96 a-c	
	450	31.60 jk	32.43 jk	37.00 e-h	41.16 b-d	35.55 a-d	
200	**0**	31.60 jk	32.84 jk	37.00 e-h	41.16 b-d	35.65 a-d	**36.12 a**
	150	31.60 jk	32.84 jk	37.00 e-h	42.82 a-c	36.07 ab	
	300	32.01 jk	33.26 i-k	37.42 e-h	42.82 a-c	36.38 ab	
	450	32.01 jk	32.85 jk	37.42 e-h	43.24 ab	36.38 ab	
300	**0**	31.60 jk	33.26 i-k	37.42 e-h	42.82 a-c	36.27 ab	**36.71 a**
	150	31.60 jk	33.26 i-k	37.83 e-g	44.32 a	36.75 a	
	300	32.01 jk	33.67 i-k	37.42 e-h	44.49 a	36.90 a	
	450	32.01 jk	33.26 i-k	37.83 e-g	44.49 a	36.90 a	
SHM x ASA	**0**	31.39 i	31.89 hi	34.20 f	38.25 d	**Means of Sulphur**	
	100	31.49 hi	32.53 g-i	36.17 e	40.85 c		
	200	31.80 hi	32.95 f-h	37.21 de	42.51 b		
	300	31.80 hi	33.36 fg	37.63 d	44.03 a		
SHM x S	**0**	31.39 d	32.64 d	35.65 c	40.43 b	**35.03 b**	
	150	31.49 d	32.64 d	36.17 c	41.22 ab	**35.38 ab**	
	300	31.80 d	32.83 d	36.59 c	41.99 a	**35.80 a**	
	450	31.80 d	32.64 d	36.79 c	41.99 a	**35.81 a**	
Means of Sheep manure		**31.62 d**	**32.68 c**	**36.30 b**	**41.41 a**		

Means of each factor and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple range test at 5% level.

3.1.2 Leaf dry weight (g)

Table (4) shows the effect of sheep manure, ascorbic acid, sulphur and their interactions on the leaf dry weight for seasons 2011 and 2012 respectively. The obtained data from table (4) clearly showed that the highest significant value was recorded in case of application of sheep manure at 45 kg/tree which for the two seasons, and lowest value was obtained in control at both seasons.

The same table also explain that the leaf dry weight significantly increased by increasing the ascorbic acid levels for the two seasons, the highest significant value was recorded with foliar application of ascorbic acid at of 300 $mg.L^{-1}$ for both seasons, while the lowest values were recorded in control for both seasons .The highest significant values were recorded as a result of sulphur application at a rate of 450 g/tree which for both seasons, whereas the lowest values were obtained in control at both seasons .

The interaction effect of sheep manure and ascorbic acid caused significant increase in leaf dry weight, and the highest significant value was recorded with application of ascorbic acid at 45 kg/tree + foliar application of ascorbic acid at 300 $mg.L^{-1}$ at both seasons, while the lowest values were recorded in control. Also the results indicated that the highest interaction effect of sheep manure and sulphur in leaf dry weight was recorded with the application of sheep manure at 45 kg/ tree + application of sulphur at 450 g/tree at both seasons, while the lowest values were recorded in control.

The highest significant value was noted in the first season with 300 $mg.L^{-1}$ of ascorbic acid + application of sulphur at 450 g/tree , whereas the highest significant value for the second season was observed with 300 $mg.L^{-1}$ of ascorbic acid + application of sulphur at 300 g/tree, and the lowest value for the first season was recorded in control, however for the second season the lowest value was recorded with treatment of 0 ascorbic acid $mg.L^{-1}$ + 150 g/tree of sulphur.

The highest significant value for the interaction of sheep manure + ascorbic acid x sulphur in leaf dry weight was recorded with application of 45 kg/tree of sheep manure + 300 $mg.L^{-1}$ of ascorbic acid + 450 g/tree of sulphur in the first season and in the second season was with application of 45 kg/tree of sheep manure + 300 $mg.L^{-1}$ of ascorbic acid + 300 ad 450 g/tree of sulphur, while the lowest values of leaf dry weight were recorded in control for the two seasons.

Table (4): Effect of sheep manure, ascorbic acid, sulphur and their interactions on the leaf dry weight (g) of apricot trees cv "Royal" for 2011 and 2012 seasons

ASCORBIC ACID ($mg.L^{-1}$)	SULPHUR (g/tree)	SHEEP MANURE (kg/tree)				ASA x S	Means of Ascorbic Acid
		0	15	30	45		
2011							
0	**0**	0.215 v	0.319 mn	0.347 i	0.401 g	0.320 h	**0.327 d**
	150	0.224 u	0.321 l-n	0.348 i	0.400 g	0.323 h	
	300	0.247 st	0.321 l-n	0.359 h	0.403 g	0.333 g	
	450	0.249 r-t	0.323lm	0.359 h	0.403 g	0.334 g	
100	**0**	0.246 t	0.327 k-m	0.360 h	0.423 f	0.339 f	**0.345 c**
	150	0.256 rs	0.330 kl	0.363 h	0.426 f	0.344 e	
	300	0.258 r	0.329 k-m	0.363 h	0.426 f	0.344 e	
	450	0.259 qr	0.335 jk	0.363 h	0.457 e	0.354 d	
200	**0**	0.258 r	0.335 jk	0.364 h	0.462 de	0.355 d	**0.358 b**
	150	0.259 qr	0.334 jk	0.365 h	0.466 de	0.356 d	
	300	0.259 qr	0.336 jk	0.365 h	0.468 d	0.357 d	
	450	0.268 q	0.341 ij	0.366 h	0.486 c	0.365 c	
300	**0**	0.288 p	0.342ij	0.370 h	0.509 b	0.377 b	**0.382 a**
	150	0.288 p	0.344 ij	0.368 h	0.514 ab	0.379 b	
	300	0.305 o	0.343 ij	0.368 h	0.521 a	0.384 a	
	450	0.312 no	0.344 ij	0.368 h	0.522 a	0.386 a	
SHM x ASA	**0**	0.234 o	0.321 k	0.353 g	0.402 d	**Means of Sulphur**	
	100	0.255 n	0.330 j	0.362 f	0.433 c		

	200	0.261 m	0.337 i	0.365 ef	0.470 b	
	300	0.298 l	0.343 h	0.369 e	0.516 a	
SHM x S	**0**	0.252 j	0.331 f	0.360 d	0.449 c	**0.348 d**
	150	0.257 i	0.332 ef	0.361 d	0.452 bc	**0.350 c**
	300	0.267 h	0.332 ef	0.364 d	0.454 b	**0.355 b**
	450	0.272 g	0.336 e	0.364 d	0.467 a	**0.360 a**
Effect of Sheep manure		**0.262 d**	**0.333 c**	**0.362 b**	**0.455 a**	

2012							
0	**0**	0.204 x	0.296 p-s	0.297 p-s	0.403 f	0.300 j	**0.304 d**
	150	0.206 x	0.297 p-s	0.289 q-s	0.405 f	0.299 j	
	300	0.213 wx	0.299 o-r	0.314 l-o	0.406 f	0.308 i	
	450	0.215v-x	0.299 o-r	0.321 j-l	0.402 f	0.309 i	
100	**0**	0.215 v-x	0.302 n-q	0.313 l-o	0.423 e	0.313 i	**0.324 c**
	150	0.227 u-w	0.306 m-p	0.335 j	0.424 e	0.323 h	
	300	0.227 u-w	0.316 k-n	0.351 i	0.428 e	0.330 g	
	450	0.227 u-w	0.317 k-m	0.352 i	0.428 e	0.331 g	
200	**0**	0.229 uv	0.318 k-m	0.352 i	0.429 e	0.332 g	**0.343 b**
	150	0.232 u	0.319 k-m	0.352 i	0.453 d	0.339 f	
	300	0.238 u	0.318 k-m	0.363 hi	0.464 d	0.346 e	
	450	0.253 t	0.319 k-m	0.363 hi	0.487 c	0.355 d	
300	**0**	0.260 t	0.326 j-l	0.364 hi	0.508 b	0.365 c	**0.371 a**
	150	0.263 t	0.327 j-l	0.370 gh	0.518 ab	0.369 bc	
	300	0.284 s	0.330 jk	0.369gh	0.523 a	0.377 a	
	450	0.284 rs	0.304 m-q	0.379 g	0.523 a	0.373 ab	
SHM x ASA	**0**	0.210 n	0.298 j	0.306 i	0.404 d	**Means of Sulphur**	
	100	0.224 m	0.310 i	0.338 g	0.426 c		
	200	0.238 l	0.319 h	0.357 f	0.458 b		
	300	0.273 k	0.322 h	0.370 e	0.518 a		
SHM x S	**0**	0.227 h	0.311 f	0.332 e	0.441 c	**0.328 c**	
	150	0.232 h	0.312 f	0.337 e	0.450 b	**0.333 b**	
	300	0.241 g	0.316 f	0.349 d	0.455 ab	**0.340 a**	
	450	0.245 g	0.310 f	0.354 d	0.460 a	**0.342 a**	
Means of Sheep manure		**0.236 d**	**0.312 c**	**0.343 b**	**0.452 a**		

Means of each factor and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple range test at 5% level.

Tables (3 and 4) illustrate the significant positive effect of sheep manure at a rate of 45 kg/tree on vegetative growth characteristics which may be due to the improvement of soil physical and biological properties and also, the chemical properties resulting in more release of available nutrient elements to be absorbed by plant

root and its effect on the physiological process such as the photosynthesis activity as well as the utilization of carbohydrates, in addition to water use efficiency, also it may secure adequate nutrient quantities in the leaves which increase both rate of leaf expansion as well as cell division which subsequently leads to larger individual leaves and higher photosynthesis activities[7, 28, 29], the increasing of leaf dry weight might be due to increase leaf area table (3) and total chlorophyll content table (5) in which the sheep manure has a positive role in the availability and concentration of nutrient elements in the leaves, in which the translocation of stored photo-assimilates in the leaves are increased subsequently reflect in high accumulation of dry matter [30], or may be attributed to a higher nutritional uptake mainly by greater expansion of root system due to increased supply of photosynthetic productions in the leaves. These results are in the line with those recorded by [31-37].

It seems from the same table that foliar application of ascorbic acid positively affected the vegetative growth characteristics of apricot tree, the highest value was found at foliar application of ascorbic acid at 300 $mg.L^{-1}$. The effect of ascorbic acid on plant growth might be due to substantial role of ascorbic acid in many metabolic and physiological processes, also the increments of leaf area and dry weight might be attributed to the effect of the ascorbic acid on cell division and elongation[38-41], also the positive action of vitamins on enhancing natural hormones as well as building all organic foods and plant pigments [42] reflected on enhancing the leaf area, subsequently increasing the leaf dry weight. These results are in accordance with those obtained by [12, 14, 43, 44-47].

Data from the same tables also indicate the positive effect of sulphur application on vegetative growth characteristics in which the highest value was recorded at a rate of 450 g/tree, application of sulphur helps in availability of other nutrients beside sulphur which results in better growth and increased uptake of all nutrients at higher level which subsequently increase leaf cell division, elongation and photosynthesis [31, 48]. The increase in dry matter production might be attributed to the increased synthesis of amino acids containing sulphur in plants which in turn resulted in the increasing of leaf area (3**)** , also it has been reported that the chloroplast protein synthesis is accelerated by a greater uptake of sulphur by plants and higher synthesis of chloroplast results in greater photosynthetic efficiency and ultimately increased dry matter production per plant [49].These results are in agreement with those obtained by [20, 31,47, 48, 50].

All the interactions between sheep manure, ascorbic acid and sulphur significantly affected in vegetative growth characteristics at both seasons, the highest means of these parameters found at the interactions between the highest levels of each factor, and this may be attributed to the synergism effect of sheep manure, ascorbic acid and sulphur as mentioned above.

3.2 Total Chlorophyll (mg/ g fresh weight):

Table (5) shows the effect of sheep manure, ascorbic acid, sulphur and their interactions on leaves total chlorophyll content for seasons 2011 and 2012 respectively. The obtained data clearly showed that significant increase in total chlorophyll contents was obtained as a result of application of sheep manure, the highest significant values were recorded at application of 45 kg/tree for the both seasons respectively, and the lowest value were recorded in control for the two seasons.

Regarding the effect of foliar application of ascorbic acid, the highest significant value of total chlorophyll content was recorded for the foliar application of 300 $mg.L^{-1}$ ascorbic acid for the two seasons respectively, while the lowest values were recorded in control at both seasons.

The same table explain that the sulphur application significantly increased total chlorophyll content of the leaves as compared with control, the highest value of chlorophyll recorded for the first season was resulted from the application of sulphur at 300 g/tree , while in the second season , it was at application rate of 450 g/tree of sulphur , however the lowest value was recorded in control for the two seasons respectively.

The interaction effect of sheep manure + ascorbic acid caused significant increase in leaves total chlorophyll content for both seasons, the highest significant values were recorder at application of 45 kg/tree sheep manure + foliar application of ascorbic acid at 300 $mg.L^{-1}$ for the both seasons, and the lowest values were found in control at both seasons .Regarding the effect of interaction between sheep manure and sulphur, the same tables indicated that the application of sheep manure at a rate of 45 kg/tree + sulphur at a rate of 450 g/tree recoded highest significant values at both seasons, and the lowest values were found in control for the both seasons.

The highest significant interaction effect of ascorbic acid and sulphur for both seasons was recorded for the foliar application of ascorbic acid at 300 $mg.L^{-1}$ + sulphur at a rate of 450 g/tree at both seasons, while the lowest values were recorded in for the both seasons .

The interaction of sheep manure, ascorbic acid and sulphur also caused a significant increase in total chlorophyll content for both seasons, and the highest significant value was recorded at the application of sheep manure at 45 kg/tree + 300 $mg.L^{-1}$ of ascorbic acid + 45 g/tree of sulphur for the both seasons, and the lowest values were obtained in control at both seasons.

Table (20): Effect of sheep manure, ascorbic acid, sulphur and their interactions on the leaf total chlorophyll (mg/g fresh weight) of apricot trees cv"Royal" for 2011 and 2012 seasons

ASCORBIC ACID ($mg.L^{-1}$)	SULPHUR (g/tree)	SHEEP MANURE (kg/tree)				ASA x S	Means of Ascorbic Acid
		0	15	30	45		
2011							
0	**0**	13.15 ē	13.99 z- ć	14.84 u-w	17.94 l	14.98 m	**15.30 d**
	150	13.19 ē	14.04 z- b^{-}	15.02 tu	18.54 k	15.20 l	
	300	13.57 ď	14.07 z- b^{-}	15.55 q-s	18.76 k	15.49 jk	
	450	13.68 ć ď	14.08 z ā	14.85 u-w	19.51 j	15.53 i-k	
100	**0**	13.69 ć ď	14.27 yz	14.90 uv	19.63 j	15.62 ij	**15.74 c**
	150	13.73 b^{-}- ď	14.40 xy	14.90 uv	19.68 j	15.68 i	
	300	13.73 b^{--} ď	14.41 xy	14.92 uv	21.96 i	16.25 h	
	450	13.80 ā – ď	14.46 xy	15.14 tu	18.17 l	15.39 k	
200	**0**	13.81 ā – ď	14.50 xy	15.29 st	22.61 h	16.55 g	**17.16 b**
	150	13.89 ā – ď	14.52 xy	15.47 rs	23.15 g	16.76 f	
	300	13.91 ā – ć	14.62 v-x	15.58 q-s	25.76 f	17.47 e	
	450	13.90 ā – ć	14.54 w-y	15.60 q-s	27.42 e	17.87 d	
300	**0**	13.92 ā – ć	15.49 rs	15.62 p-r	28.21 d	18.31 c	**18.64 a**
	150	13.94 z- ć	15.69 o-r	15.93 op	28.51 c	18.52 b	
	300	13.96 z- ć	15.86 o-q	15.97 o	28.84 b	18.66 b	
	450	13.97 z- ć	16.37 n	16.70 m	29.19 a	19.06 a	
SHM x ASA	**0**	13.40 n	14.05 k	15.07 h	18.68 d	**Means of Sulphur**	
	100	13.74 m	14.38 j	14.96 h	19.86 c		
	200	13.88 lm	14.55 i	15.48 g	24.73 b		
	300	13.95 kl	15.85 f	16.06 e	28.69 a		
SHM x S	**0**	13.64 l	14.56 j	15.16 g	22.09 d	**16.37 c**	
	150	13.69 kl	14.66 ij	15.33 f	22.47 c	**16.54 b**	
	300	13.79 k	14.74 hi	15.51 e	23.83 b	**16.97 a**	
	450	13.84 k	14.86 h	15.57 e	23.57 a	**16.96 a**	
Effect of Sheep manure		**13.74 d**	**14.71 c**	**15.39 b**	**22.99 a**		
2012							
0	**0**	12.85 n	13.16 mn	13.84 mn	20.66 g	15.13 h	**15.41 d**
	150	12.89 n	13.17 mn	14.36 k-m	20.70 g	15.28 h	
	300	12.92 n	13.17 mn	14.78 j-l	21.40 fg	15.57 gh	
	450	12.98 n	13.19 mn	14.85 j-l	21.56 fg	15.64 g h	
100	**0**	12.98 n	13.19 mn	14.88 j-l	21.67 fg	15.68 gh	**16.15 c**
	150	12.99 n	13.18 mn	14.94 j-l	22.38 f	15.87 g	
	300	12.99 n	13.18 mn	14.94 j-l	24.58 e	16.43 f	
	450	13.07 n	13.20 mn	15.04 jk	25.11 e	16.60 f	

200	**0**	13.07 n	13.20 mn	15.19 i-k	25.56 e	16.75 ef	**17.22 b**
	150	13.08 n	13.20 mn	15.59 ij	27.00 d	17.22 de	
	300	13.07 n	13.20 mn	15.63 ij	26.92 d	17.21 de	
	450	13.11 n	13.21 mn	16.22 hi	28.29 c	17.71 cd	
300	**0**	13.11 n	13.21 mn	16.23 hi	28.42 c	17.74 b-d	**18.09 a**
	150	13.13 n	13.20 mn	16.83 h	28.82 bc	18.00 a-c	
	300	13.16 mn	13.20 mn	16.92 h	29.77 ab	18.26 ab	
	450	13.17 mn	13.21 mn	17.13 h	29.93 a	18.36 a	
SHM x ASA	**0**	12.91 h	13.17 h	14.46 g	21.08 d	**Means of Sulphur**	
	100	13.01 h	13.19 h	14.95 g	23.43 c		
	200	13.08 h	13.20 h	15.66 f	26.94 b		
	300	13.14 h	13.20 h	16.78 e	29.24 a		
SHM x S	**0**	13.00 g	13.19 g	15.03 f	24.08 d	**16.33 c**	
	150	13.02 g	13.19 g	15.43 ef	24.73 c	**16.59 b**	
	300	13.04 g	13.19 g	15.57 e	25.67 b	**16.87 a**	
	450	13.08 g	13.20 g	15.81 e	26.22 a	**17.08 a**	
Means of Sheep manure		**13.04 c**	**13.19 c**	**15.46 b**	**25.17 a**		

Means of each factor and their interactions followed with the same letters are not significantly different from each others according to Duncans multiple range test at 5% level.

The promotion of sheep manure in total chlorophyll is presented in table (5) , the highest value was recorded at a rate of 45 kg/tree of sheep manure, the reason might be attributed to the fact that as a result of sheep manure application quantities of nutrients been added to the soil (table 2), which caused that apricot trees applied with 45 kg/tree of sheep manure reached the sufficiency of nutrients especially nitrogen, phosphorus, potassium and sulphur , nitrogen is a constituent of chlorophyll molecule, moreover ,nitrogen is the main constituent of all amino acids in proteins and lipids that acts as a structural compounds of the chloroplast[51, 52], The increase in leaf pigments might be resulted from the balanced of nutritional environment in the soil and thus kept iron physiologically active for chlorophyll synthesis in the plants[53,54], it has been noted that in spit that potassium is not a constituent of chlorophyll, a characteristic symptom of potassium deficiency is the destruction of chlorophyll. This means it may be suspected that part of the function of potassium is related to the formation of chlorophyll precursor or to the prevention of the decomposition of chlorophyll [17], also sulphur is associated with the synthesis of chlorophyll and proteins [49, 55] and phosphorus is necessary in chlorophyll formation, although it is not a constituent of chlorophyll [17, 56].The obtained results are similar to those found by [10,34, 35, 57].

The same table shows that foliar application of ascorbic acid resulted in increasing the total chlorophyll content in the leaves, the foliar application of ascorbic acid at 300 $mg.L^{-1}$ recorded the highest value in total chlorophyll content, the reason might be due to that ascorbic acid has a central role in photosynthesis, as high content ration in chloroplast would imply [38], also ascorbic acid has a wide range of important functions as antioxidant defense, photoprotection and regulation of photosynthesis and growth [58-60], also might be that ascorbic acid effects on many enzyme activities, and minimizes the damage caused by oxidative process through synergic function with other antioxidants [39].The results found are in agreement with those found by [12, 35, 46, 47, 61].

Regarding the effect of sulphur, also the same table indicates that highest value for total chlorophyll was found at sulphur application at a rate of 450 g/tree, the application of sulphur caused increase the uptake of nutrients, in which the nutrients have close association with chlorophyll biosynthesis and increasing of photosynthesis rate [20, 62]. These results are in a line with those found by [20, 47, 48, 50, 62].

All the interactions between sheep manure, ascorbic acid and sulphur significantly affected in leaves total chlorophyll content at both seasons, the highest means of these parameters found at the interactions between the

highest levels of each factor, and this may be attributed to the synergism effect of sheep manure, ascorbic acid and sulphur as mentioned above.

IV. CONCLUSION

Based on the obtained results from this study, the application of sheep manure, ascorbic acid and sulphur effected significantly on leaf area, dry leaf weight and total chlorophyll content, the application of 45 kg/tree of sheep manure, 300 mg.L-1 of foliar application of ascorbic acid and application of 450 g/tree of sulphur were most effective as compared with other levels of the factors, also the factors interactions in the second season were more effective on the studied parameters than the first season.

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