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JOURNAL PAPER INSTRUCTIONS TO AUTHORS

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The paper should be valuable and should not have been published or submitted for publication in any other Journals. The text should be complete with abstract, introduction, material and methods, results, discussion and reference. The text must not exceed 15 pages for sciences papers and 25 for the humanities

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ALI MUHAMMED[1], JALAL AMEEN [2] and DLOVAN ASSAD [2]

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KEYWORDS: *Erosivity factor, Rainfall, Fournier index, Water Quality*

Summary should be provided also in Kurdish and Arabic at the end of the paper.

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Except the tables, all the graphs, maps and photographs must be named as figures. Tables and Figures should be numbered consecutively by Arabic numerals. The tables and figures must not exceed the page margins and must be on one page. All Table outline border should be (1 ½ pt.), inside border should be (½ pt.); table details should be Arial font and written with 7 pt. the figure and table names must be written with 8 pt. style. Names must be written in the middle on top for the tables with space 4 after and for the diagrams/figures, underneath on the bottom with space 4 before and 12 after. If the figure and table names have to be more than one line, the line spacing should be single spaced, and the terms of "Figures" and "Tables" must be bold. (See below)

Table (1): The effect of pepper shoot & root aqueous extract on the growth of different other plants:

Shoot Extract						Root Extract				
Plant type	Conc. %	Root length (cm)	Shoot length (cm)	Intact plant length (cm)	Inhibition %	Conc. %	Root length (cm)	Shoot length (cm)	Intact plant length (cm)	Inhibition %
Okra	0	*25.7 a**	27.8 a	53.5a	-	0	25.7a	27.8a	53.5a	-
	5	25.00a	26.77a	51.77a	3.23	1	24.50a	27.00a	51.50a	3.73
	10	24.50a	25.95a	50.45a	5.70	2	23.87a	25.65a	49.52a	7.43
Sorghum	0	21.6a	27.2a	48.8a	-	0	21.7a	27.2a	48.9a	-
	5	13.00b	17.25b	30.25b	38.03	1	9.8b	25.5ab	35.3b	27.6
	10	6.00c	5.50c	11.50c	76.44	2	9.4b	22.6b	31.9 b	34.6

Figure (1): xxxxxxxxxxxxx

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CONTENTS

THE EFFECT OF SOME OPERATING PARAMETERS ON FIELD PERFORMANCE OF TRACTOR.

HANI M.A. HUSSEIN
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(Received: September 30, 2014; Accepted for publication: January 7, 2015)

ABSTRACT

This study using two levels of plow types (mould board and standard disc), three levels of the wheel pressure (2.5, 2 and 1.5) bar and three levels of the forward speed (3.94, 7.49 and 9.59) km/h, the impact of these treatments in the characters of the slipping, field efficiency and productivity was measured . The results indicated that the interaction between the treatments had a significant impact in some of these characters, the mould board plow, wheel pressure (1.5 bar) and forward speed (3.94 km/h) is superiority in other treatments in the character wheel slipping which was (8.74 %) , while the treatment superiority mould board plow, wheel pressure (2 bar) and forward speed (7.49 km/h) on the other treatments in the characters of field efficiency and productivity which was (77.94 % , 0.67 ha/h) respectively.

***KEYWORD*:** slip, productivity, field efficiency

INTRODUCTION

The wheel slipping of the tractor is one of the driving force factors that effect on their performance efficiency at the field, and reducing the slips results dramatically will in increasing the economic life of the wheels as the tractor result in reduces of the fuel consumption and power loss. Abouda and others (2001). Khafaf et al (1991) found that the optimum mechanical performance of the plow when the wheel slipping is less than (15 %), Alrajabu and others (2005) existing that the possibility of increasing the speed of plowing will act as a positive impact on productivity, without reaching the slip is not allowed. Among of Jarrah et al (2006) the increase of the forward speed resulted in increasing the percentage of slipping. Al – Jubory (2011) show that increasing the forward speed with using a mould board plow increased each wheel slip and productivity, while increasing the depth of tillage increased the slipping as well as decrease in productivity. Also reviewed Mamkagh (2009) the results of the study when increasing forward speed making increase in the slip of wheels tractor. Al – Sharifi (2009). Said the interaction between the plows and the forward speed was significant in the slipping, field efficiency and actual productivity. Al – Hamed et al (2001) reported that the tractor is working in the best performance when the air pressure was low in the wheel. Jassim and Al Sharifi (2007) results showed that the superiority of mould board plow and disc plow to significantly characteristics in wheel slipping, field efficiency and productivity. Bander and Himoud (2009). Found that the increase of forward speed leads to increase the momentum that has led to increase displacement of the soil and thus increase slipping. The results also showed that the pressures at (0.75 and 0.1 bar) gave less slipping from the pressure (1.5) bar, because of the large area of communication between the wheels and soil, which led to a decreasing in the wheel slip.

Al – Badri and Al – Hadithy (2011) found that increasing the forward speed of the moldboard plow led to increasing of the wheels slipping and productivity with decreasing fuel consumption Al – Jubory and others (2012) mentioned that the increasing of tractor forward speed has led to an increase in the characteristics slip and productivity due to reduced time period off touching wheels of tractor with the soil surface, either to increase productivity due to that speed is one of the compounds involved in the equation. Among Al – Neama and Al – Jubory (2009) that the tractor gave the best performance, the less air pressure inside the rear wheels. Where the reduce wheel air pressure to reduced the slipping of the wheels (19.6 – 5.3) %, which had the effect of significantly increasing the productivity.

The aim of study are to determine the best plow conditions, air pressure for the wheels, forward speed of the tractor and the relationship of the field performance of the tractor and plow.

MATERIAL AND METHODS

Research conducted at the field of the Faculty of Agriculture, University of Duhok, used tractor case 120 model 2005 with size (18.4 R 38) to the rear wheels and (14.9 R 28) to the front wheels with two types of the plows (Moldboard contains three bottoms which width 120 cm and standard disc contains three discs which width 135 cm) with three levels of air pressure of the rear wheels (1.5, 2 and 2.5) bar and three levels of forward speed (3.94, 7.49 and 9.59) km/h in some mechanical properties (Slipping, Field efficiency and Productivity).

The results were analyzed statistically according to split – split plot design, the main plots were used for types of plows and split plots were used for air pressure of the rear wheels and split – split plots were used for forward speed, of three replications for each treatment. Used the tape (2 m) to measure the width of the machine, either for measuring time have used timer accurately (0.01) sec and to measure the air pressure on the wheels by used pressure gauge accurately (0.1) bar, the data were analyzed using SAS (2000), The properties was calculated using the following relations:

Coefficient of the width % = (Actual with / Theoretical width) *100……...1

Coefficient of the speed % = (Speed with load / Speed without load) * 100……....2

Slip % = ((Speed without load – Speed with load) / Speed without load) * 100……...3

Field efficiency % = (Coefficient of width * Coefficient of speed) * 100…….....…4

Productivity (ha/h) = (Speed * Width * Field efficiency) / 10000 …….……...5

RESULTS AND DISCUSSION

1. Effects of study factors on slipping :

The effects of study parameters on tractor slipping can be seen from table (1). The single effect shows the highest slipping was (16.44 %) with mould board plow, while the disc plow obtained lower value (13.32 %). The reason for these results may be due to the disc plows more by weight of the mould board plow which led to increase wheel slip and a decrease in the efficiency of the machine. This result is consistent with what was said by each of the Jassim and Alon (2007).The wheel pressure shows that (2 bar) given lower slipping (best) which was (13.14 %) and this may due to the reducing of wheel rolling resistance at this level of pressure, Then the speed shown that (3.94 km/h) obtained the lowest slippage (12.36 %) comparing with other speed. The barney interaction shows that the best slip was (10.74 %) with mould plow and wheel pressure of (1.5 bar), while the highest value of slip was (20.36 %) at disc plow and high pressure of wheel (2.5 bar).The interaction between plow type and speed given best slip (11.02 %) at mould board plow and (3.95 km/h) of speed, while the highest value (18.99 %) at disc plow and (7.49 km/h) of speed. Also, the interaction of wheel pressure and speed obtained the superior slip (11.34 %) at speed of (3.49 km/h) and pressure wheel of (1.5 bar), whereas the highest value (19.27 %) with (9.59 km/h) of speed and (2.5 bar) of wheel pressure. The ternary interaction of plow type, wheel pressure and speed can be seen from table (1) the table (4) shows that interaction between plow, wheel pressure and speed the superiority treatment of mould board plow, wheel pressure (2 bar) and speed forward (3.94 km/h) to other treatments in the character slip and that was (11.43 %), while the superiority treatment of mould board plow, wheel pressure (2 bar) and forward speed (7.49 km/h). Decreases in slipping back to that time period to touch wheels with the soil were few; either to increase productivity because of that speed is one of the vehicles included in the equation. This is consistent with what was said by each of Al – Jubory and other (2012).

Table (1) :- Effect of study parameters on slipping (%).

Slipping %						
Plow	Wheel Pressure bar	Forward speed km/h			Plow * Wheel Pressure	Plow
		3.94	7.49	9.59		
Mould board	2.5	12.88 bcd	17.05 efg	18.61 gf	16.18 c	13.32 a
	2	11.43 ab	11.81 bcd	15.87 de	13.04 b	
	1.5	8.74 a	10.66 ab	12.82 bcd	10.74 a	

Standard disc	2.5	15.40 cde	17.72 cd	19.94 f	20.36 d	16.44 b
	2	11.78 abc	13.80 bcd	14.13 bcd	13.24 b	
	1.5	13.94 b	17.43 cd	15.84 cd	15.74 c	
Plow * Forward speed	Mould board	11.02 a	13.18 b	15.76 c	Wheel Pressure bar	
	Standard disc	13.71 b	18.99 d	16.64 c		
Wheel Pressure * Forward speed	2.5	14.14 b	21.39 c	19.27 c	18.27 b	
	2	11.60 a	12.81 ab	15.00 b	13.14 a	
	1.5	11.34 a	14.05 b	14.33 b	13.24 b	
Forward speed km/h		12.36 a	16.08 b	16.20 b		

2.Effect of Study parameters on field efficie ncy:

The effects of study parameters on field efficiency are shown from table (2). The single effect shows the highest field efficiency was (70.32 %) with mould board plow, while the disc plow obtained lower efficiency (62.38 %). The reason for these results may be due to the disc plows more by weight of the mould board plow which led to increase wheel slip and a decrease in the efficiency of the machine. The wheel pressure shows that (2 bar) given highest field efficiency which was (69.66 %), whereas, the lowest efficiency was (62.25 %) at wheel pressure of (2.5 bar), and this may due to the reducing of wheel soil resistance at this level of pressure, Then the tractor speed shown the speed of (3.94 km/h) obtained the highest field efficiency (69.44 %) comparing with speed of (9.59 km/h) which obtained the lowest efficiency (64.46 %) . The barney interaction between plow and pressures, shows significantly differed than other treatment, and highest efficacy was (75.06 %) with mould plow and wheel pressure of (2 bar), while the lowest efficacy value was (59.79 %) at disc plow and high pressure of wheel(2.5 bar). The interaction between plow type and speed shows there is on significantly different at mould board plow at all level of speed, the highest efficiency of (71.14 %) at mould board plow and (7.49 km/h) of speed, while the lowest value (60.66 %) at disc plow and (7.49 km/h) of speed. Although, the interaction of wheel pressure and speed obtained the superior efficiency (70.88 %) at speed of (9.59 km/h) and pressure wheel of (2 bar), whereas the lowest value (57.84 %) with (9.59 km/h) of speed and (2.5 bar) of wheel. The ternary interaction of plow type, wheel pressure and speed can show from table (2). The interaction of mould board plow, wheel pressure (2 bar) and speed forward (7.49 km/h) recorded the highest efficiency (77.94 %), whereas the lowest value (56.33 %) at disc plow, tractor speed (9.59 km/h) and wheel pressure (1.5 bar).

Table (2):- Effect of study parameters on field efficiency (%)

Field Efficiency %						
Plow	Wheel Pressure bar	Forward speed km/h			Plow * Wheel Pressure	Plow
		3.94	7.49	9.59		
Mould board	2.5	68.86 b	68.53 b	56.72 d	64.70 c	70.15 a
	2	72.17 ab	77.94 a	75.06 ab	75.06 a	
	1.5	72.12 ab	66.94 bc	72.98 ab	70.68 b	
Standard disc	2.5	67.85 b	52.57 d	58.95 cd	59.79 d	63.28 b
	2	67.29 b	58.82 cd	66.70 bc	64.27 c	
	1.5	68.38	72.65	56.33	65.79	

		b	ab	d	c	
Plow * Forward speed	Mould board	71.05 a	71.14 a	68.26 a	Wheel Pressure bar	
	Standard disc	67.84 a	61.35 b	60.66 b		
Wheel Pressure * Forward speed	2.5	68.36 ab	60.55 cd	57.84 d	62.25 b	
	2	69.73 ab	68.38 ab	70.88 a	69.66 a	
	1.5	70.25 ab	69.80 ab	64.66 bc	68.23 a	
Forward speed km/h		69.44 a	66.24 b	64.46 b		

2. Effect of study parameters on productivity:

The effects of study parameters on productivity are shown from table (3). The single effect shows there is no significantly different between plow types. The wheel pressure shows significantly differed, the highest productivity was (0.50 ha/h) at pressure value of (2 bar), whereas the lowest value (0.43 ha/h) at pressure of (2.5 bar),also the tractor speed shown the speed of (9.59 km/h) obtained the highest productivity (0.60 ha/h) comparing with speed of (3.94 km/h) which obtained the lowest productivity (0.35 ha/h) The barney interaction between plow and pressures pressure. The ternary interaction of plow type, wheel pressure and speed can show from table (3). The interaction of mould board plow, wheel pressure (2 bar) and speed forward (7.49 km/h) shows highest productivity (0.52 ha/h) with mould plow and wheel pressure of (2 bar), while the lowest productivity was(0.43 ha/h) at both mould board and disc plow with (2.5 bar) of wheel pressure. The interaction between plow type and speed shows the highest value (0.61 ha/h) at mould board plow and (9.59 km/h) of tractor speed, whereas the lowest value(0.29 ha/h) at mould board plow and (3.49 km/h) of speed Also, the interaction of wheel pressure and speed obtained the superior productivity of (0.66 ha/h) at speed of (9.59 km/h) and pressure wheel of (2 bar), whereas the lowest value (0.29 ha/h) at (9.59 km/h) of speed and (2.5 bar) of wheel given the highest productivity (0.67 ha/h) whereas the lowest value (0.28 ha/h) at mould board plow, tractor speed (3.94 km/h) and wheel pressure (2.5 bar).

Table (3): -Effect of study parameters on productivity ha/h

Productivity ha/h						
Plow	Wheel Pressure bar	Forward speed km/h			Plow * Wheel Pressure	Plow
		3.94	7.49	9.59		
Mould board	2.5	0.28 g	0.50 de	0.50 de	0.43 c	0.48 a
	2	0.29 g	0.67 a	0.59 bc	0.52 a	
	1.5	0.30 g	0.48 e	0.66 ab	0.48 b	
Standard disc	2.5	0.30 g	0.41 f	0.57 c	0.43 c	0.46 a
	2	0.30 g	0.46 ef	0.65 ab	0.47 b	
	1.5	0.31 g	0.57 c	0.55 cd	0.48 b	
Plow * Forward speed	Mould board	0.29 d	0.53 b	0.61 a	Wheel Pressure bar	
	Standard disc	0.30 d	0.48 c	0.59 a		
Wheel Pressure * Forward speed	2.5	0.29 e	0.46 d	0.54 c	0.43 b	
	2	0.30 e	0.527 c	0.66 a	0.50 a	
	1.5	0.30 e	0.53 c	0.61 b	0.48 a	
Forward speed km/h		0.35 c	0.50 b	0.60 a		

CONCLUSIONS

1. The mould board plows significant superiority on the disc plows in characteristics slip and field efficiency.

2. The wheel pressure (2 bar) has given best value for each slipping level, field efficiency and productivity.

3. The interaction among mould board plow, wheel pressure (2 bar) and speed forward (3.94 km/h) obtained best slip value compared with other treatments.

4. The highest field efficiency and productivity was observed with mould board plow, wheel pressure (2 bar) and forward speed (7.49 km/h) compared with other treatments in field.

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پوخته

د ڤێ ڤەکولینیدا دوو جوێن ئامیرێن کولانێ هاتینە ب کارئینان (گێسن و سێل)، و سێ ئاستێت فشارێن هەوای د تایراندا (2.5، 2 و1.5) بار، و سێ ئاستێت لەزاتیا سینگی (3.94، 7.49 و9.59) کم/د دەمژمێرەکێدا، و ڤان رێژەیان کارتێکرن ل سەر خاسلەتێن (حلیسانك، بەرهەڤیا گێلگەهی و بەرهەمێ وێ). دئەنجامدا دەرکەت کو تێکەلی دناڤبەرا ڤان رێژەیاندا کارتێکرنەکا بەرچاڤ هەبوو د چەندین خاسلەتاندا، کو تێدا گێسن و فشارا تایران(2 بار) و لەزاتیا سینگی (3.94 کم/ د دەمژمێرەکێدا) بەری هەمی رێژەیێن دیتر بوو د خاسلەتێ حلیسانکێدا کو ریژا وێ (11.43%)، د دەمەکیدا گێسن و فشارا تایران(2 بار) و لەزاتیا سینگی (7.49 کم/ د دەمژمێرەکێدا) بەری هەمی رێژەیێن دیتر بوو د خاسلەتێن بەرهەڤیا کێلگەهی و بەرهەمێ وێ (77.94٪، 0.67 هکتار/ د دەمژمێرەکێدا) ل سەرێك.

الخلاصة

يتضمن هذا البحث استخدام مستويين من المحاريث (المطرحي والقرصي)، وثلاثة مستويات من ضغط العجلات (2.5، 2 و1.5) بار وثلاثة مستويات من السرعة الأمامية (3.94، 7.49 و9.59) كم/ساعة، وأثر هذه المعاملات في الصفات (الانزلاق، الكفاءة الحقلية والإنتاجية). أشارت النتائج إلى أن التداخل بين العوامل كان لها تأثير كبير في بعض الصفات، حيث تفوق المحراث المطرحي وضغط العجلات (1.5 بار) والسرعة الأمامية (3.94 كم/ساعة) على بقية المعاملات في صفة الانزلاق الذي كان (8.74٪)، في حين تفوق المحراث المطرحي وضغط العجلات (2 بار) والسرعة الأمامية (7.49 كم/ساعة) على بقية المعاملات في صفتي الكفاءة الحقلية والإنتاجية والتي كانت (77.94 ٪، 0.67 هكتار/ساعة) على التوالي.

EVALUATION OF WATER BALANCE MODELING PARAMETERS FOR ZAWITA-SWARATOKA WATERSHED

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ABSTRACT

Zawita-Swaratoka watershed is located in Duhok Governorate Iraqi Kurdistan Region about 20km to the north-east of Duhok city. The study area covers about 145 Km^2. It has mean annual rainfall of about 692 mm, which falls during 59 days per eight rainy months per year. January is the most rainy month, and reaches about 146mm. The winter season is the most dense rainy season and reached about 54% of the annual rainfall. The two days maximum rainfall event during eight months is 56% of the annual rainfall, which is the surface runoff.

The water surplus was found to form 52% to 78% with 17% ground water recharge from the mean annual rainfall. The probability of return period for the maximum (725mm per year) and the minimum (255 mm per year) of the water surplus during the next year were 10% and 90% respectively, while the return period probability of the water surplus every two years was 50% between 550-725 mm per year and 50% between 255-550 mm per year respectively.

***KEYWORDS*:** Water-balance, Rainfall, water surplus, surface runoff, Zawita-Swaratoka watershed

INTRODUCTION

Zawita- Swaratoka watershed is located in the headwaters of the greater Zab River. It is bounded by Latitude N 36º 52′ and N 37º 01′ and Longitude E 42º 51′ and E 43º 06′ and covers approximately 145 Km^2. It is located in Duhok Governorate about 20 Km north east of Duhok city. The watershed is bordered from North by Maman and Kopi-lomana mountains, from East by Zenklo-Keri Mountains including Swaratoka Summer Resort, from South by Mam Sin Mountain and Sari Sten summit and from the West by Kamaka mountain ranges. The adjacent watershed downstream is Atrush area which includes part of natural pine forest. The area of the natural pine forest is in the Zawita-Sub-Watershed.

Zawita-Swaratoka watershed lacks hydrological studies except those conducted by the Food and Agriculture Organization (FAO) (Gulcur and Kettenah 1972). Presence of meteorological elements in Agricultural Office of Zawita and Swaratoka encouraged conducting this work.

This study aims at determining the water balance parameters including (rainfall as input while the outputs are surface runoff, ground water recharge and water losses of the watershed. The results could be used for increasing arable Land through constructing small dams to promid water for agricultural purposes. It also aimed at modeling the water balance parameters using meteorological data obtained from the Agro-meteorological stations of both Zawita and Swaratoka Agricultural offices for the water-year 2011-2012 (Table 10).

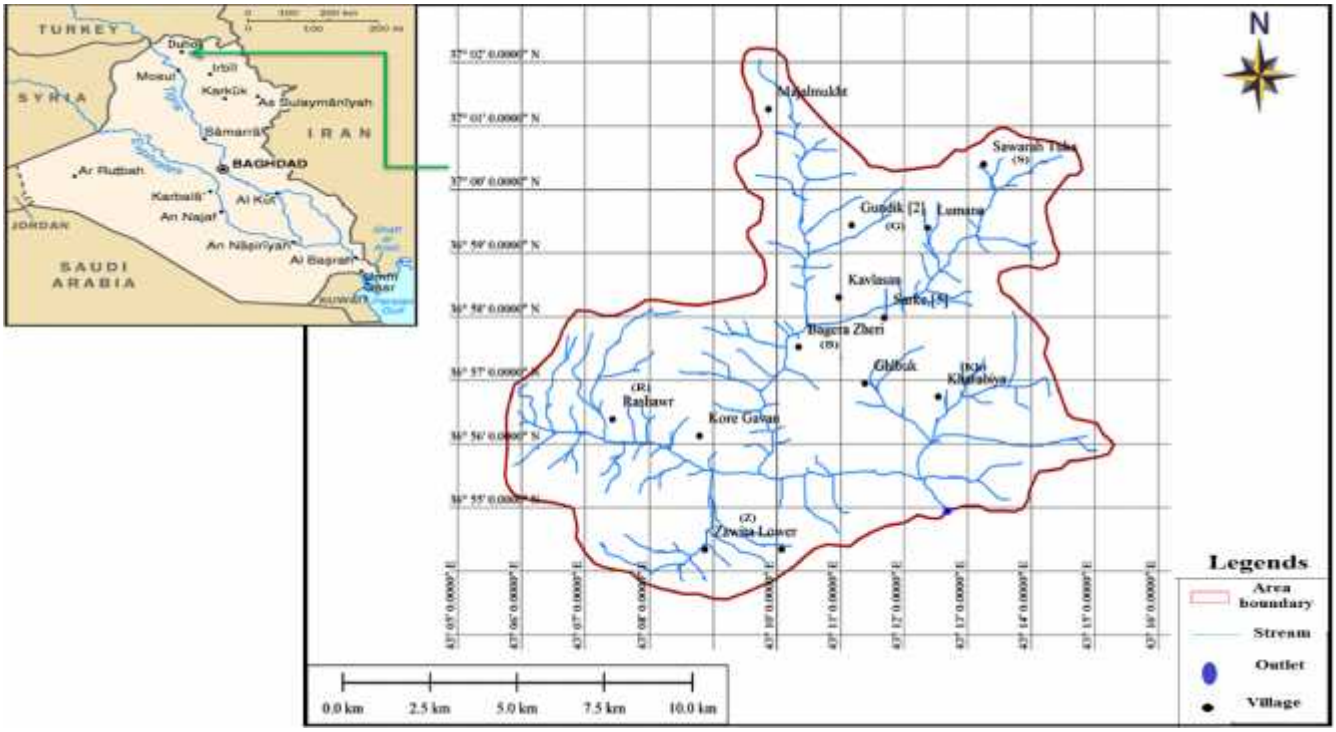

Fig. (1): Location map of Zawita-Swaratoka watershed.

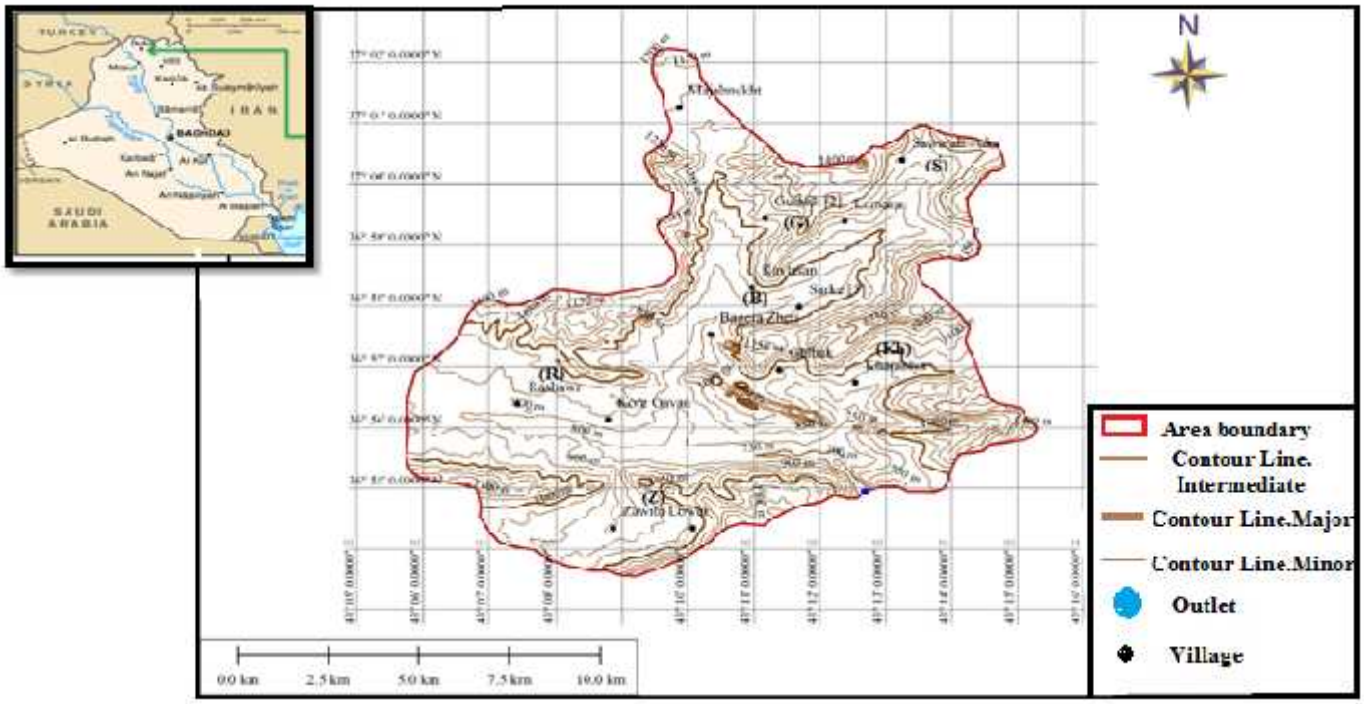

Fig. (2): Topographic map of the watershed.

Topography and Drainage Pattern of the area

Physiographically, Zawita - Swaratoka watershed has a mountainous topography which is mostly steep to very steep except in the northern part where the topography is gentle which is found as small patches in valley bottom.. Elevation of the watershed varies between 740 to 1400 meters above sea level. The area was calculated by using (Global Mapper version 12). The drainage pattern network of streams was found by using (Arc Hydro tools) (Figs. 1and 2). All streams in the watershed, mainly Kori Gavana, Gundig Nabi and Keflesun are perennials. Although Zawita and Rashawer streams, are intermittent, they have water flow for a most of the year. The basic drainage patterns of Zawita-Swaratoka watershed are dendritic and parallel.

Data Acquisition

Meteorological data including (mean monthly of rainfall, temperature, evaporation and mean number of rainy days per month) for the period from 2001-2002 to 2011-2012 were obtained from Zawita and Swaratoka meteorological stations of the Agricultural offices (Table 1, 2, 3 and 4).

Table (1): Mean monthly rainfall (mm) for water year 2001-2002 to 2011-2012 for Zawita and Swaratoka Agricultural offices stations.

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Sum
Rainfall (mm)	22.9	65.0	111.6	146.3	131.6	96.7	93.9	24.2	692.2

Table (2): Mean number of rainy days per month for water year 2001-2002 to 2011-2012 for Zawita Agriculture station.

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Sum
No. of rainy days	4	6	8	10	11	8	8	4	59

Table (3): Mean monthly temperature (C°) for water year 2001-2002 to 2011-2012 for Zawita Agriculture station.

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Agu.	Sep.	Sum
Temp. (C°)	18.3	9.8	5.5	3.4	4.9	9.0	13.9	19.3	24.4	28.9	28.9	24.2	190.5

Table (4): Mean monthly evaporation (mm) for PAN class (A) for water year 2001-2002 to 2011-2012 for Zawita Agriculture station.

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Agu.	Sep.	Sum
Evap. (mm)	143.3	64.0	35.6	40.3	53.1	93.5	114.7	197.9	288.7	329.9	308.7	221.3	1891

Data Analysis and Discussion

Data used in this study for estimating water balance parameters include:

1. The mean number of rainy days per month (n/month):

For any given year, the number of rainy days per month of the study area varies from month to another depending on the rainfall pattern. They were estimated from mean monthly distribution of the rainfall for water-year from 2001-2002 to 2011-2012. The mean number of rainy days per month ranged from 4-11 days, with annual mean of 59 days per eight months which represents mean of 692.2 mm annual rainfall (Tables 1 and 2). May was the lowest rainy month with 23.7mm, while January was the highest one and reached about 162mm. It is noticed that the seasonal distribution of the mean annual rainfall, Autumnal (October, November and December) contributed about 29%, while Winter (January, February and March) and Spring (April and May) contributed 57% and 14% respectively. No rain in summer.

2. Water Balance Parameters

Water balance is the ratio between the inputs and outputs of water. The water balance of the watershed can be estimated by calculating the input and output

of water at watershed surface. The major input of water is the rainfall (Ri), and the output is the water surplus (WSi), and water losses (WLi). According to Fetter (1980) the water surplus could be separated into surface runoff (SRi) and ground water recharge (GRi) as follows:

WSi = SRi + GRi

A water loss is considered as the evaporation type of EPAN ″A″ as maximum possible losses (Jameel *et al*., 1999) which includes also the soil moisture as a part of evaporation (Hassan and Zeki, 1982). Accordingly, the input rainfall and the output EPAN ″A″ and potential evapotranspiration (PET)were taken into consideration for correlation between them.

3. Water Surplus Parameter (WS):

Water surplus is defined as the excess of rainfall over the evaporation type of EPAN ″A″ and potential evapotranspiration values during specific months of the year. In order to determine the water surplus parameter there are many methods that can be used by comparison between mean annual rainfall and water losses. Three methods were used for estimating water surplus by using annual average parameter as a first method, while in the second method monthly average parameters were used and mean daily parameters were used in the third method.

3.a.Mean annual parameter of water surplus:

A comparison of the mean annual rainfall and potential evapotranspiration may not lead to an increase in water surplus due to the fact that the rain occurs in just limited days of the year, whereas potential evapotranspiration continues through the

year. Accordingly, the comparison is not significant because rainfalls become actual evaporation and do not cause water surplus (Jameel et al., 1999), (Fig. 3).

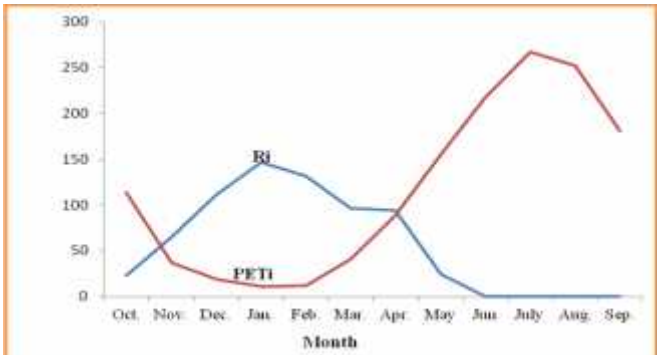

Fig. (3): Comparison between mean annual Ri and PETi.

$$ET = 0.34PTa^{1.3}$$

ET = Potential evapotranspiration in (mm/month).
P = Percentage of total daytime hours for the period used out of total daytime hours of the year.
Ta = Mean temperature in C°.

Mean, minimum , maximum , standard deviation , C.V .and R values of the previous method had very close to their corresponding values of Penman-Monteith method , it was taken as a standard to evaluate other methods for estimating potential evapotranspiration (Hassan *et al*., 2012) .

Mean monthly water surplus was estimated by comparison between mean monthly of both (Ri) and potential evapotranspiration (PETi), (Table 6) expressed as follows :

WSi = Ri –PETi
When Ri > PETi and AEi = PET
Where:
AEi= actual evapotranspiration
WSi = 0
When Ri <= PETi and AEi = Ri
Therefore,

$$WSi\% = \frac{\sum WSi}{\sum Ri} \times 100$$

$$WSi\% = 51.5$$

Table (5): Mean monthly potential evapotranspiration for Zawita-Swaratoka watershed.

Month / Factor	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Agu.	Sep.	Sum
T	18.3	9.8	5.5	3.4	4.9	9.0	14.0	19.3	24.4	28.9	28.9	24.2	
p	7.7	6.9	6.6	6.7	7.4	8.1	9.0	9.7	10.1	9.9	9.3	8.5	
PET	114.6	45.8	20.6	11.4	19.9	47.9	94.5	154.7	218.5	261.9	250.7	181.9	1426.9

Table (6): Mean monthly water surplus from comparison between mean monthly of Ri and PETi.

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Agu.	Sep.	Sum
Ri	22.9	65.0	111.6	146.3	131.6	96.7	93.9	24.2	-	-	-	-	692.2
PETi	114.6	45.8	20.6	11.4	19.9	47.9	94.5	154.7	218.5	261.9	250.7	181.9	1426.9
AEi	22.9	36.8	18.6	11.4	12.2	41.1	90.3	24.2	-	-	-	-	257.5
WSi	-	19.2	91.0	134.9	111.7	48.8	-	-	-	-	-	-	356.8
WSi%		43.4	83.3	92.2	90.7	57.5							51.5

3.C.Calculation of water surplus using daily data:

Using the number of rainy days, the following methods were implemented in calculating water surplus (Hassan *et al*., 1999). The use of evaporation instead of potential evapotranpiration is due to the fact that the latter is usually estimated on monthly basis only (Hassan and Al kubaisi , 1998) .

3.C.1. Equal probability water losses for (n/year) Event:

This method depends on a number of rainy days per year and the sum of evaporation which is corresponding to these days. Therefore, the mean evaporation associated with the mean number of rainy days can be calculated (Table 7) as follows.

Σ EPAN ″A″ = Total of evaporation during rainy month = 742.4

Σdi = Total of days during rainy month = 243.

$$En = 59 \times \frac{742.4}{243}$$

= 180.25

$$WS\% = \frac{\sum_{i=1}^{8} EPAN\ "A" - En}{\sum_{i=1}^{8} EPAN\ "A"} \times 100$$

$$WS\% = \frac{742.4 - 180.3}{742.4} \times 100$$

Where:

En = Mean total of evaporation (mm) occurs in number of rainy days per year.

n = Mean total of rainy days per year = 59.

= 75.7%

3.C.2. Variable probability of water losses for (n/month) Event:

This method depends on the evaporation from EPAN ″A″ that occurs during the mean rainy days per month. The amount of evaporation during the mean rainy days per month is calculated by multiplying the daily average evaporation from EPAN ″A″ for a given monthly by number of rainy days in that month. Water surplus (Table 7) for any given month is calculated by subtracting evaporation of the rainy days from the rainfall associated in that month as shown below:

Edi = EPAN ″A″ / di

Ei = Ni * Edi

WSi = Ri – Ei

Where:

Edi = daily average evaporation in a given month (mm).

EPAN ″A″ = monthly evaporation (mm).

di = number of days per month.

Ei = sum of evaporation for rainy days during month (mm).

Ni = sum of rainy days.

WSi = monthly water surplus (mm).

Ri = monthly rainfall (mm).

Therefore,

$$WSi\% = \frac{\sum_i^n WSi}{\sum Ri} \times 100$$

$$WSi\% = \frac{539.1}{692.2} \times 100$$

= 77.9%

Table (7): Mean monthly water surplus (WSi) of variable probability n/month for Zawita-Swaratoka watershed.

Month	Days (di)	EPAN (mm)	Edi (mm)	Ni	Ei (mm)	Ri (mm)	WSi (mm)
Oct.	31	143.3	4.6	4	18.4	22.9	4.5
Nov.	30	64.0	2.1	6	12.6	65.0	52.4
Dec.	31	35.6	1.2	8	9.6	111.6	102
Jan.	31	40.3	1.3	10	13.0	146.3	133.3
Feb.	28	53.1	1.9	11	20.9	131.6	110.7
Mar.	31	93.5	3.0	8	24.0	96.7	72.7
Apr.	30	114.7	3.8	8	30.4	93.9	63.5
May	31	197.9	6.4	4	25.6	24.2	0.00
Sum	243	742.4	24.3	59	154.5	692.2	539.1

3.C.3. Maximum daily rainfall:

Water surplus is obtained from multiplying sum of one day maximum rainfall per month by equivalent parameter = 2. While surface runoff is obtained from sum of two days maximum per month (Hassan *et al.*, 1999) as shown below:

WS = m * Σ R1d

SR = Σ R2d

Where:

WS = Monthly water surplus (mm).

m = Equivalent parameter = 2

R1d = One day maximum rainfall/month (mm).

SR = Monthly surface runoff (mm).

R2d = Two days maximum rainfall/month (mm).

The last equation allows estimating the surface runoff from (R2d) comfortable to U.S.G.S method of (n).

$2 \Sigma R1d > \Sigma R2d$

Therefore,

$GW = 2 \Sigma R1d - \Sigma R2d$ where

GW = Ground water recharge

Sum of the individual annual rainfall for Agro-meteorological Stations of Zawita and Swaratoka Agricultural Office for water-years from 2001-2002 to 2011-2012. Calculated table (8) indicates that the water surplus is about 73% of the annual rainfall, while the surface runoff is about 56% of the annual rainfall and ground water recharge is about 17% of the annual rainfall according to U.S.G.S. method.

Table (8): Maximum daily rainfall for the water-year 2001-2002 to 2011-2012 for Zawita-Swaratoka watershed.

Water-year	Ri (mm)	2ΣR1d= WSi	WSi %	ΣR2d= Sri	SRi%	GW	GW%
2001-2002	834.5	607.5	72.8	459.0	55.0	148.5	17.80
2002-2003	862.8	553.9	64.2	385.9	44.0	168	19.47
2003-2004	785.3	596.8	76.0	451.5	57.4	145.3	18.50
2004-2005	656.7	466.2	71.0	323.8	49.3	142.4	21.68
2005-2006	978.0	726.7	74.3	569.2	58.2	157.5	16.10
2006-2007	696.6	487.6	70.0	402.6	57.7	85.0	12.20
2007-2008	378.4	306.5	81.0	244.8	64.6	61.7	16.31
2008-2009	447.0	351.3	78.6	287.4	64.2	63.9	14.30
2009-2010	902.0	572.8	63.5	476.3	52.8	96.5	10.70
2010-2011	664.9	591.1	88.9	422.2	63.4	168.9	25.40
2011-2012	408.0	257.0	63.0	197.9	48.5	59.1	14.49
Mean	692.2	501.58	73.03	383.69	55.92	117.89	17.03

3.d. Results obtained

The water surplus is a term related to input rainfall parameter at a given period with respect to its water losses. Therefore, there will be different values for water surplus depending on the chosen period of comparisons.

Based on annual method there is no water surplus because rainfalls become actual evaporation, but it is about 52% with respect to monthly method. Both methods use the potential evapotranspiration.

The method of rainy days values is based on equivalent evaporation by maximum EPAN ″A″. Equal probability evaporation for 59 days rainfall per year, the water surplus is about 76% . The variable probability evaporation for mean (n/month) event gives about 78% water surplus. Using the daily method as maximum one/two days rainfall per month shows that, the water surplus is about 73% of the annual rainfall, then the mean water surplus is about 73% which is the optimum value.

4. Surface runoff and ground water recharge parameters:

Table (8) shows that the surface runoff parameter is about 56% of the annual rainfall or 76% of the water surplus, which corresponds to ΣR2d maximum of one/two days or (SRi) = 0.76 WSi. Thus, the ground water recharge will be 17% of the annual rainfall or (GWi) = 24% (WSi) according to WSi%= SRi% + GWi% (Fetter, 1980) .Table (9) shows the mean monthly distribution of the water surplus in to surface runoff and ground water recharge which will be from October to April.

Surface runoff and ground water recharge show increasing from October to February and from October to January respectively then they decrease until the end of rainy season (Fig. 3).

Table (9): Partition of WSi into SRi and GWi for Zawita-Swaratoka watershed for the period 2001-2002 to 2011-2012.

Month	WSi	SRi	GWi	Month	WSi	SRi	GWi
Oct.	04.5	3.4	1.1	**Feb.**	110.7	84.1	26.6
Nov.	52.4	39.8	12.6	**Mar.**	72.7	55.3	17.4
Dec.	102	77.5	24.5	**Apr.**	63.5	48.3	15.2
Jan.	133.3	101.3	32	**May**	00.0	00.0	00.0
				Σ	539.1	409.7	129.4

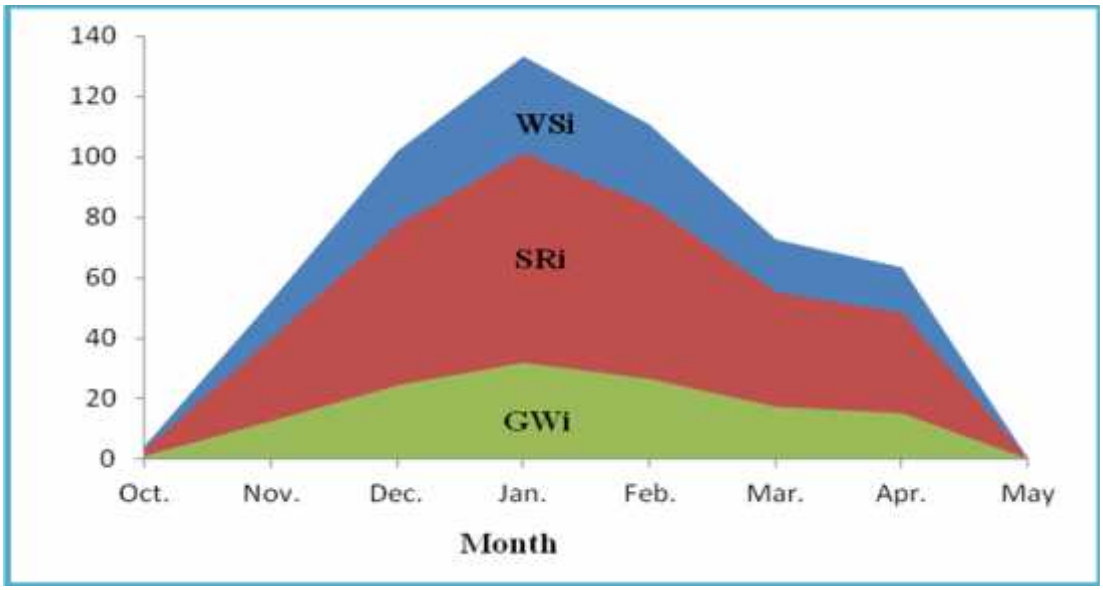

Fig. (3): Partition of WSi into SRi and GWi for the watershed for the period 2001-2002 to 2011-2012

5. Water Balance Model:

The water balance model was verified by input rainfall of the water-year 2011-2012 of both Zawita and Swaratoka Agricultural Offices Stations.

Model verification starts from the theoretical model of output in term of (WSi) such that:

WSi = Ri – Ei; the next step is to estimate the (SRi) and the (GWi) (Fetter,1980) as given bellows:

WSi = SRi + GWi; therefore:

SRi = 0.76 WSi

GWi = 0.24 WSi

Table (10) shows the correlation among water balance parameters for the watershed and it also shows the values of (Ri), (Ei), (WSi), (SRi), (GWi), which are 449.4 mm, 154.5 mm, 340.6 mm, 258.8 mm and 81.8 mm respectively from November to March, While the months of October, April and May have no water surplus (Fig.4). Since the evaporation of these months exceeds the rainfall. Therefore, they represent no water surplus unless their rainfall exceeds 20 mm, 35 mm and 30 mm for the three months respectively.

Table (10): Water balance parameters for the water-year 2011-2012 for Zawita-Swaratoka watershed**.**

Month	Ri	Ei	WSi	SRi	GWi
Oct.	9.5	18.4	00.0	00.0	00.0
Nov.	25.4	12.6	12.8	9.7	3.1
Dec.	37.8	9.6	28.2	21.4	6.8
Jan.	142.3	13.0	129.3	98.3	31.0
Feb.	99.9	20.9	79.0	60.0	19
Mar.	115.3	24.0	91.3	69.4	21.9
Apr.	15.7	30.4	00.0	00.0	00.0
May	3.5	25.6	00.0	00.0	00.0
Sum	449.4	154.5	340.6	258.8	81.8

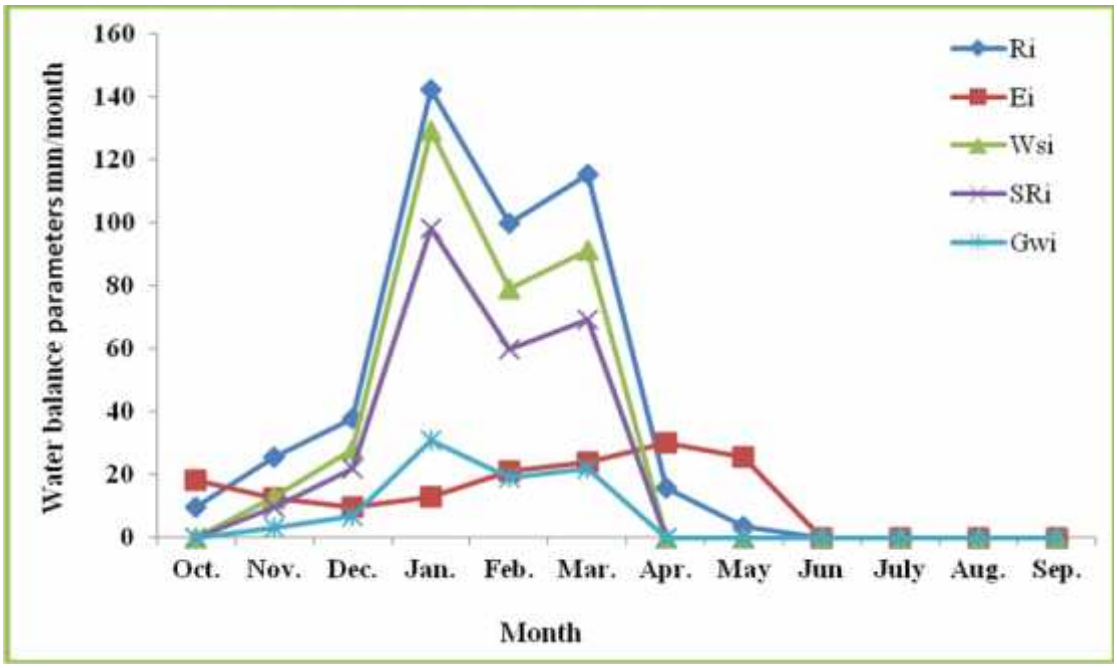

Fig. (4): Mean monthly parameters of the water balance for Zawita-Swaratoka watershed.

According to the mentioned water balance parameters of Zawita-Swaratoka watershed, the sum annual rainfall was about 449mm. Thus, this amount of the rainfall in the watershed as volume in Cubic meter equals to R(mm)*A(Km^2). = (449×10^{-3}) × (128×10^6) which equal to 57.472×10^6 m^3. About 341 mm of rainfall become water surplus which is equivalent to 76% of the annual rainfall which is equal to (341×10^{-3}) × (128×10^6) = 43.648×10^6 m^3, while about 58% of the annual rainfall which is equal to 259 mm turn to as surface runoff [(259×10^{-3}) × (128×10^6) = 33.152×10^6 m^3]. This quantity of water can be stored behind small dams and used for Agricultural purpose or for ground water recharge. The other part of water surplus is the ground water, which is about 82 mm or (17%) which is equivalent to (82×10^{-3}) × (128×10^6) = 10.496×10^6 m^3, of the annual rainfall which infiltrates and percolates through soil and rock particles.

Where: R= Rainfall (mm) , A= Watershed area (Km^2).

6. Return period of water surplus (Tr):

It is the period which can be expected to occur between successive events for any volume of a limit rain storm (Jabbouri, 1988). Therefore, the return period includes only average interval time between the events which are equal to or greater than a given event. The return period can be calculated by the following formula (Jabbouri, 1988).

Tr = n+1/m or Tr = 1/p

Where:

Tr = Return period (years).

n = Number of recording years.

m = The storm number in the Rank.

P = Probability of occurrence (%).

Thus, the probability of occurrence (P%) of the event during the next year is (P% = 1/Tr) and

probability of non-occurrence (q%) of the event during the next year is (q = 1-p) or generally ($Pn = 1-q^n$) (Jabbouri, 1988).

The annual water-surplus for Zawita-Swaratoka watershed for water years 2001-2002 to 2011-2012 was used to estimate the return period by arranging of the annual water-surplus in descending order (Kosslar and Read, 1974)). Table (11) shows that the return period of the maximum water surplus is 726.7mm/year and the minimum is 257.6mm/year of the water-surplus during the next year were 10% and 90% respectively, while the return period of the water-surplus every two years was 50% between 550-725mm/year and 50% between 255-550mm/year respectively.

Table (11): Return period of water surplus for Zawita-Swaratoka watershed.

R	Water-year	WS	P	Q	Tr
1	2005-2006	726.7	0.10	0.90	12.0
2	2001-2002	607.5	0.17	0.83	6.0
3	2003-2004	596.8	0.25	0.75	4.0
4	2010-2011	591.1	0.33	0.67	3.0
5	2009-2010	572.8	0.42	0.58	2.4
6	2002-2003	553.9	0.50	0.50	2.0
7	2006-2007	487.6	0.59	0.41	1.7
8	2004-2005	466.2	0.67	0.33	1.5
9	2008-2009	351.3	0.77	0.23	1.3
10	2007-2008	306.5	0.83	0.17	1.2
11	2011-2012	257.0	0.90	0.10	1.1

R = Rank.
Q = Probability of un occurrence.
P = Probability of occurrence.
Tr =Return period (year).

CONCLUSIONS

- The number of rainy days (n) per month for Zawita-Swaratoka watershed were estimated from mean monthly distribution of the rainfall and was between 4 to 11 days per month which is occurred during 59 rainfall days per eight rainy months per year. This represents mean of about 692.2mm annual rainfall. The number of rainy days varies from 32 days per year to 80 days per year. According to seasonal distribution of the rainfall, winter season has more rain than other seasons which reached about 57% of the total annual rainfall.
- The two-day maximum rainfall covers about 55% of the annual rainfall, which is corresponding to possible surface runoff (SR). Therefore, 16 days of eight rainy months provides 55% of the annual rainfall, while the other 43 days of 59 rainfall days will provide the 45% of the annual rainfall.
- Water surplus is a term used in this study to represents the surface runoff and ground-water recharge. Therefore, the rainfall – input parameter of the watershed will be of two parts, both referred here in term of water surplus and water losses.

There are different values of water surplus according to comparison method. Depending on annual procedure, the water surplus is about 58% of the annual rainfall, while it is about 81% with respect to mean monthly procedure. Based on number of actual rainy days with correspondence evaporation from EPAN″A″, then it is possible to calculate the water surplus. Equal probability (n/year) event shows that the water surplus is about 76% of the annual rainfall. Using the variable probability procedure of monthly losses (n/month) shows about 78% water surplus. Depending on the daily procedure as maximum one/two days per month, the water surplus is about 73%. Thus 73% can be the mean value of water surplus the 73% is the optimum value.

- The surface runoff is about 56% corresponding to ΣP2d maximum of the annual rainfall. This ratio is part of 76% water surplus and therefore, the ground water recharge will be about 17% of the annual rainfall. The result will leads to 76% surface runoff and 24% ground water recharge from the water surplus.
- The water balance model is based on initiation of water surplus from converted rainfall, temperature and pan evaporation. The surface runoff can be obtained from the water surplus or directly from rainfall. Then the ground water recharge can be calculated. Therefore, the

ground water recharge is occurring from November to March, and depletion occurred during other month. The model is converted directly from rainfall of the watershed area during the water-year 2011-2012. It was noticed that there is about 259 mm surface runoff and about 82 mm ground water recharge occurring during that period (2011-2012).

- The return period probability of the maximum and the minimum of the water surplus during the next year are about 10% and 90% respectively, while the return period probability of the water surplus about every two years was 50% between 550-725 mm/year and 50% between 255-550 mm/year respectively.

Recommendations

- Quantities of water surplus which equal about ($33\times10^6 m^3$) as surface runoff can be stored behind small dams that can be used for agricultural purposes during the summer season.
- It is necessary to install gauging station on the outlet of the basin in order to measure the actual discharge data in the watershed.

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هەلسەنگاندنا پارامیتەرێن هەڤسەنگیا ئاڤێ لدەڤەرا زاویتە – سوارەتویکا

پوختە

ڤەرێژگرا زاویتە-سوارەتویکا دکەڤیتە پارێزگەها دهوکێ ل هەرێما کوردستانا عیراقێ و ب دویراتیا 20 کیلومیتران ژ سەنتەرێ دهوکێ رویبەرێ ڤەرێژگرێ د گەهیتە 145 کیلومەترین دوو جار و تێکرایا بارانێن سالانە 692 میلیمتران ئەوا کو هاتیە کومکرن بو ماوێ 59 د 8 مەهێن بارانێ د دەمێ فەکولینێ دا. هەروەسا مەها کانوونا دووێ دهێتە هژمارتن ژ پترین مەهێن بارانا وی و دگەهشتە 146 میلیمتران. هەروەسا وەرزێ زستانێ دهێتە هژمارتن پترین وەرزێن سالێ بو بارانێ کو ب رێژا 57% ژ بارانێن سالانە بو. هاتە هژمارتن بلندترین بارانێن بارانا روژانە کو دگەهشتە 56% و کو نێزیکی رێژا ئاڤا سەرزەڤی بو.

زێدەهیا ئاڤێ دناڤبەرا 52%-78% ژ بارانێن سالانە پێکدهات دگەل 17% ژ ئاڤێن ژێرزەڤی. زڤرینا دەمی ژ بونزمترین و بلندترین ئاستێ زێدەهیا ئاڤێ بو ماوێ سالا بهێت پێشبینی دهێتەکرن بگەهیتە 10%-90%. بەلێ پێشبینیا زڤرینا دەمی ژ بو زێدەهیا ئاڤێ بو هەر دوو سالان 50% بو دناڤبەرا 550-725 میلیمتران و 50% دناڤبەرا 255-550 میلیمتران ئێك لدویڤ نێکدا.

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تقییم لمعاملات نمذجة الموازنة المائية لحوض زاويته- سوارتوكا

يقع حوض زاويته – سوارتوكا في محافظة دهوك أقليم كردستان العراق و يبعد عنها بحوالي 20كم. يقدر مساحة ألحوض بحوالي 145 كم^2 و بمعدل مطر سنوي قدره 692 ملم, و التي تحققت خلال 59 يوما في 8 أشهر ممطرة كل سنة كمعدل خلال فترة البحث. يعد شهر كانون الثاني من أكثر أشهر السنة مطرا و تصل حوالي 146 ملم. كما يعد فصل الشتاء من أكثر فصول السنة مطرا حيث تصل حوالي 57% من المطر السنوي. قدرت أعلى سقطتي مطر يومية حوالي 56% من المطر السنوي و هي مقاربة الى مقدارالسيل السنوي.

شكلت الزيادة المائية بين 52% و 78% من المطر السنوي مع وجود 17% مياه جوفية. احتمال العودة الزمنية لأعلى و أدنى زيادة مائية خلال السنة القادمة هي 10% و 90%, بينما احتمال العودة الزمنية للزيادة المائية كل سنتين تكون 50% بين 550 و 725 ملم و 50% بين 255 و 550 ملم على التوالي.

CALCULATION OF CONSUMPTIVE USE OF WATER FOR TREES SEEDLINGS USING DRIP IRRIGATION SYSTEM

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ABSTRACT

The drip irrigation was installed to irrigate 130 seedlings of second year age was cultivated in the field with four kind of seedling (Olive, Ornament, Grape, Peanut). The hydraulic performance of emitters was based on water flow along the pipe. The study was focus to find the actual evapotranspiration (ETc) value by both program Cropwat and local climate condition compared with traditional application of water, to calculate reference evapotranspiration (ET_0) for seedlings by depending on the meteorological data of the region. Crop coefficient (Kc) for each plant used to determine ETc. The results demonstrated that after the transformation of seedling from nursery to field the total fail seedling percent from all seedlings about 9%, where the success percentage recorded a high value about 91%. Traditional water applied method showed 564.3 mm/season for each seedling irrigated, while the consumptive use Cropwat programs for Grape, Ornament and Peanut, Olive were (251.46, 335.28, 335.28,544.08) and for local climate condition to the same seedlings (230.31, 307.08, 307.08,498.99) mm/season for each plants seedling respectively, it is revealed that the amount of water application by traditional method was more than that founded by both programs, therefore it's better to use the Cropwat and local climate condition program for water application.

KEY WORD: consumptive use, crop coefficient, Cropwat, Drip irrigation, local climate condition

INTRODUCTION

Irrigation water is becoming increasingly scarce and expensive due to the global climatic change, environmental pollution, and higher demand by industry and urban consumption, and therefore, it is important not to waste it (Mustaf et al. 2011). Now the country is facing a big serious problem of water shortage and it will be more aggravate in future, while population pressure appear to increase so it should take measure for the government have a vision for water management.

Evaporation and transpiration occur simultaneously and there is no easy way of distinguishing between them.Apart from the water availability in the topsoil, the evaporation from a cropped soil is mainly determined by the fraction of the solar radiation reaching the soil surface. Evapotranspiration (ET) represents the water loss from a combined surface of vegetation and soil. ET is dependent upon several factors including; the stage of plant growth and development, the evaporative "demand" of the atmosphere, soil water availability, vine cultivar, insect damage and overall plant health and cultural practices (Mullins, 1992).After plant progressing it will cover the soil and the transpiration part become the main process, while at full crop cover more than 90% of ET comes from transpiration. (FAO Irrigation and Drainage Paper No. 56, 2006). The consumptive use of water was measured by cropwat program and local climate condition and compared their results with the traditional method. There are difference between plants for their requirement of water, in our research we have four type of seedling were transport from nursery to the field (Olive, ornament, grape, Peanut). Williams and Matthews (1990) found that girdling grape vines decreases the water use of the vines for approximately one month after the girdling takes place. Irrigation frequency also has an effect on vine water use. If the soil water is depleted to the point that the vines are stressed, the use of water by the vines will decrease (Grimes and Williams, 1990). ICARDA (2011) showed that there were significant effects on growth of young olive trees properties between using of drip irrigation and traditional irrigation system with submersion. On average the trunk section under drip irrigation

growing to 3.5 cm and in against to submersion irrigated plot 3.6 cm.////In our view we see that the utilizing modern methods for irrigation will effect positively on consumptive use of water since water scarcity is prevailed in Kurdistan region, so it become a very necessity to make a comparison between the traditional and modern methods . Here drip irrigation consider as very economical way to control on water application there we arrow use this method to decrease the evaporation process and increase the saving of water for irrigation the seedling, it can be define its ability to provide small and frequent water applications directly in the vicinity of the plant root zone has attracted interest because of decreased water requirement and possible increase in production (Darwish et al., 2003; Janat, 2003).Ibragimov et al. (2007) reported that drip irrigation saved 18–42 percent water compared to furrow irrigation in Uzbekistan, hence these trails lead us to use the drip irrigation for watering the seedling. Drip irrigation system had been prepared to supply water to new seedling. The cultivated field was irrigated with drip irrigation using constant discharge(L/sec) which applied for individual seedlings, in order to control the dripper out let special valve fixed on each division and branches of drip irrigation system. In this research we focused to compute the water consumption for small seedling by more than one method through using of drip irrigation.

Special consideration should be taken for managing and supplying irrigation water for small seedling, during transportation small seedling to the permanent bad or last field site, many seedling as olives and grapes need little water requirement in second or third year that due to starting adapting these seedling gradually to rain fed or dry land farming during the rest lives of seedling growth.

The water requirement by applying drip irrigation system measured by using tensiometer instrument for monitoring the moisture content in soil .The irrigated time and quantity will be determined on each irrigation practice for each month. This paper is targeted ,1-Adapts the seedling of two years in the perennial field,2-Estimation of consumptive use of water during the adaption period in the field,3- Determine the percentage of seedling growth during their transfer from nursery to the field, 4- comparison between the Cropwat and local climate condition with manual application of water.

Material and method

The site of experiment is located at Village 30 km north east of Duhok city (36°. 95 N, 43°. 18 E) and at an altitude of 976 m. Furthermore the photo had been detected content more details on climate of the study site. Fig.1

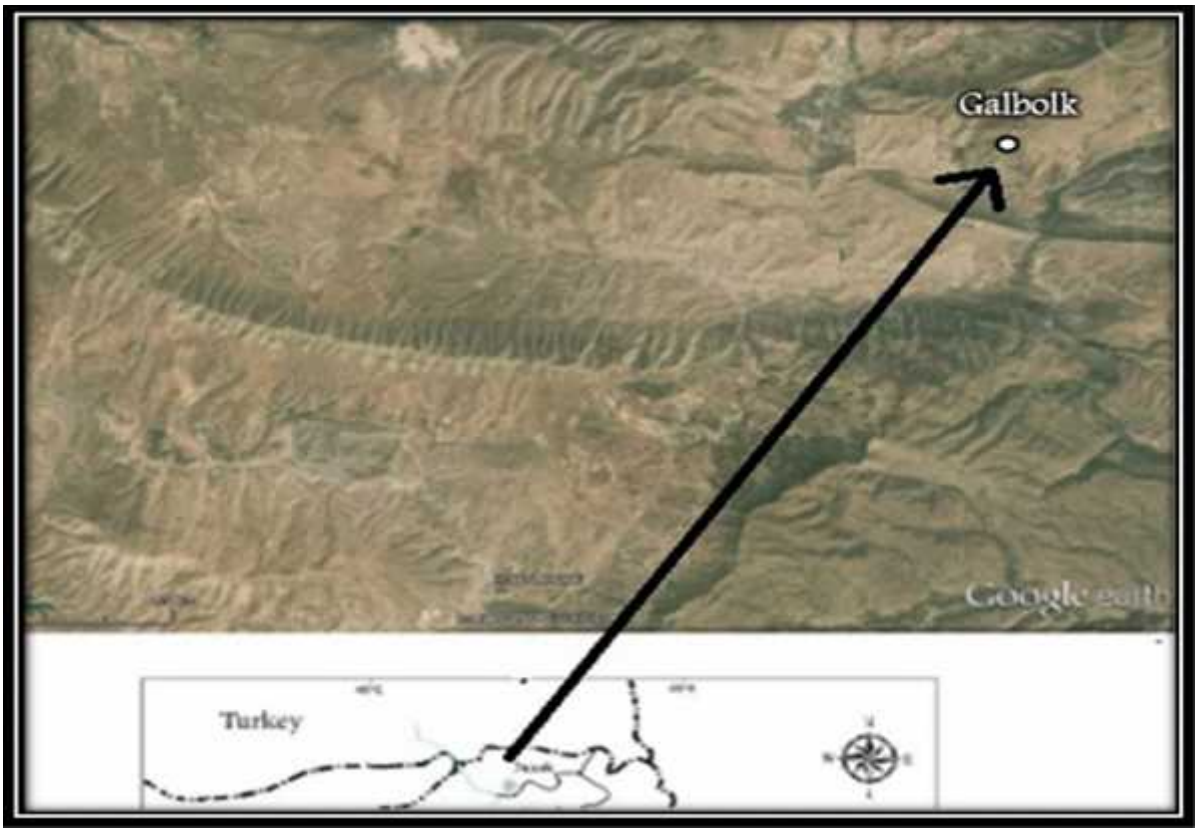

Fig. 1 show the study location in Ghalbok

Some climatological data for the study location extracted by local Climate FAO program for the study period

Table (1): shows some climate elements and Evapotranspiration (ETo) using local Climate FAO program for the study location

Month	Maximum Temp. (C°)	Minimum Temp. (C°)	Humidity (%)	Wind Speed (Km/day)	Sun Shine (Hours)	Solar Radiation (MJ/m2/day)	Evapotranspiration (ETo) (mm/day)
June	32	17.2	40	186	14.5	31.3	6.86
July	26.4	21	30	181	14.3	30.6	7.39
August	36.2	20.5	27	167	13.2	27.5	6.54
September	32	16.4	38	157.2	12.2	23.3	4.8
Average	34.2	18.8	33.8	172.9	13.6	9.4	6.39

The study was conducted to calculate the consumptive use of the seedling of two years growing for different plants which they are including (Olive ,Ornament ,Grape, Peanut), were irrigated by drip irrigation method without using a supplying motor, water was distribute on the field by gravity where the water reservoirs raised 5m up the field. Eleven branch lateral of drip irrigation system had been distribute on the five terraces on each seedling supply with one emitter fixed on each seedling, the discharge was controlled for each laterals manually by valve. The following table shows the numbers and variety of seedling with fail percentage of their growing was cultivated randomly in the field.

Table (2): Show the percentage of seedling growth after bring them from nursery to the filed condition

Number	Type	Total Number	Fail seedling	percentage
1	Olive	40	0	0
2	Ornament	45	0	0
3	Grape	30	8	26
4	Peanut	5	3	60
Total fail seedling from all species is about 9%				

Irrigation was conducted during the summer season (table 3), it was started from June to September, and tensiometer was used to monitor the soil moisture content. 18 runs of irrigation was applied with the period seven days in June and six for July and August while increased in September to 8 days, the average discharge was 2.681 L/hr. The diameter of wetted area was measured by selecting all types of plant randomly on the field.

Evapotranspiration (ETo) practically determine according to the given irrigated area around each seedling, calculated (ETo) was found by Local Climate (version.2, FAO, 2003) and Cropwat programs estimator (version.8) by FAO (2008) for study area provided by the Food and Agriculture Organization of the united nation**.**

RESULTS AND DISCUSSION

The value of ETc in table (3) are differ as the variety of cultivated seedling, where they computed by cropwat model and local climatic condition, it is clear that from the table (3) the application of water by traditional irrigation without depending on the climatic condition are more that those depending on climatic with using cropwat model with local climatic condition, the results showed that ETc in four selected seedling with same period of growing are near to each other but with huge difference as compared to the traditional method, more water should be applied with randomly irrigation, while the study of climatic data of region the water should apply more precise, this trails will help to regulate the schedule of irrigation, this regulation may have a great effect on productivity. In Annual report on program for the development and dissemination of sustainable irrigation management in olive growing (ICRDA, 2011) reported that the method of irrigation have a positive effect on truck section and height of plant after data analysis statistically of young olive compared by the submerged traditional method. Because of water crisis there must be a policy how to add water to plant especially after their transposition from nursery to the filed.

Table (3): Show different methods for calculated consumptive use.

Irrigation periods	ETc manual	Monthly ETc = ET_0 Cropwat mm/day * Kc *30				Monthly ETc= ET_0 local climate mm/day * Kc *30			
		Olive	**Grape**	**Ornament**	**Peanut**	**Olive**	**Grape**	**Ornament**	**Peanut**
June	102.6	144.09	66.51	88.68	88.68	133.77	61.74	82.32	82.32
July	154.8	156.18	72.09	96.12	96.12	144.09	66.51	88.68	88.68
August	202.8	138.84	64.08	85.44	85.44	127.53	58.86	78.48	78.48
September	104.1	105.69	48.78	65.04	65.04	93.6	43.2	57.6	57.6
Total									

*****Kc source from FAO irrigation and drainage no.56

From fig. (2) it appear that the seedling success percentage of olive and ornament were 100% after their transporting to the field, while grape and peanut were 74 and 40% respectively, it is concluded that olive and ornament have more tolerance that the grape and peanut, the reason may be return to the olive and ornament can adapted easily to the new field condition compared to the other selected seedling, therefore more attention should be paid during their transform from nursery to the filed , the result are more illustrate in fig (2).

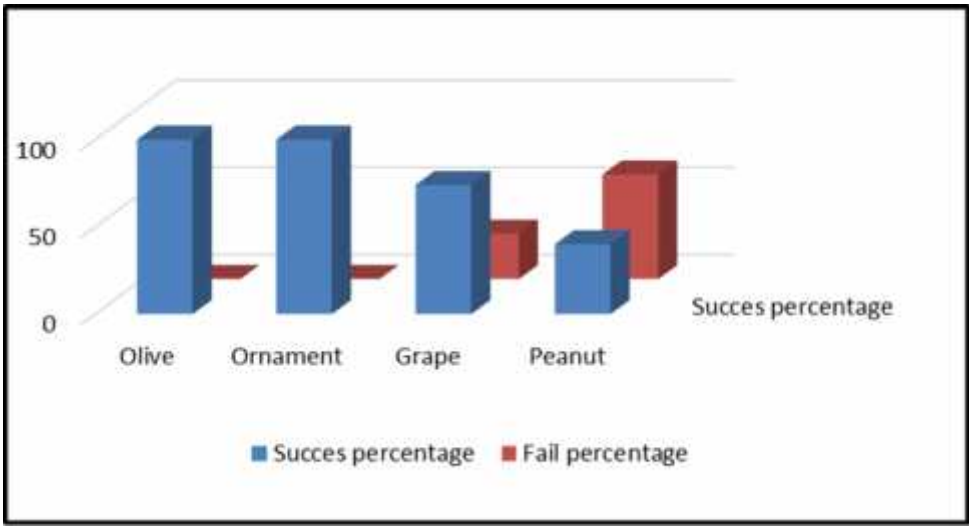

Fig.2: Show the percentage of seedling growing in the field after two years from their transition

The results were presented in table (4) it can be noticed that the water was applied from June to September and the value were varies from 24 mm at the beginning to 34mm at the August. The measurement were taken June, July, august, September and the average of irrigation interval in each month where 6 to 8 days used as interval. The computed value was divided by the number of interval days to determine the ETc. The total amount of applied water was calculated over each month as shown in the table (4).

Table (4): show the total amount of applied water to the field by drip irrigation method

Date	Area m2	q m3/hr	Time of irrigation (hr)	Q* t	d (m)	d (mm)
01/06/2013	0.135	0.0028	1.16	0.003248	0.024059	24.05926
08/06/2013			1.16			
15/06/2013			1.16			
22/06/2013			1.16			
29/06/2013			1.16			
05/07/2013	0.135	0.0028	1.5	0.0042	0.031111	31.11111
11/07/2013			1.5			
17/07/2013			1.5			
23/07/2013			1.5			
29/07/2013			1.5			
04/08/2013	0.135	0.0028	1.67	0.004676	0.034637	34.63704
10/08/2013			1.67			
16/08/2013			1.67			
22/08/2013			1.67			
28/08/2013			1.67			
06/09/2013	0.135	0.0028	1.34	0.003752	0.027793	27.79259
14/09/2013			1.34			
22/09/2013			1.34			
30/09/2013	0.135	0.0028	1.16			
7/10/2013			1.16			

Monthly ET_0 and ETc of seedling second years grown in the filed using drip irrigation, they are presented respectively in figures 3,4,5,6 for the summer season. The value of ET_0 according to cropwat begin to increase where the value recorded in June 7.39 mm/day and lead to up to reach 8.01mm/day in July then the value stared to decrease at the September to 5.42 mm/day. The reason may be due to higher solar radiation and air temperature in the first month while at the fall the relative humidity start to increase when the air temperature decrease, the ET_0 calculated by local climate condition compared to that founded by cropwat the value recorded in June was 6.86 mm/day and reach to 7.39 mm/day in July in the same time the minimum value was in September 4.8 mm/day. In the similar study Ismark (2005) viewed that during the summer season the value of ET_0 was higher compared to the fall season, ETo in fall season showed decreasing trend starting from late September, in summer, ETc of plants ranged from 2.4 mm in late June to 5.4 mm in early August whereas it ranged from 2.3 mm on 5 June to 6.8 mm on 28 July for the plants grown in the white multi pot box system (MPBS) . While the ETc computed by both Cropwat and local climate condition refer to that the olive needed more water compared to the other plants cultivated in the period where the value of ETc during the whole season was 544.8 and 498.99 mm/season, because the value of Kc of olive was 0.65 at the initial stage where the Grape and Ornament and Peanut are 0.3, 0.4 0.4 respectively. While the by traditional method the value ETc was 564.3 mm/season in the same time the ETc needed computed by Cropwat and local climate condition were (251.46, 335.28, 335.28) and (230.31, 307.08, 307.08) mm/season for Grape and Ornament and Peanut respectively, it is noticed that the R2 value are very strong between ET_0 in both programs (Cropwat and local climate condition) viewed high R^2 as shown in figures (3,4 and 5) ETc for all kinds of seedlings during irrigation period .Here there are remarkable difference between the traditional and those depending on programs where the amount of water added was double during the whole season that will enhance to increase the deep percolation that lead to leaching the valuable nutrient for plant growing.

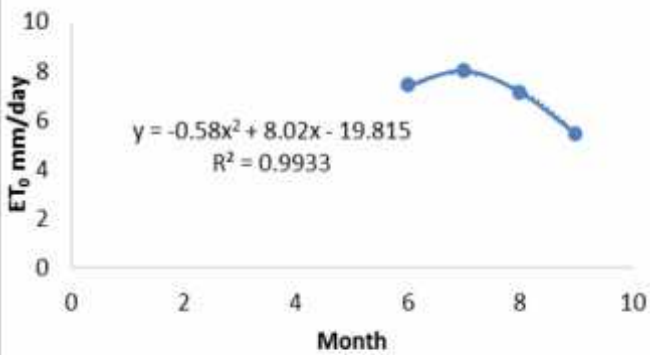

Fig.3 ET_0 calculated From June to September using Cropwat model

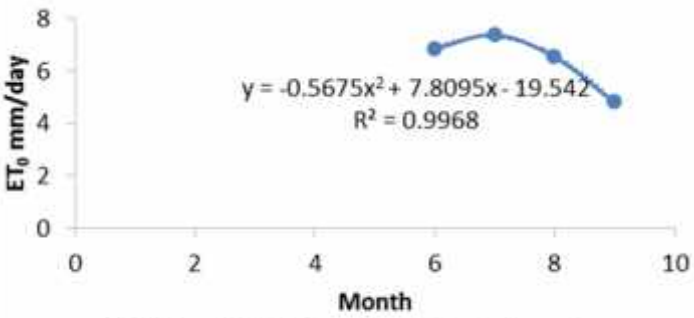

Fig.4 ET_0 calculated From June to September using local climate condition model

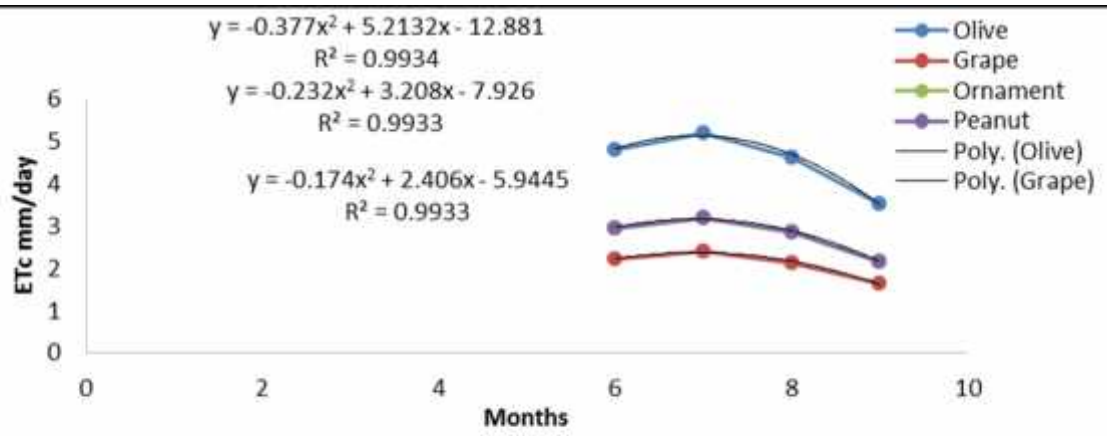

Fig.5 Shows the actual Evaporation (ETc) for seedling second years using crop wat model

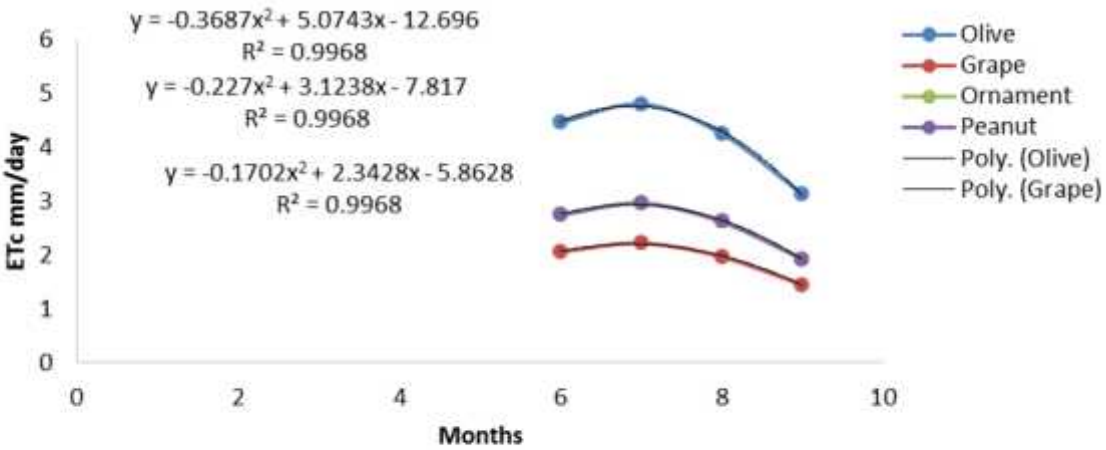

Fig.6 shows the actual evaporation (ETc) for seedling two years using local climate condition

CONCLUSION

Water was applied by traditional methods and by depending on meteorological data by using two FAO programs Cropwat and local climate condition, the results shows that the using of FAO programs will be suitable for water application compared to the traditional method. Here the water reduction by two programs was very obvious. This study can be concluded the prediction of ETc for both local climate condition and cropwat was approach and their values was differ from the traditional, so consumptive use of water in traditional was high compared to the scientific methods, the amount of water for needed was half in comparison to the Cropwat and local climate condition for Grape and Ornament and Peanut and the other half will be lost for deep percolation and lead to leach valuable nutrients for plant growing, therefore we recommended to use the Cropwat and local climate condition programs for water application instead of using the traditional irrigation.

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دەرئننا مەزاختنا ئاڤێ بوو نەمامکێن دارابکارئینانا سیستەمێ ئاڤدانێ ب چبکێ

پوختە

ئاڤدانا بجبگێ هاتە بکارینان ژبوو ئاڤدانا (130) نەمامگا هاتبوونە دابەشکرن لسەر چوار جورا (تری-زینە-فستق-زیتین). ژبوو کونترولکرنا ئاڤێ کونگێت بچیك لدێژیا تورێ هاتنە دروستکرن. دوو بروگرام (Local climate condition , Cropwat) هاتنە بکارئینان ژ بوو دەرئینانا بهایێ تیجونا ئاڤێ (ETc) وبەراوەرکرنا وان دگەل بهایێن برێکا گەڤن هاتینە دەست. دیسان ژ بوو دەرئینانا بهایێ (ETc) بوو نەمامکێن هاتیە چاندن بپالپشتیا بێزانینین سەقایی هاتە بەستن.

بمەرما دەرئینانا بهایێ (ETc) ژ بوو مامکا لقوناغا دەسبیکی (Initiate Kc)) هاتە بکارئینان لدیڤ هەندەك خشتێن تایبەت. لدوماهیا وەرزێ خاندنێ دیاربوو 9% بتنێ مرینە دیسان 91% بشیوەکێ ئالوژیکی شین بووینە. 564.3 ملم/وەرز ئاڤـــ هاتیە مە زاختن بریکا کەڤن هاتیە بوو هەر شتلەکێ , هەروەسا تیجونا ئاڤێ ب رییاهەردوو بەرنامێن هاتینە بکارئینا (Local climate condition , Cropwat) بوو هەر نەمامکەکێ ئەڤە بوون (251.46, 335.28, 335.28,544.08) و((230.31, 307.08, 307.08, 498.99)) ملم/وەرز بوو لدیڤ ئێك دا, ڤەکولین بوومە دیاردکەت کو مەزاختنا ئاڤێ ب رێیا کەڤن کەلەك بترە ببەراوەردی دگەل هەردوو پروگراما, ژ بەرڤێ چەندێ ئەم پێشنیار دکەین دئایندەدا بهایێ (ETc) درێیا هەردوو پروگرامارا بهێتە دەرئینان بو کارێ ئاڤدانێ.

حساب الاستهلاك المائي لشتلات الاشجار بأستخدام نظام الري بالتنقيط

الخلاصة

استخدمت شبكة الري بالتنقيط للارواء **(130)** شتلة موزعة على اربعة اصناف **(**عنب-زينة-فستق-زيتون**)** بعمر السنة الثانية. تم معايرة ضغط الفتحات على طول شبكة الري. استخدم برنامجين **(Local climate condition , Cropwat)** لغرض ايجاد قيمة الاستهلاك المائي **(ET_c)** ومقارنة النتائج التي تم الحصول عليها بالطريقة التقليدية, ولحساب قيمة نتح تبخر الاساس **(ET_0)** للشتلات اعتمادا على معلمات الانواء الجوية للمنطقة. ولغرض ايجاد قيمة **(ET_c)** لكل شتلة وهي في مرحلة البداية استخدم معامل المحصول **Kc** اعتمادا على جداول. في نهاية موسم الدراسة اظهرت النتائج بأن **9%** فقط من الشتلات كانت فاشلة وفي حين نسبة 91% منها كانت ناجحة. تم اضافة ماء بمقدار **564.3** ملم /موسم لكل شتلة بالطريقة التقليديةبينما الاحتياج المائي **(ET_c)** المحسوب بكلا البرنامجين المذكورين لكل شتلة من شتلات **(**العنب-زينة-فستق-زيتون**)** هي الاتي **(251.46, 335.28, 335.28,544.08)** ملم /موسم اما بالنسبة للبرنامج **(Local climate condition)** لنفس الشتلات كانت كالاتي

(230.31, 307.08, 307.08, 498.99) ملم /موسم لكل نبات على التوالي وقد اظهرت النتائج بأن اضافة الماء بالطريقة التقليدية اكبر مما لو استخدمت عملية الري باستخدام البرنامجين المذكورين, لذلك نوصي بالاعتماد على البرنامجين المذكورين في القياسات الحتياجات المائية عملية ولتقدير **(ET_c)** مستقبلا بدلا من الطريقة الري التقلدية.

SURVEYING AND DESCRIPTION OF VIRAL DISEASES ON VEGETABLE CROPS IN DUHOK GOVERNORATE/ KURDISTAN REGION/ IRAQ

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This study conducted to survey and determination of viral diseases occurred and distributed in the fields located in Duhok, Malta, Semel, Tanahi, and Gre-gawre of Duhok province/ Kurdistan region/ Iraq. Surveying was done depending on the visual observation, using X pattern for each field. Incidence of the infected plants fluctuated as the percentage of plants exhibiting virus symptoms. The observed diseases were diagnosed biologically. Biological test were done depending on the symptomatology test and mechanical inoculation of indicator (diagnostic) plants for each virus and the symptoms appeared on them. Common noticed diseases in the surveyed fields were caused by potato virus Y (PVY), potato leafroll virus (PLRV), tomato mosaic virus (ToMV), cucumber mosaic virus (CMV), zucchini yellow mosaic virus (ZYMV), garlic yellow streak virus (GYSV), onion mosaic virus (OMV), beet curly top virus (BCTV), malva mosaic virus (MMV) and okra mosaic virus (OkMV). Disease incidence of these viral diseases were 75%, 20%, 10%, 3%, 75%, 10%, 15%, 70%, 21% and 3%, respectively. So, due to diver transmission of the investigated viruses through seeds, vegetative materials, vectors, contamination and contacts, thus, farmers were recommended to use the certified seeds and vegetative propagative materials that are virus-free also, control of the vectors that enter the field to protect the crops from contamination and infection.

KEYWORDS: *Vegetable Viral Diseases, Surveying, Diseases Incidence.*

INTRODUCTION

Vegetable crops (potato, tomato, cucumber, green leafy vegetables and ….. etc) are the most important plants that widely consumed by human. Today in worldwide, vegetables are considered as the major crops with an economic importance. Many diseases are transmitted from one generation of plant to the next.Viruses are one of the most important plant pathogens that have a greatest role in economic loss. Virtually, at least one virus infects all plants that human depend on them for food, feed, and fiber. It is the viruses of cultivated crops that have been most studied because of the financial implications of the losses they cause. The study of plant viruses has led the overall understanding of viruses in many aspects (Agrios, 2005; Hull, 2009).

Viral disease is the most important reason attributed to yield loss of these crops. Each has its specific and diagnostic effect and symptoms on different hosts. Kerlan (2008) demonstrated that the yield reduction caused by the viruses was estimated up to 30-50%. This work aimed to field survey, investigation and symptomatic description of the most common viral diseases on vegetables. Diagnostic symptoms confirmed using indicator plants for each virus.

MATERIALS AND METHODS

Sampling of diseased plants was carried out in several fields at different periods of growing season. The surveyed fields were cultivated by potato, tomato, cucumber, onion, garlic, chard, and Malva, located in Duhok, Semel, Tanahi, and Gre-gawre. The definitive symptoms of the observed viruses and the disease incidence were recorded depending on the visual observation of viral symptoms. Viral diseases were diagnosed biologically using symptomatology test by using indicator plants and their inoculation mechanically using plant viral suspension. Each plant virus has its own indicator plants which presents in Table (1).

Table (1): Observed Symptoms of the Surveyed Viruses on Different Host Plants.

Plant Viruses	Indicator (Diagnostic) Plants
PVY	*Solanum tuberosum, Chenopodium amaranticolor, Datura stramonium, Nicotiana tabacum*
PLRV	*Solanum tuberosum, Lycopersicon esculentum, Datura stramonium*
ToMV	*Lycopersicon esculentum, Nicotiana tabacum, Datura stramonium, Chenopodium glutinosa*
CMV	*Cucumis sativus, Capsicum annuum, Lycopersicon esculentum, Apium graveolens*
ZYMV	*Cucurbita pepo, Cucumis sativus, Chenopodium amaranticolor*
GYSV	*Allium sativum, Allium cepa, Allium porrum, Chenopodium amaranticolor,*
OMV	*Allium cepa, Allium ascalonicum, Chenopodium* spp.
BCTV	*Beta vulgaris, Cucumis sativus, Lycopersicon esculentum, Nicotiana tabacum*
MMV	*Malva* spp., *Chenopodium amaranticolor*
OkMV	*Abelmoschus esculentus, Chenopodium amaranticolor, Cucumis sativus, Datura stramonium*

Seeds of indicator plants were cultured in pots with a mixture of sand and peat-moss (1:1). Grown plants with 4-6 fully expanded leaves were inoculated with surveyed samples using mechanical transmission for all viruses, as follows: the leaves of diagnostic plants were dusted using carborundum powder and rubbed gently, by using forefinger, with viral suspension that taken from diseased plant samples (Agrios, 2005). Symptoms were described after 4-5 weeks.

RESULTS

Visual diagnostic symptoms of the infected plants on different surveyed hosts were presented in Table (2). These symptoms described according to definitive visual observation which clarified in the figures (1, 2, 3, 4, 5, 6, 7, 8, 9 and 10). Incidence of each natural viral was presented in figure 11. Thus, the hosts of potato, tomato, zucchini, garlic, onion, chard and malva were damaged greatly compared to cucumber and okra. The symptoms were also visualized on several indicator plants as shown in Table 3, depending on the biological test (symptomatology and mechanical inoculation of indicator plants). The identified viruses were potato virus Y (PVY), potato leaf roll virus (PLRV), tomato mosaic virus (ToMV), cucumber mosaic virus (CMV), zucchini yellow mosaic virus (ZYMV), garlic yellow streak virus (GYSV), onion mosaic virus (OMV), beet curly top virus (BCTV), malva mosaic virus (MMV) and okra mosaic virus (OkMV). Identification of these diseases agree with what have been mentioned by Brunt *et al*. (1996); Anonymous (1999); Agrios (2005); Coutts (2006); Caciagli (2008); Côté *et al*. (2008); Kerlan and Moury (2008); Al-ani *et al*. (2011); Nerway *et al*. (2012)

Table (2): Symptoms of the Surveyed Viruses on Different Host Plants.

Hosts	Plant Viruses	Observed Symptoms
Potato	PVY	Mottling, yellowing, stunting, necrosis, leaf distortion, loss of productivity up to 60%.
	PLRV	Yellowing, leaf rolling, leaf thickening, stunting, loss of productivity up to 75% .
Tomato	ToMV	Yellowing, Mosaic, leaf distortion, thickening of leaves, stunting, abscission of flowers, flowers fall to set, loss of productivity up to 50%.
Cucumber	CMV	Mottling, yellowing, leaf distortion, stunting, abscission of flowers, flowers fall to set, loss of productivity up to 40%.
Zucchini	ZYMV	Mottling, yellowing of leaves, abscission of flowers, loss of productivity up to 30%.
Garlic	GYSV	Streak lines, yellowing & mosaic of leaves, loss of productivity up to 25%.
Onion	OMV	Mosaic, chlorosis of leaves, weak growth, loss of productivity up to 35%.
Chard	BCTV	Mottling, leaf distortion, small leaves, weak growth, loss of productivity up to 60%.
Malva	MMV	Mosaic, mottling and yellowing of leaves, weak growth, small leaves.
Okra	OkMV	Yellow mosaic or regular veinal chlorosis, loss of productivity up to 60%.

Fig.(1): Symptoms of Potato Virus Y (PVY) on Potato Plants. a) Mottling, Wrinkling and Stunting of Infected Plant Compared to Healthy One. b) Yellowing of Shoot Apex. c) Leaf Necrosis and Distortion.

Fig. (2): Symptoms of Potato Leaf Roll Virus (PLRV) on Potato Plants. Thickening, Rolling and Necrosis of Infected Plant Leaves.

Fig. (3): Symptoms of Tomato Mosaic Virus (ToMV) on Tomato. Mosaic and Thickening of Leaves.

Fig,(4): Symptoms of Cucumber Mosaic Virus (CMV) on Cucumber Plant. Mottling and Yellowing of Leaves, Stunted Plant with Short Internodes.

Fig. (5): Symptoms of Zucchini Yellow Mosaic Virus (ZYMV) on Zucchini. Mottling and Yellowing of Infected Plant.

Fig.(6): Yellowing, Mosaic and Streak Symptoms of Garlic Yellow Streak Virus on Garlic Leaves.

Fig. (7): Mosaic and Chlorosis Symptoms of Onion Mosaic Virus (OMV) on Onion Leaves.

Fig. (8): Symptoms of Beet Curly Top Virus (BCTV) on Chard. a) Mottling and Leaf Distortion. b) Weak Growth with Small Leaves.

Fig. (9): Symptoms of Malva Mosaic Virus (MMV) on Malva. a) Mottling and Yellowing of Infected Plant. b) Mottling and Mosaic Symptoms. c) Mosaic on Infected Plant Leaves.

Fig.(10): Symptoms of Okra Mosaic Virus (OkMV) on Okra. Yellow Mosaic or Regular Veinal Chlorosis.

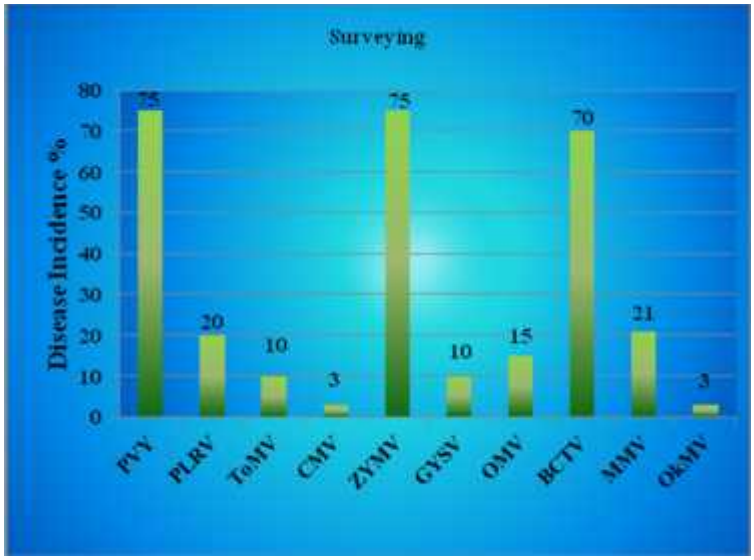

Fig. (11): Disease Incidence of the Surveyed Viruses on Different Vegetable Host Plant.

Table (3): Symptoms of the Surveyed Viruses on Different Host Plants.

Plant Viruses	Indicator Plants	Observed Symptoms
PVY	*Solanum tuberosum*	Mottling, yellowing, stunting, necrosis, leaf distortion.
	Chenopodium amaranticolor	Local chlorotic lesions
	Datura stramonium	immune
	Nicotiana tabacum	Leaf distortion, vein clearing
PLRV	*Solanum tuberosum*	leaf rolling, leaf thickening, stunting
	Lycopersicon esculentum	Stunting, leaf curling, flowers fall to set.
	Datura stramonium	Systemic interveinal yellowing
ToMV	*Lycopersicon esculentum*	Mosaic, stunting, flower abscission
	Nicotiana tabacum	Necrotic local lesions
	Datura stramonium	Necrotic local lesions, no systemic infection
	Chenopodium glutinosa	Chlorotic and Necrotic local lesions, mottling, systemic infection
CMV	*Cucumis sativus*	Mottling & yellowing, leaf distortion, stunting
	Chenopodium amaranticolor	Chlorotic local lesions
	Lycopersicon esculentum	Mosaic, stunting, reducing of leaf laminate (fernleaf)
	Spinacia oleracea	Severe chlorosis and mottling, stunting
ZYMV	Cucurbita pepo	chlorotic local lesion, leaf distortion, stunting, systemic vein netting
	Cucumis sativus	Mosaic, shoestring of leaves, stunting, fruit deformation
	Chenopodium amaranticolor	Chlorotic local lesion,
GYSV	Allium sativum	Streak, yellowing of leaves.
	Allium porrum	Chlorotic streak
	Chenopodium amaranticolor	Necrotic local lesion, yellowing
OMV	Allium cepa	Mosaic, chlorosis of leaves.
	Allium ascalonicum	Stunting, mottling
	Chenopodium amaranticolor	Chlorotic local lesion
BCTV	*Beta vulgaris*	Mottling, leaf distortion, small leaves, leaf roll, weak growth.
	Cucumis sativus	Stunting, leaf curling, resetting
	Lycopersicon esculentum	Purple veins, stunting, leaf distortion, leaf curling
	Nicotiana tabacum	Leaf rolling, resetting,
MMV	Malva spp.	Vein clearing, Mosaic, mottling and yellowing of leaves.
	Chenopodium amaranticolor	immune
OkMV	*Hibiscus esculentus*	Yellow mosaic or regular veinal chlorosis.
	Chenopodium amaranticolor	Systemic chlorotic spotting and line pattern
	Cucumis sativus	Chlorotic local lesion, vein chlorosis
	Datura stramonium	immune

DISCUSSION

Results submitted in (Table. 2) revealed that viral diseases have a great effect on their host plants included misshapen and growth reduction of the most vegetable host. Certain aspects of plant growth were affected by viral infection were also reported by Fargette *et al.* (1988) and Hooks *et al.* (2008). However, host plants have a wide range of responses to viral infection determined by cultivar, virus strain, and whether there is primary or secondary infection (Nie *et al.*, 2012). Virus infection has negative and remarkable effects on plants throughout limiting of their growth and vigour (Miteva *et al.*, 2005), initiated by the symptoms of chlorosis, mottling, mosaic, necrotic zones and reducing the size of leaf area that result of reduction of chlorophyll content (Jakab-Ilyefalvi, 2008). Furthermore, any alteration in the biosynthesis caused by viral infection leads to low chlorophyll content of the foliage. Since, reducing or inhibition of the physiological metabolic processes associated with low rate of photosynthesis lead to reduce the productivity of infected plants (Chia & He, 1999 and Hook *et al.*, 2008). Yield reduction of an infected plant become greater when the viral inoculum extend to the vegetative propagation materials of seeds, tubers, bulbs and corms than later by the vectors (Fargette *et al.*, 1988).

Results showed that the disease incidence was comparable on the most of the surveyed crops, and this may be due to two reasons, first is planting of uncertified seeds and use of viral infected seeds which produced from the local infected plants grew in the previous seasons. This causes to a serious degradation of the plants developed from such seeds so viral diseases incidence was increased (Hamm and Hane, 1999; Jones *et al*., 2003.

Secondly, predominant of such plant virus vectors as insects, mites and so on cause a gradual increasing in the disease incidence from the beginning to the end of growing season. These vectors mostly specified in their transmission of plant viruses from diseased to healthy plants that encourage their dispersal (Boiteau *et al*., 1998). In this aspect, Warren *et al*. (2005) stated that vectors play the most effective role in the transmission of plant viruses. Worthily, some plant viruses remain active after their acquisition by vectors, so the epidemic dispersal of the viruses was existed (Sławomir, 2010).

Finally, we conclude that a major viral disease on the most important vegetables in Duhok province constitute a crucial factor in restriction the areas grown particularly when the best management of these diseases are more expensive for growers and mostly require long term of rotation.

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رووپیڤکرن و رووونکرنا ئێشێن ڤایروسی ل بەروبومێن زەرزەواتێ ل پارێزگەها دهوکێ/ هەرێمی کوردستان/ عیراقێ

کورتی

ئەڤ ڤەکولینە رابوی ب رووپیڤکرن و دیارکرنا ئێشێن ڤایروسی یێن پەیدابوویی ل زەڤیێن زەرزەواتێ یێن دهوك، مالتا، سمێل، تەناهی و گرێ گەورێ ل پارێزگەها دهوکێ/ هەرێمی کوردستان ل عیراقێ. رووپیڤکرن هانە ئەنجام دان ب کارئینانا شێوا X بۆ هەر زەڤی. پەیدابوونا رووەکێن ئێشاوی ب ڤایروسێ هاتە دیارکرن وەك رێژا سەدی یا وان رووەکان ئەڤێن نیشانێن ڤایروسی ل سەر هەبوون. ئەو ئێشێن هاتینە دیتن هاتنە نیاسین ب رێکا بایلوجی. رێکا بایلوجی هاتە ئەنجام دان بکارئینانا تستا زانستێن نیشانێن نەخوشیێ لسەر رووەکێن نیاسەر بۆ هەر ڤایروسەکێ. سەرەکیترین ئێشێن ڤایروسی یێن دیتی ل زەڤیێن زەرزەواتێ بریتی بوو ژ ڤایروسا وای یا پتاتێ (PVY)، ڤایروسا لەڤبوونا بەلگێن پتاتێ (PLRV)، ڤایروسا موزاییك یا باجانێ(ToMV)، ڤایروسا موزاییك یا خیاری (CMV)، ڤایروسا موزاییك و زەربوونا کندکا (ZYMV)، ڤایروسا ستریکێن زەر یا سیری (GYSV)، ڤایروسا موزاییك یا پیڤازێ (OMV)، ڤایروسا پێچبوونا سەری یا سلکی (BCTV)، ڤایروسا موزاییك یا تولکی (MMV) و ڤایروسا موزاییك یا بامیێ (OkMV). پەیدابوونا ئێش یێن ڤان ڤایروسان بریتی بوو ژ ٧٥، ٢٠، ١٠، ٣، ٧٥، ١٠، ١٥، ٧٠، ٢١، ٣ ئێك ل دیڤ ئێکی. ژبەر ڤەگوهاستنا ڤایروسێن رووەکێ ب رێکا توڤی، کەلوپەلێن کەسك یێت زێدەکرنێ، ڤەگوهێزەر، پیس بوون، ڤێگ کەفتن و ....، لەوما پشنیار دەینە جوتیاران کو توڤێن باوەرپێکری و کەلوپەلێن کەسك یێت زێدەکرنێ یێن بێ ڤایروس ب کار بینن و هەروەسا کونترولکرنا ڤەگوهێزەران ئەڤێن دهێنە دناڤ زەڤێ دا بۆ پاراستنا بەروبومێ ژ پیس بوون و ئێشاوی بوون.

مسح و وصف الأمراض الفيروسية لمحاصيل الخضر في محافظة دهوك اقليم كردستان العراق

الخلاصة

أجريت هذه الدراسة لمسح وتحديد و توزيع الأمراض الفيروسية في الحقول المزروعة بالخضروات, في كل من دهوك، مالطا، سيميل، التناهي و كريكةورة - محافظة دهوك /اقليم كردستان العراق. تم المسح باستخدام نمط X. الإصابة النباتات الفيروس تراوحت النسبة المئوية للنباتات ظهرت عليهم اعراض الفيروس. تم تشخيص الأمراض بطريقة البيولوجية. و الأمراض الفيروسية التي شهدت خلال المسح تسسبب بها فايروسات التالية ، PVY، PLRV، ToMV، CMV، ZYMV، GYSV، OMV، BCTV، MMVو .OkMVكانت نسبة الإصابة بهذه الأمراض الفيروسية 75، 20، 10، 3، 75، 10، 15، 70، 21و 3 على التوالي .لذلك، بسبب انتقال الفيروسات من خلال البذور والمواد النباتية، وناقلات، والتلوث، والاتصالات و .....، فمن المستحسن للمزارعين استخدام البذور المعتمدة والاجزاء الخضرية التي هي أيضا خالية من الفيروسات، و السيطرة على ناقلات لحماية المحاصيل من التلوث والعدوى.

CARCASS COMPOSITION AND TISSUE DISTRIBUTION OF KARADI LAMB MAINTAINED ON CONCENTRATE OR PASTURE.

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ABSTRACT

Fourteen weaned (90 days) entire male Karadi lambs were equally and randomly divided to be fed either on concentrate *ad lib* or on pasture supplemented with barley. All lambs were slaughtered when each animal reached its designed body weight (35 kg).

Result revealed that lambs raised on concentrate had significantly (P< 0.05) lower percentage of lean (63.90%) and higher proportion of fat (14.89%) than lambs fed on pasture supplemented with barley (66.12; 11.63%, respectively). It seems also that the greatest proportion of body fat is the carcass fat, followed by fat tail and finally the non-carcass fat.

KEYWORDS: *carcass, tissue, feeding system, Karadi lambs.*

INTRODUCTION

It is well recognized that the primary value of a market animal is determined by the quality and proportion of lean meat in the carcass (Sents et al., 1982). Therefore, considerable interest has been generated at times in the use of muscle:bone ratio as a guide to carcass meat (Berg and Butterfield, 1976), as an index of maturity (Davies and Kallweit, 1979), and is potentially the most important function of conformation (Kempster et al., 1987). Moreover, carcass composition is determined by two principal factors : 1- Animal intrinsic factors, as breed, sex and age, and 2- Extrinsic animal factors, as production system and diet (Delfa et al., 1996).

Moving weaned lambs directly to the feedlot results in faster, more efficient growth than animals fed forage for a period of time (Notter et al., 1991). Finishing meat animals on forage, rather than concentrate, may lead to the production of leaner carcasses (Ely et al., 1979). Thus forage-based production systems may offer the option of reduced daily costs of production, but may lead to increased number of days required to finish animals (Notter et al., 1991). Therefore. The aim of this study is to investigate the effect of feeding system on carcass composition of Karadi lambs.

MATERIALS AND METHODS

Fourteen weaned (90 days) entire male Karadi lambs maintained at animal farm, Faculty of Agriculture and Forestry, University of Duhok were used in this trail. Lambs were equally and randomly divided to be fed either on concentrate (14.11 CP% and 2718 ME) *ad lib* or on pasture supplemented with barley at a rate of 1kg/ head/daily. Animals were slaughtered when each individual lamb reached its designated body weight (35 kg). Following fasting for 18-hr with free access to water and weighed immediately before slaughter. After skinning, the carcass and non-carcass components were weighed. Omental, mesenteric, kidney and pelvic fat, cardiac fat and testes fat were separated and weighed. The digestive tract were removed, and weighed, then emptied of their content, washed drained and weighed to facilitate the calculation of empty body weight. Following chilling the carcasses at 4C° for 24 hrs, cold carcasses were weighed, then split along the vertebrate column into two halves. The left side was cut into leg, loin, rack, neck, shoulder, breast, foreshank, and flank. Each cut was dissected completely into lean, fat and bone. These components were weighed separately to calculate their percentage.

General Linear Model (SAS, 2002) was used to study the effect of treatment on studied traits according to the following model:

$Y_{ij} = \mu + T_i + e_{ij}$

Where:
Yij= Observation value of jth animal.//μ = Overall mean.
Ti= Effect of feeding system (i= concentrate, pasture)///eij= Experimental error assumed to be NID (0, σ^2 e).

RESULTS AND DISCUSSION

Tissue Distribution In The Carcass

Percentage of separable lean, fat and bone for individual cuts of the carcass are given in Table 1. It seems from the table that the lean percentage of all cuts was higher in lambs maintained on pasture supplemented with barley compared to lambs fed on concentrate either significantly (P< 0.05) in the leg and breast cuts or numerically on all other cuts except shoulder. Conversely with respect to proportion of fat in different cuts, results indicate that lambs fed on concentrate excelled those of lambs kept on pasture and supplemented with barley. However, the proportion of bone in all carcass cuts was not differ significantly (P> 0.05) between the two feeding systems.

Table(1): Proportions of separable carcass tissues of cuts of karadi lambs maintained on different feeding regimen (mean ± s.e.).

Carcass Cuts	Feeding System		
	Proportions	Concentrate	Pasture
Leg	Lean	67.24±1.05 [b]	70.12±0.69 [a]
	Fat	11.63±1.36 [a]	8.42±0.77 [a]
	Bone	21.11±0.60 [a]	21.44±0.30 [a]
Shoulder	Lean	68.04±0.40 [a]	66.61±0.81 [a]
	Fat	11.03±0.88 [a]	10.75±0.95 [a]
	Bone	20.91±0.84 [a]	22.6±0.41 [a]
Breast	Lean	51.14±1.78 [b]	56.67±1.11 [a]
	Fat	27.1±1.55 [a]	20.07±2.36 [b]
	Bone	21.73±1.03 [a]	23.24±1.50 [a]
Flank	Lean	73.54±2.38 [a]	78.66±3.18 [a]
	Fat	26.45±2.38 [a]	21.33±3.18 [a]
	Bone	-	-
Fore shank	Lean	59±0.79 [a]	60.06±0.70 [a]
	Fat	8.67±0.69 [a]	6.9±0.70 [a]
	Bone	32.3±0.93 [a]	33.02±0.91 [a]
Neck	Lean	62.6±4.32 [a]	66.35± 4.61 [a]
	Fat	12.54±5.50 [a]	7.58± 2.50 [a]
	Bone	24.83±1.51 [a]	26.04± 2.79 [a]
loin	Lean	60.66±1.76 [a]	61.43± 2.15 [a]
	Fat	15.61±1.35 [a]	15.11±1.91 [a]
	Bone	23.7±1.13 [a]	23.44±1.71 [a]
Rack	Lean	55.91±1.65 [a]	58.78± 1.31 [a]
	Fat	20.38±1.34 [a]	17.98± 1.81 [a]
	Bone	23.69±1.39 [a]	23.22± 1.70 [a]

*****Means with different letters for each characters alone are significantly different at (P ≤ 0.05)

Additionally, muscle content varied according to its location in the carcass. For example, the highest muscle content was in the leg (70.12%), whereas the lowest (56.67%) was in the breast cut. Such variation in muscle mass is mainly due to differences in the total number of muscle fibers. Possibly the evolutionary increase in muscle fiber size is limited by physiological status in that normal cell function is maintained as long as certain limit in cell size is not exceeded (Rehefeldt et al., 2002).

The weight and the proportions of separable carcass tissue of the carcass side of Karadi lambs maintained either on concentrate or on pasture supplemented with barley are presented in Table 2. Result revealed although the weight of carcass

of both feeding systems are almost the same (P> 0.05), yet lambs raised on concentrate had significantly (P< 0.05) lower percentage of lean as compared to those fed on pasture supplemented with barley (63.90 vs. 66.12%). Such result suggests that lambs raised on pasture and supplemented barley delayed physiological maturity and allowed continued lean growth beyond that noticed in lambs raised on concentrate (Borton et al., 2005). Also, comparisons of forage vs. concentrate finishing on carcass lean tissue content have been previously reported by other investigators (Mc Clure et al., 1994; Murphey et al., 1994a).

When fat expressed as a weight or as a percentage of carcass side weight, lambs fed on concentrate had significantly (P< 0.05) higher weight (977.85 vs. 755 gm) and as a proportion (14.89%) compared to those maintained on pasture and supplemented with barley (11.63%) (Table 2). Also, the lean to fat ratio of lambs fed on pasture and supplemented with barley was significantly (P< 0.05) greater than those fed on concentrate (6.0;1 vs. 4.32;1) (Table 2). However, no significant differences was noticed in the percentage of bone between two feeding systems (21.20 vs. 22.24 %) (Table 2). Similarly, several investigators including Tatum et al. (1989); Mc Clure et al. (1994); Murphy et al. (1994b) and Borton et al. (2005) who found that lambs finished on pasture had lower proportion of fat than those finished on concentrate. Several studies have verified this for beef cattle (Burson et al., 1980; Schroeder et al., 1980) and goat (Daskiran et al., 2006; Dosky et al., 2009).

Table(2): The effect of feeding regimen on physical dissection of half carcass of Karadi lambs.

Items	Feeding System	
	Concentrate	Pasture
Carcass weight (kg)	6.54 ± 0.31 [a]	6.56 ± 0.37 [a]
Carcass Lean (gm)	4183.29±137.40 [a]	4343.00±172.08 [a]
Carcass Fat (gm)	977.85±55.84 [a]	755.00±51.09 [b]
Carcass Bone (gm)	1385.71±37.75 [a]	1459.29±60.95 [a]
Lean (%)	63.90±0.31 [b]	66.12±0.73 [a]
Fat (%)	14.89±0.50 [a]	11.63±0.93 [b]
Bone (%)	21.20±0.38 [a]	22.24±0.56 [a]
Lean: Fat	4.32±0.15 [b]	6.01±0.68 [a]
Lean: Bone	3.02±0.05 [a]	2.98±0.08 [a]

*****Means with different letters for each characters alone are significantly different at (P ≤ 0.05)

Partitioning Of Fat

It is well recognized that fat is the most variable tissue in the carcass and it varies not only in its amount but also its distribution between the various deposits which changed markedly during growth, and the proportion and location of the fat in the body are important in meat animals (Oramari et al., 2014). Although it seems from Table (3) that no significant difference exist in total body fat as well as in its partitioning in different locations, however, it seems that in both feeding regimen, the greatest contribution was the carcass fat (64.56 and 63.46 %) followed by fat tail (22.41 and 23.54 %) and finally the non-carcass fat (13.01 and 12.59). Moreover among the non-carcass fat, omental and mesenteric fat forms the greatest proportion of non-carcass fat followed by kidney and pelvic, cardiac and testes fat. Similarly, working with Awassi and Hamdani lambs, Oramari et al., (2014) found that the greatest proportion of the body fat was deposited in the carcass, followed by tail and on internal organs, as a non carcass fat.

Table(3): Partitioning of fat depots as a percentage of total body fat.

Items	Feeding System	
	Concentrate	Pasture
Omental and mesenteric fat	8.74±0.98 [a]	9.08±1.43 [a]
Cardiac fat	1.15±0.28 [a]	1.15±0.13 [a]
Testes fat	0.10±0.01 [a]	0.13±0.02 [a]
Kidney and pelvic fat	3.01±0.35 [a]	2.62±0.25 [a]
Noncarcass fat	13.01±0.91 [a]	12.99±1.63 [a]
Carcass fat	64.56±0.68 [a]	63.46±1.19 [a]
Fat tail	22.41±0.55 [a]	23.54±0.51 [a]
Total fat (Kg)	3.49± 0.17 [a]	3.18± 0.31 [a]

*****Means with different letters for each characters alone are significantly different at ($P \leq 0.05$)

CONCLUSION

It can be concluded that carcasses of lambs raised on pasture supplemented with barley are leaner and had higher lean-to-fat ratio than lambs fed on concentrate.

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پێکهاتی وبەلاڤبونا شانێن لەشی یێن بەرخێن کوردی هاتینە خودانکرن ل چەروانی یان لسەر ئالفێن چێکری

پوختە

دڤێ ڤەکولینێ دا 14 بەرخێن کوردی یێن شیرڤەکری (90 روژی) هاتینە دابەشکرن بو دوو گروپان, گروپەك هاتە خودانکرن لسەر ئالفێ چێکری وگروپێ دی ل چەروانی هاتنە خودانکرن زێدەباری دانا جەهی دهەمان کێشا لەشی (35 کگم) هاتنە ڤەکوشتن.

د ئونجاماندا دیاربو پێکهاتی یێ لەشێ بەرخان ئەوێن هاتینە خودانکرن لسەر ئالفێ چێکری ژگوشتی جیاوازی ب رێژا (أ < 0,05) (63,90%) و بلندترین رێژا چەوری یێ لەشی (14,89%) بەروارد ب بەرخێن هاتینە خودانکرن ل چەروانی (66,12و11,63%) ب دیفکرا.

هەروەسا دیاربو کو پتر رێژا چەوری یاگرتی ل ژێر پیستی پاشی دوینگی وچەوریا هناڤێت نافخوی.

تركيب الجسم وتوزيع الانسجة لذبائح الحملان الكرادية المرباه في المراعي او على الاعلاف المركزة

الخلاصة

تم توزيع 14 حمل كرادي مفطومة (90 يوم) الى مجموعتين لتتغذى الاولى على عليقة مركزة واما الثانية فقد غذيت على المراعي مع اضافة الشعير. وتم ذبحها عند نفس الوزن (35 كغم).

تشير النتائج الى ان محتوى ذبائح الحملان المغذاة على العلف المركز من اللحم كانت اوطأ معنويا (أ < 0,05) (63,90 %) واعلى في نسبة الدهن (14,89%) مقارنة بالحملان المغذاة على المراعي (66,12 و11,63%) على التوالي.

كما يتضح بان الجزء الاعظم من الدهون المترسبة كانت الدهن الذبيحة ومن ثم الالية ودهن الاحشاء الداخلية.

EFFECT OF GENETIC GROUP ON FATTY ACID COMPOSITION IN LAMB'S MEAT

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ABSTRACT

Fatty acid composition of homogenous samples from leg, loin and shoulder were studied in five lambs from each of Karadi,(K), Awassi(A) and their crossbred($\frac{1}{2}A + \frac{1}{2}K$)lambs raised at animal farm, Department of Animal Production, Faculty of Agriculture,University of Dohuk. Each group of lambs was kept in a separate pen, and concentrate (14.3% crude protein and 2538 k cal energy) was offered ad *libitum*. All lambs were slaughtered when they reached their target weight (45kg).The highest numerically total fatty acid (g\ 100g fat) was recorded in crossbred lambs (161.68±14.18), followed by Karadi(152.68± 20.95), and Awassi (143.52±11.52).While, karadi lambs had significantly ($p<0.05$) more content of poly unsaturated fatty acid (12.70±0.45) compared to Awassi (10.79 ±0.25) and crossbred lambs(11.20±0.11). Also Karadi lambs had significantly($p<0.05$) higher content of n-6 especially C18:2 n-6 fatty acid (8.61± 0.22) compared to Awassi lambs (7.10±0.23) and crossbred lambs (7.48±0.21).The PUFA/ SFA and n-6:n-3 ratio were not significantly differ among different genetic group.

KEYWORDS: Fatty acid, Lamb Meat, KARADI, AWASSI

INTRODUCTION

The Awassi and Karadi comprises almost 60 and 20 %, respectively of the total sheep population in Iraq, and raised mainly for lamb and mutton production (Alkass and Juma,2005). It is known that lambs meat contain relatively high amount of fat and cholesterol, and its characterized by comparatively less desirable fatty acid profile (unsaturated to saturated fatty acids, and poly unsaturated to saturated fatty acids(Barton et al.,2007). Therefore, such profiles of acids in the human diet have received a great attention due to their influence on health (Zapletal et al,2010).

Lamb fat deposition and composition of fatty acids (FA) can be influenced by many factors including breed, gender, age/body weight, fatness, depot site, environmental conditions, diet and rearing management (Nürnberg et al. 1998, Szumacher-Strabel et al. 2001, Gruszecki et al. 2004. Additionally, breed of lamb determine the rate and amount of fat deposited in muscle tissue and other parts of the body. (Zygoyiannis, et al 1985). Arsenos, et al (2006) reported that breed significantly affected the fatty acid composition of lambs' fat depots. Also, it is known that intramuscular fat has a more beneficial lipid profile than subcutaneous and other depot fats (Bas and Morand-Fehr, 2000; Potkanski et al.,2002;Wood et al., 2008).Moreover, it seems that Awassi lambs had significantly higher carcass fat than Karadi lambs (Hassan, 2014).

Therefore, the main objective of this study is to determine the influence of, genetic group on fatty acid profile of fattened lambs.

MATERIAL AND METHODS

Five entire weaned lambs (4 month old) from each of Awassi, Karadi and their crossbred ($\frac{1}{2}$Awassi + $\frac{1}{2}$Karadi)and averaged 31.0, 30.8 and 30.2kg in weight, respectively raised at the Animal Farm, Department of Animal Production, Faculty of Agriculture, University of Duhok were used in this experiment. Each group of lambs was kept in a separate pen, and concentrate contained 14.3% crud protein and 2538 Kcal energy was offered *ad libitum*. The lambs were slaughtered when each of them was reached its target weight (45kg) according to Islamic way at the farm abattoir. After chilling the carcass at 4 $^{\circ}$C for the 24 hours, the homogenous samples of meat from the leg, loin and shoulder were collected, and the muscle tissue was blended using a small food

processor. Fatty acids were measured according to the method described by O'Fallon et al. (2007). Briefly, 500 mg of dry meat was placed into test tubes to which 1.0 mL of internal standard (0.5mg of C13:0/mL of methanol), 0.7 mL of 10 N KOH and 5.3 mL of methanol were added. The tubes were incubated in water bath at55°C for 90 min with vigorous hand-shaking for 5 s every 20 min and 580 µL of 24 N H2SO4 was added after cooling the tubes. The tubes were then incubated for further 90 min in 55°C water bath with shaken by hand for 5s every 20 minutes. The tubes were cooled and 3 ml of hexane were added and vortexed. After centrifugation, the hexane layer was placed into a GC vial. The fatty acid composition of the FAME was determined by capillary GC on a CP-SIL88, 100 m × 0.25 mm × 0.20 µm capillary column installed on a Hewlett Packard HP 6890 series gas chromatograph equipped, a flame ionization detector, and split injection. The initial oven temperature was 70°C, held for 2 min, subsequently increased to 225°C at a rate of 4°C/ min, and then held for 15 min. hydrogen was used as the carrier gas at a flow rate of 2.1 mL/min, and the column head pressure was 29.59 psi. Both the injector and the detector were set at 250°C. The split ratio was 100:1. Fatty acids were identified by comparing their retention times with the fatty acid methyl standards described previously.

Data were analyzed statistically by General linear model to study the effect of breed on lambs' meat fatty acid profile (SAS, 2002) according to the following model:

$Y_{ij} = \mu + B_i + e_{ij}$

Where:

Y_{ij}= observational value of $_j$th

µ = overall mean

Bi = Effect of ith breed (Awassi, karadi, cross breed)

Eij = Random error associated with each observation assumed to be NID with zero mean and 6^2e variants Also, Duncan (1955) was performed for the mean differences comparison

.RESULTS AND DISCUSSION

Results of fatty acid composition of the muscle meat are presented in Table(1).Total fatty acid composition(g/100gfat\meat) was numerically higher in the crossbred lambs (161.68±14.18) than Karadi lambs (152.68±20.95) and Awassi lambs (143.52±11.52). Also, crossbred lambs had more content of fatty acid C18:1 (71.87± 5.97) and mono unsaturated fatty acid (MUFA) (77.20±6.52) compared to both Awassi and Karadi lambs. Similarly, Popova (2014) found that the crossbred lambs (Northern Bulgarian fine wool × lle de France) had significantly higher amount of C18:1 and MUFA than did the purebred Northern Bulgarian fine wool. A similar trend was also noticed by Maia et al (2012).

Breed displayed an effect on the content of C16:0 and SFA which was higher in crossbred lambs as compared to Awassi and Karadi lambs, which in agreement with Popova (2014) and contrary to the results of Salvatori et al (2014) who indicated lower content of SFA in lambs that were crosses of IDF.

It appear from the results presented in Table (1) that Karadi lambs had significantly ($p<0.05$) higher content of C18:2(8.61± 0.22) than Awassi (7.10±0.23) and crossbred (7.48±0.21). Also, there was a tendency toward significantly ($p<0.05$) higher amount of PUFA in Karadi lambs (12.70± 0.45) compared to Awassi (10.79±0.25) and crossbred lambs (11.20±0.11).

This result is in accordance with those reported earlier by Kaczor et al (2010) and Popova (2014).

The lower content PUFA in the muscle of crossbred lambs correspond to the relatively higher content of intramuscular fat compared to Karadi lambs in the same animals (Hassan, 2014).According to Wood et al(2008), the muscle of breeds or genotypes that are characterized with higher content of lipids, lower part of phospholipids and poorer in PUFA.

With the regard to the ratio of PUFA\SFA, no significant changes were noticed among the studied breeds and their crossbred, though its value tended to be lowers in the crossbred (0.16±0.02) which is in agreement with results of Popova (2014).Also, a strong negative exponential relationship exists between the intramuscular fat content and the PUFA\SFA ratio (Scollan et al, 2003).

It can be concluded that crossbred lambs had relatively higher amount of fatty acid and lower ratio of PUFA\SFA compared to Awassi and Karadi lambs.

Table (1): The effect of genotype on the fatty acid composition (g/kg dry basis)

Fatty acids	No	Mean	breeds		
			Awassi	Karadi	Crossbred
			Fatty acids composition g/kg dry basis		
C14	15	4.83±0.039	5.04±0.37 a	4.37±0.75 a	5.09±0.90 a
C15	15	0.86±0.05	0.83±0.07 a	0.93±0.07 a	0.81±0.14 a
C16	15	35.16±2.38	34.10±3.43 a	34.82±5.53a	36.56±4.03 a
C17	15	2.99±0.24	2.74±0.33 a	3.42±0.45 a	2.83±0.48 a
C18	15	23.35±1.67	20.07±1.92 a	22.36±0.98a	27.61±3.05 a
C20	15	0.31±0.02	0.33±0.05 a	0.26±0.03 a	0.34±0.02 a
C14:1	15	0.29±0.02	0.30±0.02 a	0.27±0.05 a	0.29±0.03 a
C16:1-N-7	15	3.63±0.23	3.80±0.39 a	3.68±0.55 a	3.39±0.33 a
C17:1	15	1.77±0.11	1.80±0.16 a	1.89±0.21 a	1.63±0.23 a
C18:1-N-9	15	67.82±4.38	63.68±5.01a	67.90±11.52a	71.87±5.97a
C18:2-N-6	15	7.73±0.21	7.10±0.23 b	8.61±0.22 a	7.48±0.21 b
C18:3-N-3	15	0.90±0.11	0.83±0.08 a	1.19±0.32 a	0.69±0.03 a
C20:4-N-6	15	1.85±0.05	1.74±0.07 a	1.90±0.13 a	1.91±0.08 a
C20:5-N -3	15	0.26±0.01	0.27±0.05 a	0.24±0.01 a	0.27±0.02 a
C22:6-N-3	15	0.18±0.02	0.17±0.02 a	0.15±0.01 a	0.23±0.06 a
C22:5-N-3	15	0.61±0.02	0.66±0.04 a	0.59±0.02 a	0.59±0.06 a
SFA	15	67.53±4.35	63.13±5.96 a	66.20±9.00 a	73.26±8.27 a
MUFA	15	73.52±4.68	69.59±5.56 a	73.77±12.23 a	77.20±6.52 a
PUFA	15	11.57±0.27	10.79±0.25 b	12.70±0.45 a	11.20±0.11 b
PUFA/SFA	15	0.18±0.01	0.17±0.01 a	0.20±0.03 a	0.16±0.02 a
N-3	15	1.97±0.13	1.94±0.15 a	2.19±0.35 a	1.80±0.10 a
N-6	15	9.59±0.22	8.85±0.27 b	10.51±0.25 a	9.40±0.17 b
n-6:n-3	15	5.11±0.34	4.69 0.42 a	5.32±0.89 a	5.31±5.31a
Fatty acids composition g/100 g fat	15	152.62±8.8	143.52±11.52 a	152.68±20.95 a	161.68±14.18 a

Means with different letters within each raw differ significantly ($P < 0.05$)

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پوخته

دیڤجون ل سەر پێکهاتیێن ترشاتیێن کزی ژ سامپلێت تیکەلکری ژ گوشتێ پارچێن رەهنی وپشتێ و ملی ژ بەرخێن ژ توخمێ کوردی وعواسی و بەرخێن لیکدایی ژ توخمی کوردی وعواسی ئەوێن هاتینە بخودانکرن لپروژی خودانکرنا گیانەوەرا سەر ب فاکولیتی جاندنێ ل زانکویا دهوکێ هاتە کرن . هەر توخمەك یان گروپەك جودا هاتە بخودانکرن و ئالفدان ل سەر ئالفێ جێکری ب رێژا 14.3 % پروتین و 2538 کیلوسعرە وەك وزە. هەمی بەرخ هاتنە سەرژیکرن پشتی گەهەشتینە سەنکا 45کگم .

ئەنجامێن ڤەکولینێ دیاردکەن کو بارستە ترشاتیێن کزی (گم/ 100 گم کزی) پتربون لدەف بەرخێن لیکدایی ژ توخمێ کوردی وعواسی (161.68±14.18) دیڤدا برخێن کوردی (152.68±20.95) و بەرخێن عواسی (143.52±11.52) . ترشاتیێن ژ جورێ (unsaturated fatty acid) بشیوەیەکی بەرجاف پتربون ل گوشتێ بەرخێن کوردی (70. 12±0.45) براورد دگەل گوشتێ بەرخێن عواسی (10.79 ±0.45) وبەرخێن لیگدایی ژ توخمێ کوردی و عواسی (11.20±0.11) . هەروەسا، بەرخێن کوردی بەرزترێن ترشاتیێن کزی ژ جورێ n-6بتایبەتی 8.61 ±0.22) C18:2) بەراورد دگەل بەرخێن لیکدایی (7.48±0.21) وبەرخێن عواسی (7.10±0.23) .دیسان دیار بو کو ج کارتیکرنێن بەرجاف نەبون دناڤ بەرا هەرسێ توخمێن بەرخا د رێژا ترشاتیێن کزی ژ جورێ (unsaturated fatty acids/ saturated fatty acids)) و جورێ n-6 و n-3 .

تأثير لحوم حملان المجاميع الوراثية على تركيب الأحماض الدهنية

الخلاصة

تم دراسة تركيب الاحماض الدهنية لنماذج متجانسة من لحوم قطعيات الفخذ و القطن و الكتف للحملان الكرادية و العواسية و تضريباتهما و المرباة في الحقل الحيواني التابع لفاكليتي الزراعة/ جامعة دهوك. تم ايواء كل مجموعة في حظيرة منفصلة و غذيت على العلف المركز و الحاوي على 14,3% بروتين خام و 2538 كيلو سعرة بصورة حرة. ذبحت جميع الحملان لدى وصولها وزن 45 كغ.

تشير النتاج بان مجموع الاحماض الدهنية(غم /100 غم دهن) كانت اعلاها حسابيا لدى الحملان المضربة (161,68 ± 14,18) و من ثم الحملان الكرادية (152,68 ± 20,95) و ادناها لدى الحملان العواسية (143,52 ± 11,52) . كان محتوى الاحماض الدهنية المعقدة غير المشبعة اعلاها معنويا في لحوم الحملان الكرادية (12,70 ± 0,45) مفارنة بالحملان العواسية (10,79 ± 0,45) و من ثم الحملان المضربة (11,20 ± 0,11). كما تبين بان اعلى محتوى من الاحماض الدهنية n-6 و خاصة c18:2 كان لدى الحملان الكرادية(8,61 ± 0,22) مقارنة بالمضربة ((7,48 ± 0,21) و العواسية (7,10 ± 0,23). تبين انعدام الفوارق المعنوية بين المجاميع الوراثية في نسبة الاحماض الدهنية المعقدة غير المشبعة الى الاحماض الدهنية المشبعة و كذلك نسبة n-6 الىn-3.

PRETREATMENTS EFFECT ON SEED GERMINATION AND EARLY GROWTH OF *Gleditsia Triacanthos* L. SEEDLINGS.

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ABSTRACT

The experiment was carried out in the forest nursery in the faculty of agriculture/university of Duhok, to investigate the effect of hot water and sulphuric acid for during times on the seed germination and seedling growth during the growing season. The results showed that the seeds of *Gleditsia triacanthos* L. soaking in hot water at 90C° for 20 minutes and sulfuric acid (98%) treatment for 90 minutes, were the best method for breaking dormancy of *Gleditsia triacanthos* which resulted in an increased germination percentage and germination rate to (52.66%, 49.33%) and (2.589, 1.220) respectively, compared with control (2.5%) and (0.104) respectively. Stem length, stem diameter and root length, followed the same trend of higher value in sulphuric acid and hot water for 90min. and 30min.

INTRODUCTION

Some species for reproducing seed emergence successfully require scarification; it is the reason might be over dormancy to seed production and dispersal strategies (Yang, *et al.*, 2008). In this circumstance, the seed coatis a limit that absorption of water and gas exchange may be needed for germination through natural conditions when needed the process of mechanisms germination (sun, water, light, fire, acid, etc.). Many different scarification treats will be needed in the nursery before sowing to increase and guarantee of germination and seedling growth (e.g. Baskin and Baskin, 2001 and Nasha't M. A., 2009).

Gleditsia triacanthos (Honey Locust) is a deciduous tree species of the Legume Family (*Caesalpiniaceae*). It considered as exotic species in Australia, Canada, France, India, Lesotho, New Zealand, Russian Federation, South Africa, Tunisia, United Kingdom, (but native in USA). In Kurdistan region of Iraq, it occurs in edge way of road and street; *G. triacanthos* also grown in gaps in a forest, edges and floods, roadway and much in the shade (Sullivan, 1994).

Gleditsia triacanthos has a wide ecological range: For example, a large amount variation in climate and soil conditions within natural range, *G. triacanthos* occurs naturally in humid and sub-humid climate regions; it grows naturally to 760 m but has been planted from sea level to 1500 m in temperate latitudes and will grow above 2500 m in subtropical highlands. It is shade intolerant and will only become established in open spaces. *G. triacanthos* is resistant to both drought and salinity (Ertekin & Kirdar, 2010; Asl, *et al.*, 2011).

From morphological standpoint, itvariesin height from 10 – 50m, and diameter from 0.5 – 1.8m. Trees are open, narrow or spreading crown, bark reddish-brown to black, scaly, ridged, often covered in clusters of large, branched thorns. It has a strong taproot and a profusely branched root system (Asl, *et al.*, 2011).This tree is fast growing, short lived (about 125 years). It is highly tolerant of flooding, drought, heat, pollution, compacted soil, and salt. It is not resistant to fire. Fruit is 15-40 cm long pods, flat, curved, twisted and brownish; husk leathery; falling in winter without opening. Honey locust is a large, rapidly growing tree. In the past it has been deliberately promoted and planted in Australia as a fodder tree and garden ornamental. Although beneficial in the short-term as stock feed, the long-term consequences of its growth and spread are counterproductive.

Honey locust tree is considered a serious pest due to its invasiveness and environmental, economic and social impacts (Vines, 1960).This species also multipurpose uses for agro-forestry system in the world, Shade or shelter: *G. triacanthos* is hardy and drought tolerant; it can be grown in windbreaks with the added benefit of pod production.(Davies and Macfarlane, 1979; Felker and Bandurski, 1979). Its wood is strong, hard and durable, resistant to shock, and reddish-brown with attractive figuring; it is used locally for fence posts, pallets, crating, general

construction, railroad ties and by woodworkers for making guitars.

Honey Locust had some medicinal uses: for example; the pods were used as an adjuvant, as an anthelmintic, and as an antiseptic. It can be applied in erosion control, *G. triacanthos* is being tested in many temperate, Mediterranean and highland tropic regions of the world (Vines, 1960).

The pod legumes may have up to 12 seeds. These seed characteristics are differences between other species (Brown and Kirkman, 1990). This species has physical seed dormancy type due to its thick and hard seed coat. Therefore, the impermeable seed coats of honey-locust are treated different scarification before germination can occur (Heit, 1942; Liu, *et al.*,1981 and Nasha't M. A., 2009). It worth noting that the seed of this species has a long viability. For example, A few seeds germinated after 50 years in storage at 4% MC and ambient temperature; viability was maintained for several years in hermetic air-dry stored at 0-8 deg.

Seed germination and seedling production are essential in plantation programs, where the impermeable seed coat to a water supply that is low germination. So, in this trait we have investigated the responses of *G. triacanthos* seeds for a different period of H_2SO_4 and hot water at the gradually of times to increase seed germination and improved seedling growth.

MATERIAL AND METHOD:

Seed treatments:

Mature fruits were collected from Forest nursery in the faculty of Agriculture/ University of Duhok during November in Duhok province. The seeds were extracted from their pods with a hand and were numbered. One hundred of seeds were taken to test, including (weight of 1000seeds, viability, seed length, width and thickness) as shown in table (1).

Table (1):- Morphological characteristics measured of *Gleditsia triacanthos* seeds.

Seed testing	Min	Max	Average	STDEV.
Weight of 1000 seeds	156.72	165.48	162.53	4.08
Seed Length (mm)	8.82	10.88	9.79	0.42
Seed Width (mm)	2.96	7.02	6.03	0.41
Seed Thickness (mm)	2.25	3.90	3.26	0.32
Viability %	90%	95%	91.25%	2.50
M.C.%	4.831	9.310	6.98	1.95

The seeds were treated with two groups; the first group was treated with hot water at ($90C^0$); four seed lots of 100 seeds each were treated with different periods (10, 20, 30 and 40min). The second group, the same procedure of seed lots were treated with H_2SO_4 (98%), at soaking in different time (30, 60, 90 and 120min), after end time of soaking then washing with tap water for 5 minutes to stop heating action. The experiment, designed using Completely Randomized Design (CRD) consisting 9 treatments with four replications and each treatments represented by 400 seeds. Seeds were placed in a plastic container contain sandy loam soil and watering according to need. After two month seeds were germinated when the radical had grown from the seed coat (Wiese and Binning, 1987). Seed germination and germination rate were calculated using the following equation (Maguire, 1962):

$$\text{Germination\%} = \frac{\text{No.of germinated seeds}}{\text{No.of seed sown}} \text{ X } 100$$

$$\text{Germination rate} = \sum (A_i/D_i)$$

Ai = total number of germinated seeds

Di = number of days per counting. After germination the Experiments will stain and continue to grow of seedling until the end of the growing season. The following data were recorded on the obtained seedlings:

- Stem length (cm)
- Stem diameter (mm)
- Root length (cm)
- Germination %
- Germination rate

Statistical Analysis:

All of the parameters were analyzed using the software SAS (SAS,2001), one-way ANOVA and carried out the main treatments using Duncan's multiple range tests (Duncan, 1955) and significance was determined at $p \leq 0.05$.

RESULTS AND DISCUSSION:

- **Germination % and Germination Rate:**

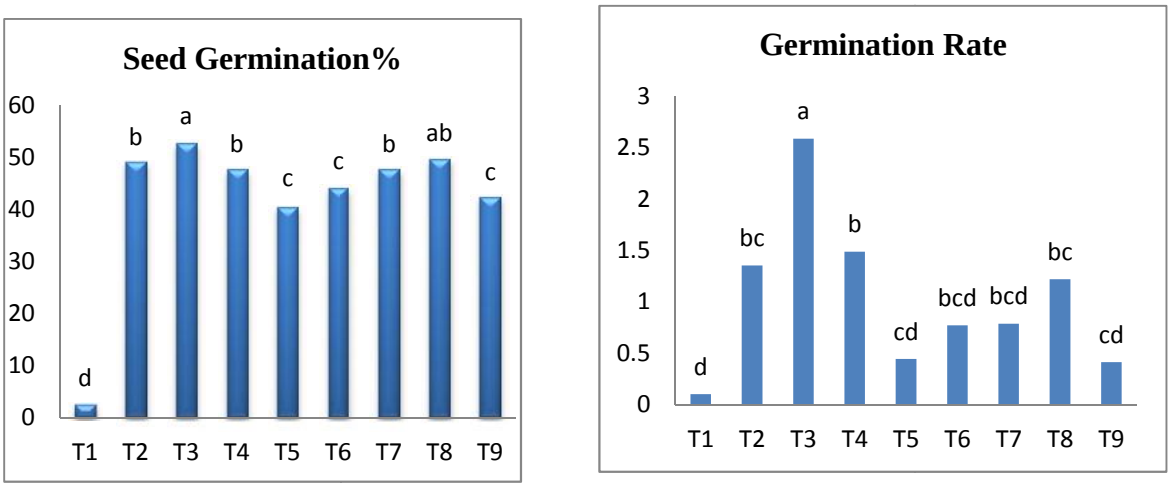
The Physiological dormancy of hard seed coat of *Gleditsia triacanthos* seeds that need to be pretreatments before sowing in the nursery. As

shown in the table (2), analysis of variance indicated a significant differences of the seed germination percentage; In fact, the experiment was indicated that the soaking period of (20min) of original seeds in hot water tested increasing seed germination% compared to all treatments excepts similarity results of H_2SO_4 at period (90min). It was observed that the maximum germination percentage (52.66%) was soaking in hot water at period (20min), but no significant differences of germination percentage (49.33%) with H_2SO_4 at period (90min), figure (1.a). Whereas the minimum percentage of germination (2.5%) was recorded for control (seed not treated). Also, in the same (Table, 2) analysis of variance, resulted that the soaking seeds of *Gleditsia triacanthos* with hot water and H_2SO_4 (98%) for different duration had significant effect on germination rate. However, the minimum and maximum germination rate (0.104 and 2.589) were noticed in treatments T1 (control) and T3 (hot water for 30min), respectively (fig.1.b). From these results may be the softest of seed coat where allowed boiling water, lead to the Imbibitions of water in the embryo changed germination (Aliero, 2004). This result supports the results obtained by Muhammad and Amusa (2003) on *Tamarindus indica* L. containing hard seed coat, the results were increased germination percentage that soaking of *T. indica* seeds in hot water at 100°C for 30 min. Also highest seed germination when *T. indica* seeds were soaked in 98% sulfuric acid concentration for a period of 30 min.

The process of hydrolysis could release primary sugars that could be utilized in protein synthesis. Release of auxins which could be increase metabolism process and protein synthesis (Irwin, 1982; Jackson, 1994).This is in accordance with studies by Mitra, *et al.* (2013) where studies the effect of hot water and acid scarification on germination of black locust (*Robinia pseudoacacia* L.), there are conclusion more effective treatments than the two other ones. Bagas, *et al.* (2010) had reported that the hot water pretreatment of 90C°, were an effective to hasten germination in black locust seeds. Vasichkina, *et al.* (2014) also found that the scarifications in hot water increase the percentage of seed germination significantly. Consequently, hot-water treatment has been reported to increase germination, seed coat permeability for water to maximize seed hydration (Longer and Degago, 1996), for gaseous exchange and release of inhibitors (Mohamed-Yaseen, *et al*., 1994). Similar success in a softening seed coat of hot-water treatment has been achieved with a range of species, including *Rhus coriaria* L. (Doussi and Thanos, 1994), *Rhus lanceolata* (Rasmussen and Wright, 1988), teak (Yadav, 1992) and numerous species of *Acacias* (Halle, *et al*., 1981; Bell and Williams, 1998). Sedigheh, *et al.* (2009) According to results of chemical scarification (treatment with H2SO4 for 15 minutes) and hot water were recommended highly promoting germination of *Rubia tinctorum* L. Other studies for boiling water treatments as Sanjay, *et al.* (2008) concluded that the best germination percentage of *A. auriculiformis* is soaked in hot water at period 10 min.

Immersion of *Gleditsia triacanthos* seeds in H_2SO_4 for 90 min was considerably higher germination percentage (49.33%) than the control (2.5%) (Fig.1). Similar results were obtained in studies carried out on four African *Acacia* species (Masamba, 1994) showed that H_2SO_4 testing alone resulted in 97% germination.

Long period of seeds in soaking of H_2SO_4 (98%) may be the thickness of the seed coat and simply burnt the seeds. This result was un agreement with the same results from another author's by Bowen and Eusebio (1981) who recommenced hot water gave the best results of *Albizzia falcataria*. Saikou, *et al.* (2008) also found that treating *Acacia senegal* with hot water at 80C° for 10 – 40 minutes gave the best results. Truong and Hans (2007) reported that high temperature may affect either initial processes of water uptake by seeds that result in cell division. Some researchers that have been done on the other species of leguminous like as *Albizia julibrissin* (Nasiri and Isvand, 2001) emphasize the effect of hot water and sulphuric acid.



(a) **(b)**

Fig.1. (**a**) and (**b**) Germination percentage and Germination rate of *Gleditsia triacanthos.* Treated with Control (T1), hot water for 10min (T2), hot water for 20min (T3), hot water for 30min (T4), hot water for 40min (T5), H_2SO_4(98%) for 30min (T6), H_2SO_4 for 60min. (T7), H_2SO_4 for 90min (T8), H_2SO_4 for 120min (T9).

Consequently, Ren and Tao (2004) reported that concentrations of sulphuric acid treatment recorded superior germination rate in *Calligonum* species compared to cold scarification treatment. The effect of H_2SO_4 on promotion of seed germination might be due to the highly desiccant effect of the acid on the seed coat thereby allowing easier water uptake and oxygen diffusion. Also, Ebeid (2000) studied the effects of some scarification treatments on some legume trees, and found that concentrated sulphuric acid treatments gave the best results on germination percentage.

- **Stem length (cm):**

Data obtained of stem length of *Gleditsia triacanthos* seedlings as affected by chemical scarification and hot water are shown in Table 2. The longest seedling was recorded in hot water at time of 30 min and soaking the seeds in H_2SO_4 at period 90min were (28.25cm, 26.75cm) respectively, figure (2). This result may be due to the speed germination that leads to speed radical growth and development of seedling than other treatments such as a control (without treatments). This agrees with the findings of Hossain, *et al.* (2001) who reported that pre-sowing treatment had a significant effect on seedling growth of *Tectona grandis*. Similar results were reported by Edward Missanjo, *et al.* (2014) by suggesting to use nicking as a pretreatment method on *Acacia polyacantha* seeds in order to enhance the speed and the amount of early seedling growth at the nursery stage.

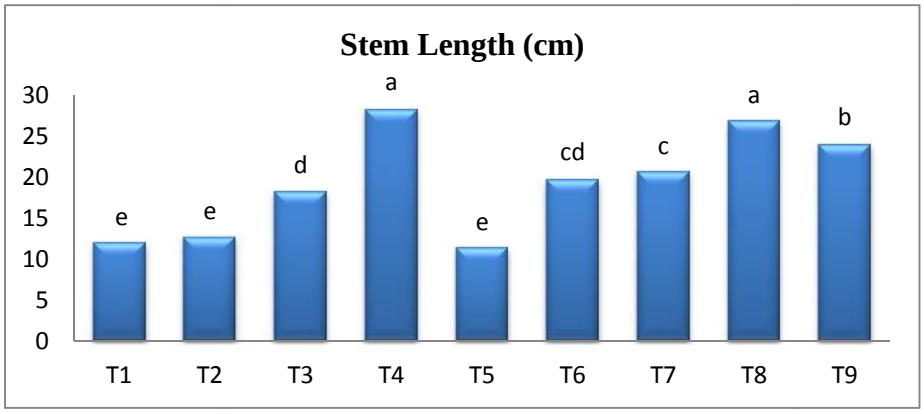


Fig.(2):- Influence of duration of hot water and H_2SO_4 scarification on the stem length (cm) of *Gleditsia triacanthos.*

Amira and Mohamed (2013) concluded that the best method for breaking dormancy of *Cassia fistula*, which gave high quality of golden shower seedlings, is acid scarification for 2 minutes and then soaking in hot water at 100 °C for 6 minutes. Similar results were reported by Joshi and Pant (2010), who indicated that H_2SO_4 scarification for 2 hours increased growth characteristics of *Canna indica.* However, Mehta and Sen (1990) reported that the seeds of *Cassia Italica* exhibited seed dormancy and pre-treatment with concentrated H_2SO_4 and mechanical scarification improved germination.

Olatunji, *et al.* (2013) reported higher seed germination, seedling growth, and survival in immersion in concentrated sulphuric acid treatment than other treatments for different seed species. The differences may arise due to the concentration of the acid and the time of exposure for the seeds to the acid, since seeds exposed for a long time get damaged easily (Azad, *et al.* 2012; Schmidt, 2000).

- **Stem diameter (mm):**

Early seedling growths begin after radical of seeds for growth and development to seedling, according to table (2) analysis of variance of stem diameter was the high significant differences between treatments in probability (0.05). It is noticed that immersing the *Gleditsia triacanthos* seeds in concentrated sulphuric acid (98%) for 90 min. Resulted in the biggest stem diameter was (3.3mm.) as shown in figure (3). Whereas, the smallest diameter obtained due to untreated seeds was (2.25mm). Similar results were reported with those obtained by many authors, (Everitt, 1983; Diangana, 1985; Nutumbula, *et al.*1990 and Demel, 1994).

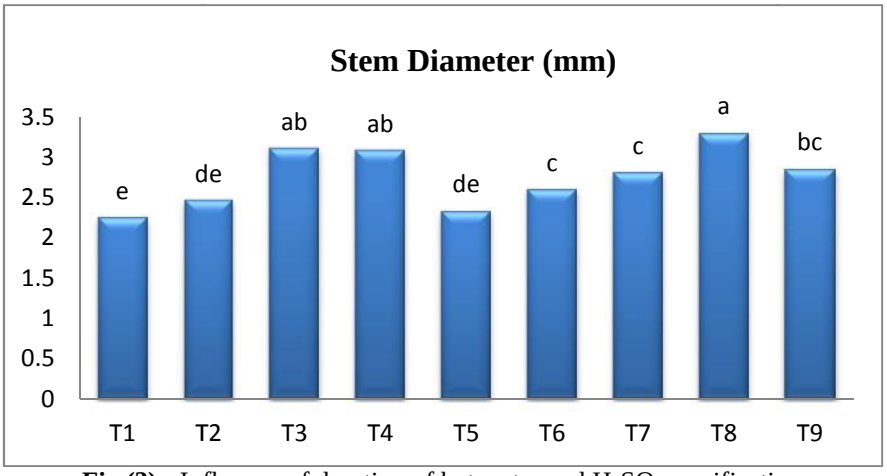


Fig.(3) :-Influence of duration of hot water and H_2SO_4 scarification on the stem diameter (mm) of *Gleditsia triacanthos.*

Oboho and Ogana (2012) recommended that the hot water treatments positively improve the germination and early growth of *Dialium guineense* seed. Olatunji, *et al.* (2013) Also showed that the increasing percentage of germination and growth performances of *Acacia auriculiformis* with sulphuric acid (5 and10 min).

- **Root length (cm):**

Data analysis on root length of seedling of *Gleditsia triacanthos* as affected by pretreatments of hot water and sulphuric acid during traits are presented in (Table 2). The tallest roots were obtained due to immersing seeds in sulfuric acid (98%) for 90 min and similar significant with hot water were (30.5, 31.25cm) respectively. While the shortest routes were recorded with untreated seeds (control) were (13.62cm) as shown in figure (4). According to Tian, *et al.* (2014) seed germination is the most crucial stage that affects earlier seedling growth and establishment. According to Mwase and Mvula (2011) soaking in boiling water makes the seed coats permeable to water the seeds imbibe and swell as the water cools. Most studies reported that immersion in hot water was the best method for breaking the dormancy of hard coat seeds (Azad, *et al.* 2010; Azad, *et al.* 2006 and Ali, *et al.* 1997). However, Alamgir and Hossain (2005) found the highest germination and seedling growth, success in nail clipping followed by hot water treatment. The differences may be due to the difference in temperature and the boiling time and also may be due to the variation of seed coat thickness (Azad, *et al.* 2011). He also added that manual scarification followed by sulphuric acid treatments resulted in tallest aerial parts, longest roots.

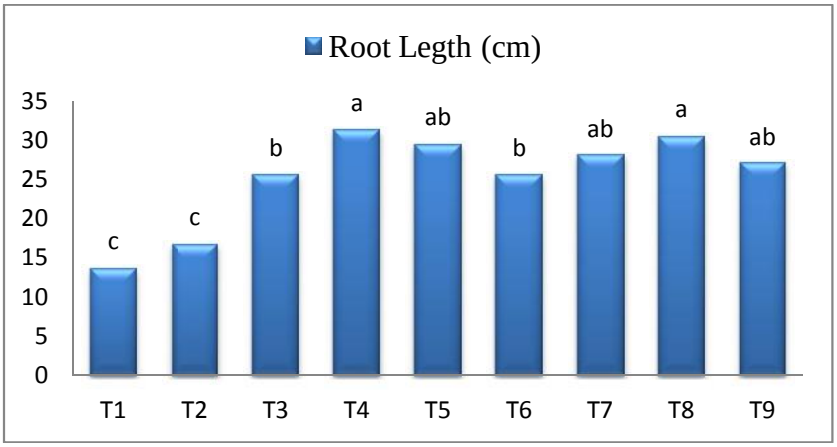


Fig.(4):-Influence of duration of hot water and H_2SO_4 scarification on the Root length (cm) of *Gleditsia triacanthos.*

Table (2):- Analysis of variance showing the effect of the duration of hot water and sulphuric acid (98%) on germination and seedling growth of *Gleditsia triacanthos.*

S.O.V.	D.f.	SS	MS	F Value	PR> F
Germination %	8	4216	527	272.38	<.0001
Germination Rate	8	17.92	2.24	6.24	<.0001
Seedling length (cm)	8	1307.34	163.41	88.47	<.0001
Stem diameter (mm)	8	4.33	0.54	18.19	<.0001
Root length (cm)	8	1199	149.87	17.62	<.0001

CONCLUSION:

According to obtained results, sulfuric acid treatment with 90 min. and hot water for 20min. treatments had the highest values germination percentage and germination rate difference with control. To growth characteristics of *Gleditsia triacanthos*, the hot water at 30min. and sulfuric acid has no significant differences, but it had differing effectively than other treatment. Seeds must absorb water, we are suggesting hot water and sulphuric acid treatment could open a way to entrance of gasses and uptake water with decreasing seed resistance.

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كارتيكرنا پێش مامەلەكردن لسەر رواندنا توقێ بەزوویی گەش ێن نەمامكەێن *Gleditsia triacanthos L.*

پوختە

ڤەكولین یاهتیەكرن ل نەمامگەها پشكا دارستان ل فەكولتیا چاندن / زانكویا دهوك، ب مەرەما كارتێكرنا ئاڤا گەرم وترشا كبریتی لە دەمێن جوراوجور لسەر رواندنا توڤی گلادیشیا و بەزوویی گەش. ئەنجامیین هاتینە پێشان دان كو توڤیین گلادیشیا ئەویین هاتینە نوقم بوون دناڤ ئاڤا گەرم دپەلیا **90** پلە لە دەمی**20** خولكا، و نوقم بوونا توڤی د ترشا كبریتی**(98%)** لە دەمی **90** خولكا، باشترین ریكە كو قوناغا بێ دەنگی توڤی گلادیشیا، هاوتا بو زیدەبوونا ریژەیا رواندنا و هێزیا توڤەی **52.66%، 49.33%، 2.589، 1.220** لدویف ئیك جیاوازە دگەل توڤیین نەهاتنە موعامەلەكردن **2.5%، 0.104** ولدویف ئیك.

دریژاهی وپاناتیا قەدی وهەروە سا در ژاهیا رەگی ئەو نەماما هەمان كارتێكرن هەیە ژ موعامەلەكردنا توڤی ژ ئاڤا گەرم وترشا كبریتی لەدەمی **30** و **90** خولكا لدویف ئیك هەیە.

تاثير المعاملات الاولية على انبات البذور والنمو المبكر لشتلات **Gleditsia triacanthos L.**

الخلاصة

اجريت هذه التجربة في مشتل قسم الغابات في فاكولتي الزراعة/ جامعة دهوك، بهدف تأثير الماء الحار وحامض الكبريتيك في أوقات مختلفة على انبات بذور الكلاديشيا ونمو البادرات خلال موسم النمو. أظهرت النتائج ان بذور الكلاديشيا المغمورة بالماء الساخن بدرجة حرارة **(90)** درجة لمدة **(20)** دقيقة وايضا غمرالبذور بحامض الكبرتيك **(98%)** لمدة **(90)** دقيقة كانت افضل طريقة لكسر طور السكون لبذور الكلاديشيا مما ادى الى زيادة نسبة الانبات وسرعة الانبات **52.66%،49.33%، 2.589، 1.220** على التوالي مقارنة مع بذور بدون معاملة **2.5%، 0.104** على التوالي.

طول وقطر الساق وكذلك طول الجذر لها نفس الاتجاه في التاثير من معاملة البذور في الماء الساخن وحامض الكبريتيك لمدة **(30و90)** دقيقة على التوالي.

RESPONSE OF GRAPEVINE (VITIS VINIFERA L.) CV. TAIFI TO FOLIAR APPLICATION WITH MAMMOTH AND LICORICE EXTRACT

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ABSTRACT

This study was carried out during growing seasons of 2012 on 14 years old Taifi grapevine in a private vineyard located at Atrush, Nineveh governorate, Kurdistan region, Iraq, in order to study the effect foliar application of three concentration of Mammoth (0, 1 and 2 ml.l^{-1}), three concentrations licorice root extract (0, 3 and 6 g.l^{-1}) and their interaction. Results indicated that foliar application of 2ml.l^{-1} Mammoth and 6 g.l^{-1} licorice root extract significantly increased leaf area, leaf dry weight, leaf chlorophyll content, as soon as number of clusters per vine, cluster weight, yield per vine, Total soluble solid %. And total sugar %. Whereas the same concentrations significantly reduced total acidity % in the berry's juice.

KEY WORDS: Mammoth, licorice, root extract, grape, Taifi.

1. INTRODUCTION

Grape (*Vitis vinifera* L.) belongs to Vitaceae family, grown in many parts of the world, in a wide range of climates and conditions. Grape is considered one of semi-tropical, hot and cold temperate plants; it is widely cultivated between latitudes 20-50 north of equator and 20-40 south of equator (Hidalgo, 1980 and Al-saidi, 2014).

Grape is one of the most appetizing, refreshing and healthful subtropical fruits. The berries are a good source of minerals and vitamins like B1, B2 and C. The berries are consumed in fresh forms as a table grape and in the processed form as raisin and fresh juice (Al-saidi, 2014).

Mammoth seen as sugar express is unique innovative micronutrient formulation technology from napnutriscience. This high performance liquid formulation provides rapid foliar absorption of micronutrients and enhances waxy-shine leaves. It has been suggested to causing an increase in the leaves number per vine at the time of flowering. These outcome suggest that sugar express might affect floral transition by activating or inhibiting genes that act to organize floral transition, depending on the concentration of sugars, the genetic background of the plants, and when the sugar is introduced (Koch, 1996). It may probably affect various aspects of development in plants (Jang *et al*., 1977; Dijkwel *et al*., 1997).

Licorice plant (Licorice) (*Glycyrrhiza glabra*) belongs to the legume family Leguminosae and genes Glycyrrhiza (Foster, 2000). It is a herbaceous plant as exists in Iraq in the wilderness on the banks of rivers and increased its spread in Asia and Europe, it is growing in Spain, Italy, Turkey, Iran, China, Syria, and Spain is one of the largest producing countries agriculturally (Ippolito and Casulli, 1995).

The perfume of licorice root comes from a complex and variable combination of many compounds. Much of the sweetness in Licorice comes from glycyrrhizin, which has a sweet taste, 30–50 times the sweetness of sugar. The sweetness is very different from sugar, being less instant and permanent longer (Tamir, *et al*., 2001; Somjen, *et al*., 2004). Shayal-Alalam (2009) showed that Foliar spraying of peach trees with Licorice root extract at a concentration of 2 g.L^{-1} significantly increased leaves carbohydrates concentration, number branch per tree and trees main stem diameter, while the foliar spray with this extract at a concentration of 4 g.L^{-1} significantly increased branches carbohydrates concentration. Whereas leaves K concentration, leaves total chlorophyll, leaf area and trees height was not affected significantly with the foliar spray Licorice root extract. Qaraghouli (2005) found that foliar spray of apple trees cv. Anna and Sharabi with licorice extract by 2.5 and 5 g.L^{-1} has significantly improved the vegetative growth of both cultivars. Mohammed (2008) studied the

effect of spraying plants of strawberry cultivars (Hubble and Caesar) with licorice extract at concentration of 2 and 4 $g.L^{-1}$. Results indicated that spraying licorice extract caused a significant increase in single leaf area and content of chlorophyll and both cultivars. AL-Dulaimy1 and Jumaa (2012) investigated the effect of foliar spray with Yeast suspension, Licorice roots extract and Amino Quelant-K compound on some growth and yield traits of cv. Black Hamburg

Grape, Study factors were spraying three concentrations (0, 5 and 10 $g.l^{-1}$), (0, 2 and 4 g/l) and (0, 2 and 4 $ml.l^{-1}$) of Yeast suspension, Licorice roots extract and Amino Quelant-K, respectively. Results indicated that foliar spraying with these materials was resulted in significant increment in number of cluster per vine, yield in both seasons, Licorice roots extract gave the highest yield and reducing sugars in berry also, there were significant

increments in cluster weight, berries size and anthocyanine pigment content accompanied with significant reduction in total acidity content. Treatments application was significantly affected plant leaf area, leaf content and chlorophyll. Therefore, the aim of this study is to investigate for first time the effect of mammoth on the growth and yield of grapes in addition to study the effect of licorice and the interaction between them.

MATERIAL AND METHODS

This experiment was carried out during growing seasons 2012 on 14 years old Taifi grapevine planted 2.5 × 2.5 m. under drip irrigation system in a private vineyard located at atrush, Nineveh governorate, Kurdistan region, Iraq. The vines under taken in this study were trained with T-trellis system, winter pruning was done at the mid March by living 7 fruiting canes each with 8 buds and four renewal spars × 2 buds (total load was 64 buds).

A randomized completely block design (RCBD) was used in this investigation. Each treatment was replicated three times with one vine per each replicate. The factors included the foliar application of three concentration of mammoth (0, 1 and 2 $ml.l^{-1}$), three concentrations licorice root extract (0, 3 and 6 $g.l^{-1}$) and their interaction. Spraying was starting from two weeks before blooming. All vines under taken in this experiment received the identical horticultural practices that usually carried out in the vineyard. Data were analyzed by using SAS program (SAS, 2003).

Experimental measurements were as follows:

1-Vegetative growth characteristics:-

a) Leaf area (cm^2).

b) Leaf dry weight (g).

c) Leaf chlorophyll content (%.)

2 – Yield characteristics:

a) Cluster weight (g).

b) Number of clusters per vine.

c) Yield per vine (kg).

3- Chemical characteristics:

Total soluble solid %, Total sugars (%),and Total acidity (%).

RESULTS AND DISCUSSION:

1-Vegetative growth characteristics:

It is clear from table (1) that foliar application of Mammoth and licorice root extract had positive effect on all vegetative growth parameters undertaken in this study especially at high concentration, spraying grapevine with Mammoth at (2 $m.l^{-1}$) and licorice root extract at (6 $g.l^{-1}$) give the highest value of single leaf area, leaf dry weight and total chlorophyll content.

Table (1):- Effect of mammoth and licorice extract on some vegetative growth characteristics of grapevine (*Vitis vinifera* L.) cv. Taifi.

Characters	Leaf area (cm^2)				Leaf dry weight (g)				Chlorophyll content (SPAD)			
Mammoth	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**
($ml.l^{-1}$)	0	3	6		0	3	6		0	3	6	
0	117.6	128.77	141.59	129.32	0.484	0.59	0.68	0.587	33.25	41.98	47.49	40.91
	c	bc	ab	b	d	cd	abc	b	d	c	b	c
1	142.1	130.88	148.78	140.92	0.524	0.69	0.76	0.661	46.83	46.83	50.67	48.11
	ab	bc	ab	a	d	abc	a	a	b	b	b	b
2	140.2	145.08	161.36	148.9	0.614	0.73	0.80	0.718	46.68	49.87	56.36	50.97
	ab	ab	a	b	cbd	ab	a	a	b	b	a	a
Mean effect	133.3	138.24	150.58		0.541	0.67	0.75		42.25	46.22	51.51	
licorice	b	b	a		c	b	a		c	b	a	

Mean within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

For the interaction between Mammoth and licorice extract, same table shows that the best values were obtained from the interaction between ($2ml.l^{-1}$) Mammoth and ($6\ g.l^{-1}$) licorice root extract.

2- Yield and Its component:

Table (2) shows that spraying Mammoth and licorice extract with a concentration of $2\ ml.L^{-1}$and $6\ g.l^{-1}$ respectively caused a significant increase in number of clusters per vine, on the other hand, spraying Mammoth and licorice extract with both concentrations significantly increased cluster weight and yield per vine compared with control treatment. The highest values of clusters number, cluster weight and yield per vine were resulted from spraying with a concentration of $2\ m.L^{-1}$ Mammoth and $6\ g.l^{-1}$ licorice extract.

For the interaction between Mammoth and licorice extract, there is a real effect shown in table (1) from the interaction between $2\ ml.L^{-1}$ Mammoth and $6\ g.L^{-1}$ licorice extract was significant in its effect, the plants of this interaction characterized by the highest values of (32.06, 842.25 g and 27.06 kg) number of cluster, cluster weight and yield per vine respectively.

Table (2):- Effect of mammoth and licorice extract on yield and its comments of grape (*Vitis vinifera* L.) cv. Taifi.

characters	Clusters number ($luster.vine^{-1}$)				Cluster weight (g)				Yield ($Kg.vine^{-1}$)			
Mammoth	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**	**licorice extract ($ml.L^{-1}$)**			**Mean Effect of M.**
	0	3	6		0	3	6		0	3	6	
0	20.89	23.19	26.34	23.48	455.3	572.0	675.9	567.7	9.50	13.28	17.53	13.44
	b	ab	ab	b	e	d	bc	c	e	de	bcd	b
1	24.51	27.78	31.04	27.77	534.9	686.7	759.6	660.4	13.09	18.90	23.68	18.56
	ab	ab	a	ab	de	bc	ab	b	de	bcd	ab	a
2	26.48	31.57	32.06	30.04	632.1	708.7	842.2	727.7	16.70	22.38	27.06	22.05
	ab	a	a	a	cd	bc	a	a	cd	abc	a	a
Mean effect of	23.96	27.51	29.81		540.8	655.8	759.2		13.10	18.19	22.76	
Llicorice	b	ab	a		c	b	a		c	b	a	

Mean within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

3-Chemical characteristics:

Data in table (3) shows that Mammoth and licorice extract had positive effect on all quality traits as compared with control, spraying of 2ml.$^{-1}$ Mammoth and 6 g.l^{-1} licorice extract gave the best value of TSS, total sugar percentage and total acidity percentage. Also the interaction between Mammoth and licorice extract was significant in its effect, since grapevine received 2 ml.L^{-1} of Mammoth and 6 g.L^{-1} of licorice extract were characterized by the highest value in TSS (20.56 %), Total sugar (24.18 %) and lowest value in total acidity (0.352 %).

Table (3):- Effect of mammoth and licorice extract on some chemical characteristics of grape (*Vitis vinifera* L.) cv. Taifi.

characters	TSS (%)				Total sugars (%)				Total acidity (%)			
Mammoth	**licorice extract (ml.L^{-1})**			**Mean Effect of M.**	**licorice extract (ml.L^{-1})**			**Mean Effect of M.**	**licorice extract (ml.L^{-1})**			**Mean Effect of M.**
	0	**3**	**6**		**0**	**3**	**6**		**0**	**3**	**6**	
0	13.22	15.85	18.23	15.77	13.52	17.27	19.26	16.69	0.96	0.47	0.46	0.63
	f	e	bcd	c	g	f	cde	c	a	b	b	a
1	16.37	18.63	19.56	18.19	17.99	19.09	20.07	19.05	0.44	0.43	0.42	0.43
	de	bc	abc	b	ef	de	cd	b	b	b	b	b
2	17.75	19.77	20.56	19.36	20.78	22.58	24.18	22.51	0.38	0.38	0.35	0.37
	cd	ab	a	a	c	b	a	a	b	b	b	b
Mean effect of	15.78	18.08	19.45		17.43	19.65	21.17		0.60	0.42	0.41	
Llicorice	c	b	a		c	b	a		b	b	a	

Mean within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

DISCUSSION:

The positive effect of the mammoth may be attributed to that Sugar plays a role as a signaling molecule that regulates a variety of genes (Koch, 1996).

In addition to these developmental aspects that are affected by sugar, flowering also seems to be influenced by sugar. There has been a good amount of evidence suggesting that Sugar promotes flowering in most species that have been examined (Bernier, *et al*., 1993).Concerning the enhancement in the characteristics of the vegetative growth, yield and quality of the grapevine due to licorice extract application may attributed to that roots of this plant contain Glyceyrrhizic acid, sugars, pigments and numerous mineral elements as well as mevalonic acid started it in the synthesis of GA3 in the plant, and that it improves the vegetative growth of many plant species as well as their production (Qaraghouli, 2005).

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؛ەلام دانەی مێوێن تری (Vitis vinifera L.) جورێ تایفی بو رەشاندنا بەلکی ب ماموپ و پوختەی رەهێن سوسێ

پوختە

ئەف فەکولینە هاتە ئەنجامدان ل وەرزێ ،شە یێ 2012 ەر مێوێین تری ل رەزەکێ تایبەت ل دەڤەرا ئەتریش/ ارێزکەها نەیناوە/ ،ریما کردستانێ/ ،یراق، ب مەرەما دیارکرنا کاریگری رەشاندنا بەلکێن مێوێین ی ب سیێ یریاتێت0) Mammoth ، 1و2 مل.لتر-1) سیێ یریاتێت0)licorice root extract ، 3و 6غم.لتر-1) تێکهەلاوان. ئەنجاما دیارکر کو رەشاندنا Mammoth بتیریاتیا 2مل.لتر-1 و Licorice root extractبتیریاتیا 6 غم.لتر-1 نەکەرا زێدەبونا رووبەرێ بەلکێت مێوی و قورسێ شك یێن بەلکا وکەسکاتیا بەلکی دکل زیدەبونا ژمارا ئیشیا لهەرمێوەکێ ،ورسیا هەر ئیشیەکی و بەرهەمێ ،یوێ رێژی دی یا سەرجەما تواوە رەق و رێژی سەدی یا سەرجەما شەکرێ بەلێ هەر ئەو تیراتی بوونە ئکەرێ کیمونا ی سەدی یا سەرجەما ترشاتیێ ، ناف شەربەتا تلێن تری.

استجابة كرمة العنب (Vitis vinifera L.) للرش الورقي بالماموث ومستخلص عرق السوس

الخلاصة

اجريت هذه الدراسة خلال موسم النمو 2012 على كرمات العنب صنف طائفي مزروعة في مزرعة اهلية تقع في اتروش/محافظة نينوى/اقليم كردستان/عراق بهدف دراسة الرش الورقي لثلاث تراكيز من الماموث (صفر، 1 و2 مل.لتر$^{-1}$) وثلاث تراكيز من مستخلص عرق السوس (صفر، 3 و 6 غم.لتر$^{-1}$) وتداخلاتهما. بينت النتائج بان الرش الورقي ل 2 مل.لتر$^{-1}$ من الماموث و 6 غم.لتر$^{-1}$ من مستخلص عرق السوس سببت زيادة معنوية في مساحة الورقة والوزن الجاف للورقة ومحتوى الورقة من الكلوروفيل كذلك عدد العناقيد في الكرمة ووزن العنقود وحاصل الكرمة والنسبة المئوية للمواد الصلبة الذائبة الكلية والنسبة المئوية للسكريات الكلية في حين نفس التراكيز ادت الى خفض معنوي في النسبة المئوية للحموضة الكلية في عصير الحبات.

EFFECT OF HUMIC ACID AND ALGEREEN ON GROWTH OF LETTUCE (*Lactuca sativa* L) BY USING N.F.T. CULTURE.

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ABSTRACT

The experiment was carried out in March 2012 in theFaculty of Agriculture, University of Duhok inside greenhouse to test the effect of humic acid on growth of lettuce (*Lactuca sativa varcapitata)*. Seeds were planted in podsfrom March to April.The experiment consisted of three concentration of humic acid , the solution was algereen (sea weeds) about (1ml.l^{-1}) .,Complete Randomized Design (C.R.D.) was used in this studyconsisted one factor that is three concentrations of humic acid (0 and 0.8 and 1.6 gm.l^{-1}) .Theresults appeared that humic acid showed significant increases in all of vegetative growth characteristics (length of stem, length of head, head diameter, number of leaves, chlorophyll content (SPAD.) ,fresh weight of vegetative growth ,dry weight of vegetative growth, fresh weight of roots and dry weight of roots), as compared with untreated plant (control) which gave lower values. Also significant increaseswere found in the nutrient elementsmacro and micro (N.P.K %) and Fe and Mg ppm when the plants were sprayed with 1.6 gm.l^{-1} humic acid as compared with control.

KEY WORDS: Humic acid, N.F.TCulture,Algereen, Lettuce.

1. INTRODUCTION

Lettuce, *(Lactuca sativa* L.) is the most important hydroponically grown vegetable crop using the nutrient film technique (N.F.T) system (Resh, 2006).Lettuce is rich in vitamin A, C and minerals like Calcium and Iron. It's also contains protein and carbohydrates (Tindall, 1993)., andit is one of the most commonly grown hydroponic vegetables andit isplated as a leaf vegetable also planting leafy vegetables in a floating system is the easiest and cheapest means of production, since this system shows high water and fertilizer efficiency and low environmental impact **(**Gonnella*et al*., 2003**).** Soilless culture allows direct control of the nutrient solution, making it possible to modify composition and concentration to achieve predictable results in relation to dry matter content, nitrate content or other organoleptic and structural (calcium) features of produce (Elia*et al*., 1999).

Hydroponic lettuce is commonly produced using either the nutrient film technique (N.F.T.) or the floating raft method, they both are closed systems. Lettuce (*Lactuca sativa*) has been grown in N.F.T for many years. Over recent years, systems have become more intensive. Some of these systems attempt to make better use of greenhouse space by using various vertically spaced gully systems or horizontal systems with movable gullies to permit spacing to be adjusted as the lettuce grow (Lynette, 1999). Humic acid and Algereen are two novel materials that have shown promise for protecting turf grasses against oxidation stress., much early work by Schmidt and collaborators focused on refining appropriates dilution rates of seaweeds extract and Humic substances originated from the chemical and biological degradation of plant, animal residues and from metabolic activities of microorganisms they might be expected to show hormonal characters. (Young and Chen, 1999),humic acid grown in nutrient solution enhanced transplants growth and increasing its mineral structure(David*et al*,1994).Humic acid and (algereen) promoted plant growth and induce soil microorganisms like bacteria and fungi and provide carbon as a source for the organisms

humic acid as well acting as chelating good martial, **(**Leonard, 2008).

Humic acid has efficiency in the growth of plants the availability of the elements, the using of humic acid even though with little concentration lead to increase permeability of the cellular membrane. It is one of the important features which is done by the acid ie, making auto – activation to the enzymes of plants. This can be interpreted with the presence of guanine in the humicacid .Humic substances classified into three categories like humic acid, fulvic acid and humin (Solange and Rezende 2008). Humic compounds are the most abundant of the complex ligands, which are found in nature. In this regard, it is well known that the humic compounds improve soil structure, increase soil microbial population, increase soil cation exchange capacity and providing some specific materials for plant root indirectly by providing macro and micro minerals, leading to the increase of soil fertility. Humus is final residue obtained from microbial decomposition of organic matter (Rizal*et al*.2O10). Fike*et al* (2001) reported that sea weeds derived from A. Nodesum contains various compounds including amino acids and micronutrients. Siomos*et al*., (2001) found plants from a soilless culture had higher total nitrogen, phosphorus and potassium content compared with plants harvested from soil culture. No significant differences in calcium content were observed between plant harvest from the soilless and the soil culture.

Thomas (2002) concluded in his experminet that (Algereen) causes increasing growth and fresh weight of vegetative and growth of roots significantly.Zhang and Ervin (2004) found that the influence of Cytokinin of seaweed extracts and humic acid tended to improve the resistance of herbaceous plant to drought condition and to increase Cytokinin content and its physiological role in plant.Ventura and Castanon (1998) pointed out that sea weeds represents medium quality forage for goats, with high protein content. Hansen et al (2003) concluded that seaweeds *Laminariadigitata*and *Laminariahyperborea*have the potential to be used as an alternative feed source for small ruminants under some conditions. Moracastro*et al*. (2009) suggested that marine algae *Macrocystispyrifera*represents a good unconventional feeding as a nutritional supplement for goats. Rjibaktita*et al*.(2010) concluded that seaweeds *Ruppiamaritima*and *Chaetomorphalinum*could be used as alternative feed resources for growing lambs during drought periods.

Seaweed extracts are bioactive at low concentrations (diluted as 1:1000 or more) and also Liquid extracts obtained from seaweeds have recently gained importance as foliar sprays for many crops including various grasses, cereals, flowers and vegetable species. (Crouch and van Staden1993).Although many of the various chemical components of seaweed extracts and their modes of action remain unknown, it is plausible that these components exhibit synergistic activity (Vernieri*et al*2005)..Studies of bacterial inoculant use in hydroponic systems have shown increased plant disease resistance with product use (Rankin and Paulitz, 1994). These researchers reported improvements to plant growth as a result of both bio-stimulation and increases in nutrient processing. With a relatively brief establishment period, bacterial populations have the potential to establish and impact growth in both short and extended crop production cycles. Cirou*et al.* (2011) established protocols for bio-stimulation of beneficial bacteria in hydroponic potato roots, 9 citing methods to boost beneficial bacterial populations in a hydroponic rhizosphere. While many studies have been completed observing bacterial interactions with plant roots, few studies have evaluated the performance of commercially available microbial inoculant products in hydroponic lettuce production.

Gravel *et al.*(2009**)** reported that rhizobacteria may interact with mycorrhizal fungi to increase root colonization and nutrient content of plant tissue. This research suggests potentially beneficial interactions when using a compliment of bacterial and mycorrhizal inoculant products. Schmilewskiand Carlile (2010) concluded that substantial microbial populations are not present in sphagnum peat due to the high lignin content and acidic tendencies inherent to the material. With the addition of fertilizer amendments such as dolomitic limestone and plant root-substrate interactions, sphagnum peat has the potential to sustain diverse microbial populations.

Al-Bayati (2010) showed that using Algereen with 3ml.L^{-1} had significant increase in plant length, leave area, dry matter percentage of foliage of potato crop .Increase nitrate concentrations, resulting in an organic fertilizing source that could be used in a hydroponics system. With a time frame of 50 days, researchers showed that

predominately ammonium-based organic fertilizers could undergo microbial conversion, resulting in plant available nitrate from organic hydroponic solutions (Shinohara *et al*., 2011).These researchers reported improvements to plant growth as a result of both bio-stimulation and increases in nutrient processing. With a relatively brief establishment period, bacterial populations have the potential to establish and impact growth in both short and extended crop production cycles.

2. MATERIALS AND METHODS

The experiment was done in March 2012 in the Faculty of Agriculture, University of Duhokinside Greenhouse to test the effect of humic acid on growth of Lettuce (***Lactuca sativa varcapitata)***. Seeds were planted in podsfrom March to April., twenty two days after planting the seedlings were transplanted into into the N.F.T. system the plants were grown in shallow troughs and somewhat supported by the trough covers. In the deep flow hydroponics system (approximately 20 cm deep), The advantages of the deep flow hydroponics system included the buffer capacity of the nutrient solution (for water, nutrients, and temperature) and the ease with which plant material could be transported., experiment consist of three concentration of humic acid The solution was algereen (sea weeds) about (1ml.l^{-1}) that potted in a basin contain approximately 40 L of water. The solution was circulated to all lettuce plant. And the solution was changed every two weeks. Complete Randomized Design (C.R.D.) was used in this studythat experiment included one factor, three concentration of humic acid (0 and 0.8 and 1.6 g.L^{-1}) after one month of plantinghumic acid werespraying by three times within ten intervals day the obtained data was statistically analyzed by using SAS program, and the significant difference between means was evaluated according to Duncan multiple range test at 5 % level(SAS, 2007) program.

Hydroponic Lettuce culture byusingNutrient Film Technique*(N.F.T) System*.

EXPERIMENTAL MEASUREMENTS

1 –Vegetative Growth Traiels

It concluded the following vegetative growth characters (length of stem, length of head ,head diameter, number of leaves, chlorophyll content (SPAD.),freshweight of vegetative growth , dry weight of vegetative growth,fresh weight of roots and dry weight of roots)

2- Mineral Nutrient Contents Of The Leaves

a.) Macronutrient Content In Vegetative Charecters

It concluded the following elements (N.P.K %).

b.) Micronutrient content (Mg and Fe (ppm)).

3. RESULTS

3. 1. Vegetative Growth Charecters:

Table (1) shows the effect of humic acid on vegetative growth characters (length of stem , length of head , head diameter, number of leaves, chlorophyll content (SPAD.)fresh weight of vegetative growth , dry weight of vegetative growth, fresh weight of roots , and dry weight of roots).It showed that there are significant effects on vegetative growth characters when plants treated with 0.8 and 1.6gm.l^{-1} humic acid compared with untreated plant with humic acid (control.

Table (1): Effect of humic acid on vegetative growth characters on Lettuce by using N.F.T.Culture.

Humic acid gm.l^{-1}	Length of stem (cm)	Length of head(cm)	Head diameter(cm)	Number of leaves	Chlorophyll SPAD
control	4.2b	22.66b	10.33b	25.66b	34.93b
0.8	5.4a	26.66a	14.22a	31.33a	38.21a
1.6	5.66a	33.4a	14.33a	33.66a	38.93a

Humic acid gm.l^{-1}	Wt. weight of leaves(gm)	Dry weight of leaves	Wt. weight of roots	Dry weight of roots
control	137.11b	34.31b	55.14b	16.06b
0.8	183.09a	38.62a	68.85a	17.89a
1.6	185.11a	39.57a	69.41a	18.18a

*Means with a column, row followed with same letters are not significantly different from each other according to Duncan's multiple range test at 5% levels

3.2. Mineral Nutrient Contents Of The Leaves

3.2.1 Nitrogen (%)

Figure (1) shows the effect of spraying, humic acid on nitrogen (%) of leaves. It appears that spraying humic acid gave significant effects on nitrogen (%) as compared to untreated plant, applying humic acid with 0.8g.L^{-1}significantly reduced nitrogen percentage in leaves compared to the 1.6g.L^{-1} humic acid but significantly increased compared to control, (2.73, 2.93, 2.4%) respectively.

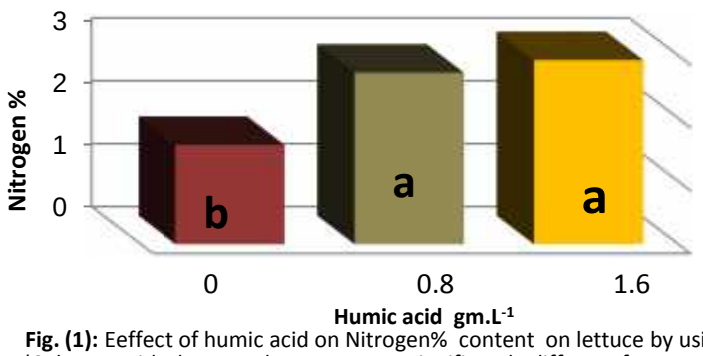

Fig. (1): Eeffect of humic acid on Nitrogen% content on lettuce by using N.F.T. culture. (Columns with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% levels).

3.2.2. Phosphorus (%.)

Figure (2). Showsthe effect of humic acid on phosphorus (%)when plant treated with 1.8 humic acid it gave high value of phosphorus (%) compared with the control that gave low value of it.

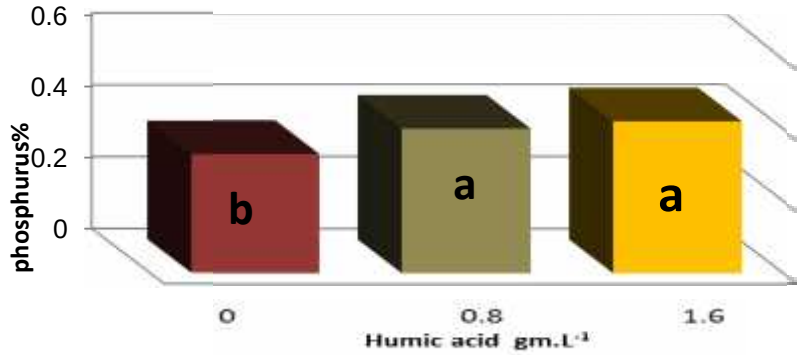

Fig. (2): Effect of humic acid on Phosphurus % on lettuce by using N.F.T. culture .
(Columns with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% levels).

3.2.3 Potassium (%)

Figure (3) shows that spraying, humic acid on potassium (%). It showed that potassium (%) in the leaves was significantly influenced by the concentration levels, the leaves of the treated plant had significantly more potassium (%) than the leaves of untreated plants.

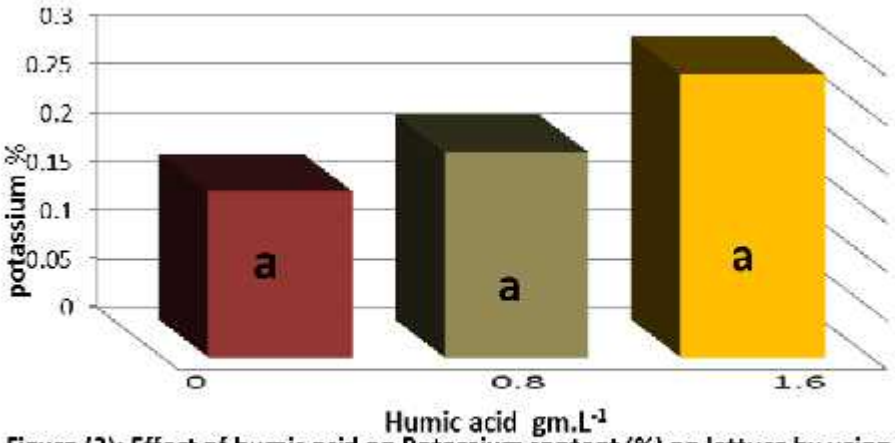

Figure (2): Effect of humic acid on Potassium content (%) on lettuce by using N.F.T. culture..
(Columns with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% levels).

3.2.4. MAGNESIUM CONTENT (ppm)

Figure (4) shows that spraying; humic acid on lettuce plant, showed that magnesium content in leaves was significantly influenced by the concentration levels of humic acid the highest levels of it give high value of magnesium compared to the low concentration of humic acid and was significantly differed with control (untreated plant with humic acid) that gave lower content of Mg (6.04ppm).

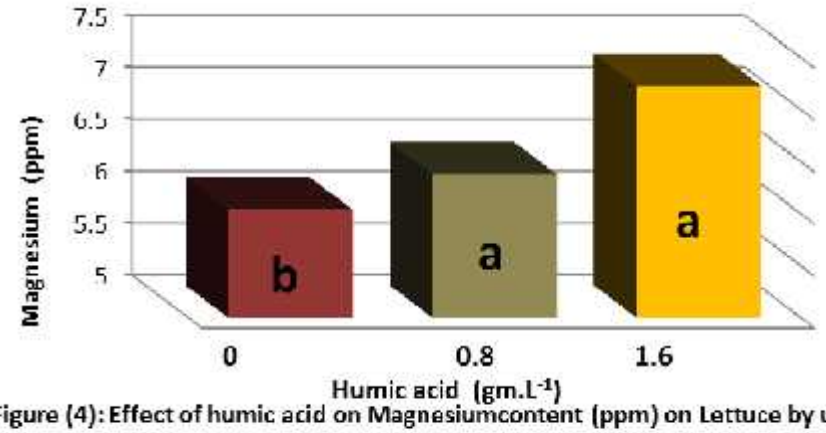

Figure (4): Effect of humic acid on Magnesiumcontent (ppm) on Lettuce by using N.F.T. culture. .
(Columns with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% levels).

3.2.5. Iron Content (ppm)

Figure (5) shows that there are significant differences among treated plant compared with untreated once., spraying; humic acid on plant with (0.8gm.l$^{-1)}$, showed that iron content in leaves was significantly increased compared with control that gave the lowest value of iron content (ppm)and the higher iron content was when plant sprayed with (1.6gm.l^{-1}) humic acid that record (860ppm) compared with control(304ppm)

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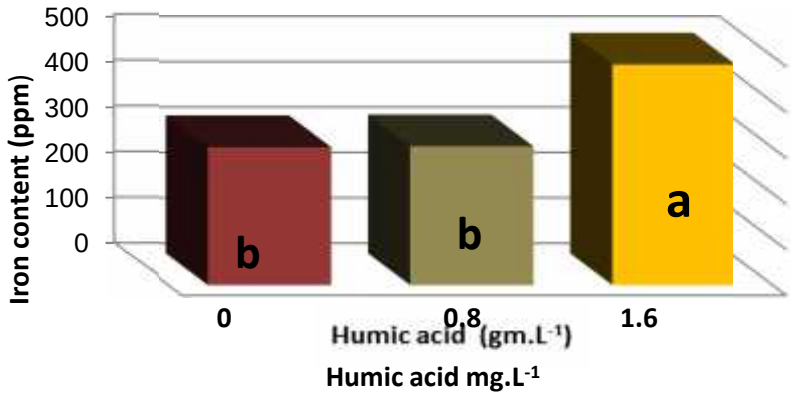

Figure (5): Effect of humic acid on Iron content (ppm) onLettuce by using N.F.T. culture..
(Columns with the same letters are not significantly different from each other according to Duncan's multipe range test at 5% levels).

4. DISSCUTION

4.1. Effect Of Humic Acid On Vegetative Growthcharecters

Results in table (1) showsthat a significant increase occurred in vegetative growth characters (length of stem (cm), length of head (cm), head diameter (cm), number of leaves, chlorophyll content (SPAD.) fresh weight of vegetative growth (gm), dry weight of vegetative growth (gm), fresh weight of roots (gm) and dry weight of roots (gm)).Increasing vegetative components by concentration of humic acid may be attributed to the role of humic acid increasing the availability of nutrient elements (N, P, K and Fe) that make the plant absorb it more and develop the vegetative growth characters (AL-Mokhtar *et al*., 1991), or they may be due to the role of humic acid that provides nutrient elements that share in bio efficiency and then increasing the growth (Abdel-Mawgoud*et al*., 2007), David *et al*. (1994) reported that humic substances promoted growth and more mineral nutrient uptake of plant due to the better-developed root systems. The effect of

humic acid on lettuce growth may be due to the presence of plant growth regulators, which are produced by enhancing the activity of microbes such as fungi, yeasts, and algae (Arancon*et al*., 2004). The microbes are able to produce auxins, cytokinins and gibberellins and then lead toenhance plant growth appreciably (Tomati*et al*., 1990). The enhancement of the plant growth using humic acidmay be due to increasing nutrients uptake such as N, P, K, Fe, (A.O.A.C., 2000 andBijay (1999). Enhancing photosynthesis, chlorophyll density and plant root respiration which resulted in greater plant growth and the beneficial effects of humic acid on plant growth could be referred to its acting as source of plant growth hormones yield (Azooz. 2009). Spraying humic acid and bio stimulators led to positive effects on plant growth, of cucumber production **(**El-Nemr*et al*., 2012).

Seaweed extracts contain various micro elements (Cu, Zn, Mo, B, Co) in addition to macro elements and contain Auxins, Gibberellins' and Cytokinins, when spray on plants lead to increase root growth ability, nutrient elements absorption, and stem thickness growth significantly(Jensen ,2004).The dual effect of Humic acid and algereen on growth and physiology of some herbaceous plants Bentgrass, found positive growth and nutrient content of plant significantly. **(**Zhang *et al* ,2003).Seaweeds and seaweed products enhance plant chlorophyll content (Blunden *et al* 1997). Glycine betaine delays the loss of photosynthetic activity by inhibiting chlorophyll degradation during storage conditions in isolated chloroplasts (Genard*et al*1991).Or the enhancing in growth characters may be due to the Seaweed products that promote root growth and development and the root-growth stimulatory effect was more pronounced when extracts were applied at an early growth stage in maize, and the response was similar to that of auxin, an important root growth- promoting hormone (Jeannin*et al*1991).

4.2. Effect Of Humic Acid On Macro And Micronutrients Elements Content Of Lettuce

Figures above (1,2,3,4,and 5) it showed that Concentrations of N, P, K, and Mg and Fe content (ppm) were gave high content of element in the leaves of Lettuce that treated withhumic acid, it was found that humic acid has an enhancing effect on the absorption of minerals., and this may be as a result to its effect on enhancing metabolism., also humic acid has an enhancing effect on the absorption (Sivakumar and Devarajan, 2005). This might contribute to regulating the nutritional and the adaptability state of stressed plants (Jianguo*et al*., 1998).

Humic acids can, through the ability to form complexes with metal ions and hydrous oxides, affect the availability of nutrients to plant roots and possibly facilitate the movement of metal ions, such as iron, within the plant Moreover, Böhme and ThiLua (1997) reported that K-humate had beneficial effects on nutrient uptake by plants and was particularly important for the transport and availability of micro nutrients. The stimulatory effects of humic substances have been directly correlated with enhancing the uptake of macronutrients, such as nitrogen, phosphorus, sulfur (Chen and Aviad, 1990) and micronutrients (Fe, Cu and Mn). Or maybe as a results of the role of Seaweed (Algareen) that contains major and minor nutrients, amino acids, vitamins, cytokinins, auxin and abscisic acid like growth promoting substances (Mooney and Van Staden, 1986) and have been reported to stimulate the growth and then the uptake of elements from it be fast and improved it.algereen lead to increasing growth as a result of its content of auxin, **(**O"Dell, 2003 **)**. The application of seaweed extract for different crops was a great importance due to contain high levels of organic matter, micro elements, vitamins and fatty acids and also rich in growth regulators such as auxins, cytokinin and gibberellins (Crouch and Van Staden, 2005).

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کارتێکرنا ترسێ هیومێك و ئەلگەرین لسەر شینبوونا روەکێ خەسێ (Lctuca sativavarcapitata)) ب رێکا چاندنا ل(N.F.T.)

پوختە

ئەڤ ڤەکولینە هاتە کرن ل ئاداریێ سالا 2012 د خانێ شێشیدا یابسەر فاکولتیا چاندنێ زانکویا دهوك ژبو ئەزمونکرنا کارتێکرنا ترشێ هیومیك لسەر شینبوونا خەسێ ((Lctuca sativavarcapitataکو توڤ هاتە چاندن د قافکێن بچووك ژ ئاداریێ تاکو نیسانێ ئەڤ ڤەکولینە سێ ریزژێن (0 ,0.8, 1.6)مل.لەتر بخوڤە کرن ژترشا هیومێك و حەلاندنا رەئیسی ئەلگەرین ب ریژا 1 مل د هەر لیترەکێ دە و ب سیستەمێ بەرە لای تەمام هاتە بکارئینان , (C.R.D.) وکارتیکرنا سێ ریژین ز ترشێ هیومیکی (0 ,0.8,و 1.6) مل.لتر . دەرئەنجام هاتن دیارکرن کو زێدەبونەکا بەرچاف د هەر ساخلەتەکێ کەسکاتی یی خەسێ دا دریژیا سەری,روبەری سەری,ژمارا بەلگان و پیکهاتیا کلوروفیلی د بەلگاندە SPAD کیشەی تەر و حشك ین کەسکاتی, کیشەی تەر و حشك ین رئها بەراوەرکرن دگەل روەکێن نە ب کارئینان (کونترول) , هەرواسا زیدەبوونەکا بەرچاف د ئیلیمینتن مەزن مەزن (N,P,K)و ئیلیمنتین بجووك (Fe ,Mg ppm) دەما رووەك هاتن رەشاندن ب ترشێ هیومیکی ب ریژەیا 1.6 غم.لەتر بەراوەرکرن دگەل رووەکینَ کونترولکری.

تاثیر حامض الهیومك واللجرین علی نمو نبات الخس(*Lactuca sativa* L) باستخدامالزراعة في (N.F.T)

الخلاصة

اجریت هذه التجربة في اذار من عام 2012 في البیت الزجاجي التابع لفاکولیتی الزراعة,جامعة دهوك لاختبار تاثیر حامض الهیومك علی نمو نبات الخس (*Lctuca sativa*varcapitata)حیث زرعت البذور في اوعیة صغیرة من اذار الی نیسان تضمنت التجربة ثلاث تراکیز من حامض الهیومك والمحلول الرئیسی کان اللکجرین بتركیز 1مل لکل لتر, واستعمل تصمیم العشوائیة الکاملة (C.R D) , في هذه التجربة .حیثتضمن التجربة استخدام حامض الهیومك بثلاث تراکیز (0, 0.8 , 1.6)مل\لتراظهرت النتائج حدوث زیادة معنویة في کل صفات النمو الخضري (طول الساق سم,طول الراس سم, قطر الراس سم, عدد الاوراق ومحتوی الکلوروفیل فی الاوراق SPAD , وکذلك الوزن الرطب والجاف للمحموع الخضری , والوزن الرطب والجاف للجذور) مقارنة بالنباتا الغیر معاملة (معاملة المقارنة), وکذلك حدثت زیادة معنویة فی محتوی العناصر الکبری(N,P,K%) والعناصر الصغری (Fe, Mg ppm) عندما رشت النباتات ب 1.6غم لکل لتر, مقارنة ب الغیر مغاملة.

EFFECT OF DIFFERENT LEVELS OF CINNAMON ON PERFORMANCE AND SOME SERUM PARAMETERS OF JAPANESE QUAILS

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ABSTRACT

This study was conducted to evaluate the effect of adding different levels of cinnamon powder 1% and 2% on quail performance, carcass traits and serum biochemical attributes. A total of (126) one week old quail chicks randomly divided into three treatments with two replicates. Chick received basal ration (21% crude protein and 2800 kcal/kg ME) as a control group. The ration was supplemented with either 1% (T1) or 2% (T2) cinnamon. At the ends of experiment (18) birds were randomly chosen for carcass and serum biochemical traits. Results revealed that cholesterol was significantly (P ≤ 0.01) increased in serum of birds fed ration containing 2% cinnamon (300.16 mg/dl) compared with control (198.5 mg/dl) and 1% cinnamon (240.83 mg/dl). The treatments have no significant effect on other traits.

KEY WORDS: J. quail, cinnamon, body weight, carcass, serum parameters.

INTRODUCTION

Fed additives supplemented to ration in order to achieve maximum growth. Use of in-feed-antibiotics not only increases the cost of production but also leads to residues in meat and eggs (Yang *et al*., 2009) and develops antibiotic resistance in microbes (Denli *et al*., 2003). Herbs and herbal products are incorporate in livestock feeds instead of chemical products and antibiotics in order to stimulate the effectiveness of feed nutrients which result in more rapid gain, higher production and better feed efficiency (Al-Noori *et al.*, 2011). Moreover herbs and the logically active substances content stimulate body metabolism, improve digestion, and have bactericidal activity, its immunostimulant action improved productivity of poultry (Sabra & Mehta, 1990).

Among herbs, cinnamon proportion including are astringent, warming, stimulating, carminative, antiseptic, antifungal, antiviral, blood purifying, antimicrobial agent (Simic *et al*., 2004), and it is an anti-inflammatory compound (Chao *et al*., 2005) and aiding digestion. All of these properties of cinnamon make it a good medicinal plant. Cinnamon is more often used as a non-essential addition to other remedies than as a remedy by itself. The medicinal effects of cinnamon oil are very powerful, and there are many uses for it. However, principally it is used as an aromatic to cover the unpleasant taste of other drugs. The various terpenoids found in the spice essential oil are thought to be the reason for cinnamon's medicinal properties. Eugenol and cinnamaldehyde are two very important terpenoids found in cinnamon.

Cinnamaldehyde and cinnamon oil vapors act as potent antifungal agents. The diterpenes found in the cinnamon oil have shown antiallergenic activity (Faix *et al*., 2009).

MATERIALS AND METHOD

A total of (126) one week old quail chicks were obtained from the department of animal production/ Faculty of Agriculture/ university of Duhok, and randomly distributed into three treatments, (control, 1% cinnamon and 2% cinnamon) with 2 replicates for each replicate involved 21 chicks. Chicks were fed ad-lib during the experiment period (4weeks). Ration containing (21%) Crude protein and (2800 kcal/kg) Met. Energy.

The first group considered as a control (T1) the second and third treatment birds fed basal diet supplemented 1% cinnamon (T2) and 2% cinnamon (T3).

Chicks were weighted individually by sensitive balance (0.05) gm, at the end of the experiment six birds from each treatment were chosen randomly for serum biochemical were determined by using

commercial kits that produced by BIOLABO SA, made in France. Attributes and carcass characteristics.

Statistical Analysis

Data of experiment design was CRD and analyzed statistically by General Linear Models (GLM), using SAS(2002), According to the following model:

$Yij = \mu + Ti + eij$

Where: Yij = Observations traits measured on the jth traits in the ith treatment.

μ = Overall mean.

Ti = Effect of the treatments (i= 1, 2, 3,..).

eij = Random error effect.

Differences among means were separated using Duncan's Multiple ranges test (Duncan, 1955).

RESULTS AND DISCUSSION

Live Body Weight:

The effect of Cinnamon powder supplementation on body weight of quail is presented in Table, 1. The analysis of variance of the data showed that there were no significant differences in LBW among different levels of cinnamon. Similar results were found by Sadeghi *et al*., (2012), who reported that live body weight was not affected by infusion additives, which contained thyme, turmeric and cinnamon, in male broilers. However, these results disagree with finding of (Zavaragh, 2011), and (Mansoub and Myandoab, 2011), who observed significant effects (P<0.05) of different levels of cinnamon on performance of broilers.

Table (1): Effect of different dietary levels of cinnamon on Live Body Weight (gm) of Japanese quail at different weeks of age (means ± standard error).

Age (Weeks)	Over all Means	Treatments			Significance
		Control group No cinnamon	1% cinnamon	2% cinnamon	
W1	36.42±0.84	36.90± 1.90	36.30±1.30	36.06± 2.26	N.S
W2	81.5± 1.13	82.39±1.61	81.19±3.56	80.93± 1.68	N.S
W3	128.58±1.31	129.50±1.04	128.18±4.76	128.07± 0.96	N.S
W4	167.18±2.00	168.33±0	165.13±7.24	168.08±1.13	N.S
W5	197.85±4.36	193.91±0.09	204.16±3.83	195.50±14.50	N.S

Carcass Characteristic

The effects of cinnamon supplementation on carcass traits of quail at the end of experimental period are summarized in Table,2. Results revealed that cinnamon supplementation had no significant effect on carcass weight, breast, neck, legs, wing and back weight compared with control. However, differences were numerically found in carcass, breast, neck and wing weight between two level of cinnamon and control (Table 2). The presence of antioxidants and phenolic substance in cinnamon may be the main cause of improvement in breast percent of bird carcass, as reported by Lee *et al*., (2003).

These results agreed with the results of Koochaksraie, (2011), who showed that different level of cinnamon powder had no significant effect (P>0.05) on the evaluated carcass traits. On the other hand, disagreed with the work of Mansoub and Myandoab (2011) who showed that the application of different levels of cinnamon significantly affected the carcass traits (P<0.05). Also Zavaragh (2011) indicated that the highest percent of Japanese quail carcass was pounded in the group (250 ppm cinnamon extract herbal plant) compared to control diet.

Table (2): Effect of different level of cinnamon on carcass characteristics (g) of Japanese quail (mean + stander error).

Treatments	Over all Means	Treatments			Sig.
		Control group No cinnamon	1% cinnamon	2% cinnamon	
Live body weight	198.78± .21	195.83±5.48	205.00±7.67	195.83±8.98	N.S
Carcass weight	137.85± .25	136.55±4.20	140.51±5.79	136.48±7.39	N.S
Breast	55.14±1.79	55.11± 3.75	57.28±2.69	53.03±3.11	N.S
Neck	6.47±0.31	5.86±0.38	6.63±0.72	6.91±0.47	N.S
Legs	31.53±0.72	31.60±0.81	31.10±1.26	31.9±1.75	N.S
Wing	12.30±0.32	11.81±0.45	12.63±0.68	12.45±0.57	N.S
Back	31.49±0.84	31.68±1.26	32.43±1.27	30.36±1.88	N.S

Serum Parameters

The effect of different levels of cinnamon powder supplementation on some biochemical blood parameters of quail at the end of experiment period has been shown in Table (3). Results reveal that cinnamon at rate of 1% significantly ($p<0.05$) increased total cholesterol (300.16 mg/dl), as compared with the control (198.5). This finding is in accordance with the results Lee *et al.*, (2004) who noticed that the supplementation of rye diet with cinnamaldehyde significantly increased plasma cholesterol levels in broiler chicks. However, these results disagree with the results of Zavaragh (2011), who showed that the serum total cholesterol concentration was significantly reduced when increased level of cinnamon compared to the control group ($P< 0.05$) in Japanese quail. AL-Kassie (2009), showed that groups of broiler fed oil extract (Derived from thyme and cinnamon) had significantly lower cholesterol compared with the control group ($P<0.05$).

Treatments have no significant effect on the (glucose, creatine, total protein, albumen, triglyceride and globulin). These observations are agreement with the results published by some authors (Koochaksaie, 2011) and (Mansoub and Myandoab, 2011) who's stated that adding different levels of cinnamon on the concentration of serum HDL (High-density lipoprotein), Globulin, Albumin were non significantly affected.

Faixov and Faix (2008), in study about effects of different doses of Cinnantonumzeylanicunt on blood biochemistry showed that 38 d age administration of cinnamon caused a significantly lower plasma glucose level by broiler chickens.

Table (3): Effect of different level of cinnamon on serum biochemical of Japanese quail at 5 weeks of age (mean + stander error).

Blood parameters	Over all Means	Treatments			Sig.
		Control group No cinnamon	1% cinnamon	2% cinnamon	
Glucose (Mg/ dl)	264.75±17.85	296.5±16.58	229.94±48.24	267.83±14.22	N.S
Urea (Mg/dl)	3.98±0.28	4.25±0.66	3.95±0.53	3.76±0.28	N.S
Creatin (Mg/dl)	0.03±0.007	0.02± 0.01	0.02±0.01	0.05±0.1	N.S
Total protein (g/dl)	3.42±0.14	3.18±0.24	3.83±0.21	3.27±0.21	N.S
Albumin (g/dl)	1.4±0.05	1.29±0.08	1.54±0.09	1.38±0.11	N.S
Total Cholesterol (Mg/dl)	246.5±16.67	198.5±27.12b	300.16±20.97a	240.83±24.82 ab	0.05
Triglyceride (Mg/dl)	149.72±6.84	146.5±8.44	156.66±16.7	146.0±10.57	N.S
Globulin (g/dl)	2.02±0.08	1.88±0.16	2.29±0.12	1.89±0.11	N.S

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كاتيكرنا بكارئينانا رێژين جاواز ين دارجينێ دناف ئالفى دا لسەر سالوخەتێن بەرهەمى د سيسكادا

پوخته

ئەڤ ڤەكولينە هاتە ئەنجامدان ل پروژێ خودانكرنا مريشكا ل كوليژا چاندنێ - زانكويا دهوك. دڤێ ڤەكولينێ دا 126 سيسك د ژێ حەفت روژاندا هاتنە بخودانكرن. ئەف سيسكە هاتنە دابەشكرن ل سەر سێ كروباندا هەر گروبەك دبو دوو بەش و هەر بەشەك ژ 21 سيسكا پێك دهات.

خارنا هەر سێ گروبين سيسكا وەك ئيك بون ژلايێ پروتين (21%) و وزێ (2800 كيلوكالورى) ڤە. رَيژێن دارجينى ئەوێن هاتينە بكارئينان دڤێ ڤەكولينى دا 1% و 2% بون. ئەف ڤەكولينە يا بەردوام بو تا ژێ سيسكا بويە پێنج حەفتى. لديماهيا ڤەكولينێ دا 18 سيسك بشێوەيەكى بەربەلاف هاتنە ژێگرتن ژبو دياركرنا سالوخەتێن خوينى و كەلەخى. و دڤێ ڤەكولينى دا دياربو دەمێ رێژا 2% يا دارجينێ هاتيە بكارئينان رێژا كولسترولى دخوينى دا زيدەتربو ((mg/dl 300.16 بەراوردكرن دگەل كونترولى (mg/dl 198.5) و ريژا 1% يا دارجينێ (mg/dl 240.83). بەلێ چ جوداهيێن بەرجاف نەبون دنافبەرا رێژين دارجينێ دا لسەر سالوخەتين بەرهەمى وكەلەخى دسيسكادا .

تأثير نسب مختلفة من القرفة على الصفات الانتاجية وبعض صفات الدم والذبيحة لطائر السمان

الخلاصة

اجريت هذة التجربة في حقل الدواجن التابع لقسم الثروة الحيوانية / كلية الزراعة / جامعة دهوك. لدراسة تأثير إضافة مستويات مختلفة من القرفة الى العليقة على الاداء الانتاجي وبعض الصفات الفسيولوجية لطائر السمان. استخدم في الدراسة 126 طائر السمان بعمر اسبوع واحد وتم توزيعها بصورة عشوائية إلى ثلاث مجاميع بواقع مكررين لكل مجموعة وفي كل مكرر 21 طير وغذيت الطيور في المجاميع الثلاثة بعلائق متساوية في محتواها من البروتين (21%) والطاقة (2800 كيلوكالوري) واستمرت التجربة لغاية عمر خمسة اسابيع. أضيف مسحوق القرفة إلى العليقة الأساسية بنسب 0.0 (معاملة السيطرة), المعاملة الثانية غذت الافراخ على عليقة مضافا لها 1% من القرفة والمعاملة الثالثة غذت الأفراخ على عليقة مضافا لها 2 % من القرفة. وتم اختيار 18 طير بصورة عشوائية عند نهاية التجربة لاجراء عملية سحب الدم واخذ قياسات الذبيحة . واظهرت النتائج بان اضافة القرفة بمعدل 2% كانت لها تاثير معنوي بزيادة نسبة الكولسترول في الدم (300.16 mg/dl) مقارنة بمعاملة السيطرة (198.5 mg/dl) ومعاملة 1% (240.83 mg/dl). وعدم وجود فروقات معنوية بين معاملات التجربة فيما يتعلق بالصفات الانتاجية والذبيحة.

EFFECT OF CULTIVARS, COMPOST, HUMIC ACID AND THEIR INTERACTIONS ON LEAF HEAVY METAL ACCUMULATION OF SWEET CHERRY (*Prunus avium* L.).

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ABSTRACT

The present study was carried out on sweet cherry tree (*Prunus avium* L.), during the growing season of (2012-2013) on private orchard of sweet cherry tree, located in the Bibad village near Amadi town / Duhok governorate- Kurdistan region-Iraq. The field experiment was done in the orchard that contained two cultivars of sweet cherry ("Nefertity" and "Berlit"). The application of compost was done in December 25th 2012, at (0, 2, 4 and 6 kg.Tree^{-1}), foliar spray of humic acid done at (0, 100, 200 and 300 mg.L^{-1}) and repeated after two weeks. The results are summarized as follows: Nefertity cultivar significantly dominated over Berlit cultivar in leaf Cd, Pb and Fe content. Whereas Berlit cultivar dominated in leaf (Ca, and Zn). Compost specially at kg.Tree^{-1} has significantly improved leaf Cd and Fe. Whereas, compost at 6 kg.Tree^{-1} in leaf nutrient content Cd and Fe. Humic acid specially at 300 mg.L^{-1} has significantly increased the leaf nutrients content Ca, Cd, Zn and Fe, while, 200 mg.L^{-1} increased the leaf Cd, Pb and Zn. The interactions between cultivars, compost and humic acid has affected significantly most of the studied parameters. The more effective treatment interactions was Nefertity + 6 kg.Tree^{-1} of compost plus300 mg.L^{-1} of humic acid increased Cd significantly.

***KEY WORD*:** Cherry cultivar, Compost, Humic acid, Heavy metal

INTRODUCTION

The sweet cherry (*Prunus avium.* L) belongs to the Rosaceae family, sub-family Prunidaecea (Rodrigues and Antunes, 2008). It is believed to have originated from the regions between the Black and Caspian Sea of Asia Minor. Seed spreading by birds carried it to Europe, where the earliest cultivation of sweet cherry was reported. Further spread to North America via English colonists occurred in the seventeenth century. (Webster and Looney, 1996). Sweet cherry is one of the most popular temperate fruits. According to the (FAO, 2011), cherries produced worldwide, cherries are an important horticultural crop - approximately 2.2 million tons of cherries were produced worldwide in 2009 (Anonymous, 2010). Compost is a resource of converting organic waste material, such as food waste, yard waste and manure, into a matter called humus, a nutrient-rich soil amendment.

Part of thesis from the second one Humus is an essential element in maintaining healthy soil and plant, making composting a useful tactic for nurturing productive agricultural fields, ornamental plants and grasses (Chiumenti, 2005).The compost has an important role in the agriculture sector because it contain a high amount of elements necessary for plant growth and soil improvement, the use of compost as a fertilizer for plant in Iraq and Kurdistan has a large space and this is backward in the field of agriculture when we compare with the progressive countries. Thus, I was encouraged to use the compost as a first study in Kurdistan and Iraq in order to encourage our farmer to use the compost as a plant fertilizer. The risks and problems posed by heavy metals in fertilizers and other soil inputs have increasingly drawn the attention of farmers, environmental organizations, consumers, and public policymakers.

This study examines a wide spectrum of soil amendments and fertilizers used in organic agriculture, including biosolids, major nutrient fertilizers, industrial wastes, composts, liming materials and micronutrient sources with a focus on inputs used in organic agricultural production in Iraq. Humic substances are no one single chemical recognized as humic acid, since the chemical makeup has never been completely defined. These materials are composed of complicated organic mixtures which are

associated together in a random manner, resulting in extraordinarily complex materials, it has been suggested that no two molecules of humus are exactly the same (Mikkelsen, 2005). The cherry fruit is desirable in Kurdistan in relations of the consumption and also desirable by farmers to cultivate but the production is very little so far. For this reason, the propose of this study as the first study on the leaf nutrition state of cherry fruits in order to improve the quality and increase their production.

This investigation aimed to study the responsible of two cultivars to local environmental condition, and their responsibility to fertilized by organic matter (compost and humic acid). However, it also hopes to confirm the risk of heavy metal concentration in compost also to find a fertilization program that can replace the minerals which will be beneficial for organic production of sweet cherry, since there are little or no studies in Kurdistan about the role organic fertilization in yield and quality of sweet cherry for this reason the aims to study interaction effect of cultivars, compost, humic acid on some heavy metal concentration of two cultivars of sweet cherry.

MATERIALS AND METHODS

This study was carried out in the Bibad village near Amadi townDuhok governorate Kurdistan region-Iraq. The orchard is situated at latitude: 37.05°N, and longitude 43.29° E and at an altitude of 1202 m above the sea level. The experiment included the two cultivar of sweet cherry "Nefertity" and "Berlit", application of compost at different levels (0, 2, 4 and 6 kg.Tree^{-1}), and foliar spray of humic acid at concentrations (0, 100, 200 and 300 mg.L^{-1}). The compost which used in this experiment is consisting from resides waste of Dohuk city, is produced in Kawsha manufacture of compost fertilizer. The orchard experiment of compost application was done in December 25th 2012, by working hole around the tree under brunch projection and mixed with the soil in order to investigate the effect of soil application of four levels of compost (0, 2, 4 and 6 kg.Tree^{-1}). The humic acid which used in the experiment is a liquid content analysis w/w, organic matter 5%, (K_2O) 1%, total humic + fulvic acid 15%. The foliar spray of humic acid was done in April 15th 2013, after full bloom at four concentrations (0, 100, 200 and 300 mg.L^{-1}) and replicated the same concentrations after two weeks of the first spray.

Statistical analysis

All the obtained data statistically analyzed with computer using SAS system (SAS, 1996). The experiment which conducted in this study followed by Randomized Complete Block Design in Factorial Experiment; the experiment comprised of 32 treatments with three replicates, each replicate was presented by one tree of each cultivar. The differences between various treatment means were tested with Duncun multiple range test at 5% level. (Al- Rawi and Khalaf-Alla, **2000).**

Measurements:

Heavy metal was determined using Atomic absorption (Mehmet, 2010) but lead (Pb) according (Ge´rard *et al.*, (2000).

1. Cadmium (Cd) (mg.L^{-1})
2. Lead (Pb) (mg.L^{-1})
3. Zinc (Zn) (mg.L^{-1})
4. Iron (Fe) (mg.L^{-1})
5. Calcium (Ca %)

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

Properties	Value
PH	8.22
E.C. D.S^{-1}	0.52 dS.m^{-1}
Texture	Clay
total N	0.70%
total P	0.02%
total K	1.60%
Ca	2.6 %
Zn	0.92 ppm
Fe	3.69 ppm
Cd	0.023 ppm
Pb	0.038 ppm

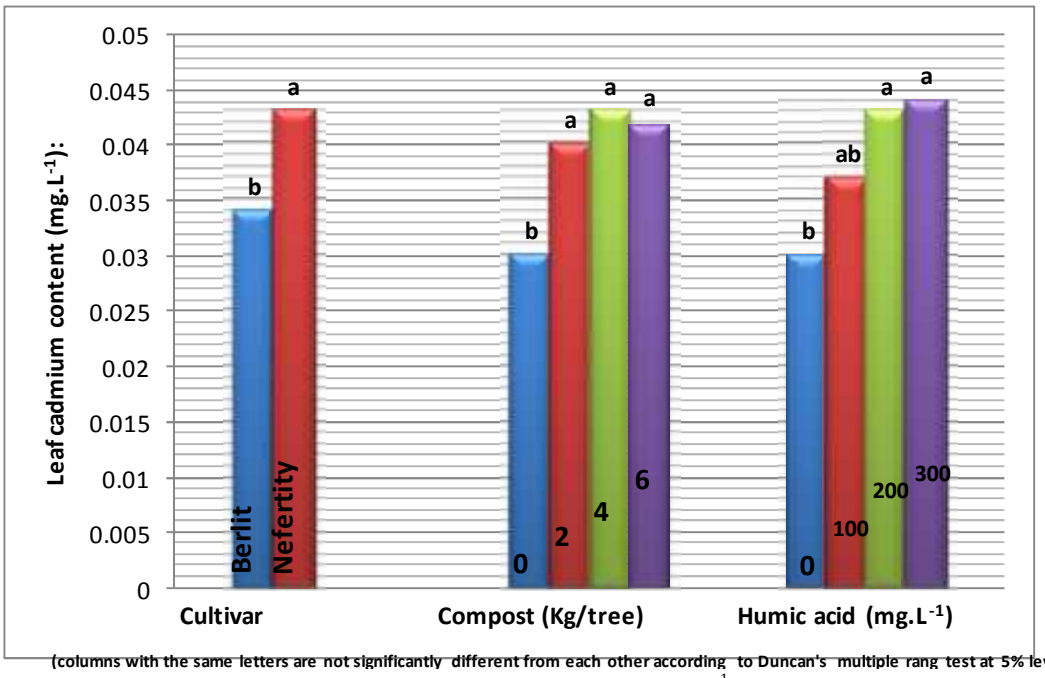
Soil analysis was carried out at Faculty of Agricultural Research Center in Duhok.

RESULTS

1.Leaf cadmium concentration(mg.L^{-1})

The figure (1)demonstrates the leaf Cd content in cultivar Nefertity had significant differences with cultivar Berlit Obviously shows that compost at a

level (4 kg.Tree-1) was the best treatment which recorded (0.043 mg.L^{-1}). However, the lowest value was recorded in control (0.030 mg.L^{-1}). The same figure illustrates the data which obtained from the foliar spray of humic acid at (300 mg.L^{-1}) was the better results which recorded (0.046 mg.L^{-1}), while the lower value was recorded in control (0.030 mg.L^{-1}).



(columns with the same letters are not significantly different from each other according to Duncan's multiple rang test at 5% le

Fig.(1): Effect of cultivar, compost and humic acid on leaf Cd content (mg.L^{-1}) of sweet cherry.

Explain to the interaction effect on leaf Cd content in the table (2) the interaction between cultivar Nefertity + (4 kg.Tree-1) of compost was better treatment were compared with other treatments. The interaction between cultivar Nefertity plus (200 mg.L^{-1}) of humic acid had better treatment were compared with other treatments. Manifest the interaction between compost (6kg.Tree-1) compost plus (200 mg.L^{-1}) humic acid caused the highest significant value in leaf Cd (0.049 mg.L^{-1}). However, the lowest leaf Cd was observed in control (0.019 mg.L^{-1}). The same table displays the effect of triple interaction between cultivar Nefertity + (6 kg.Tree-1) compost + (300 mg.L^{-1}) of humic acid provided the best value (0.057 mg.L^{-1}) were compared with control (0.017 mg.L^{-1}).

Table (2): interactions effect of cultivar, compost and humic acid on leaf Cd (mg.L^{-1}) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg.Tree-1)				Cultivar × Humic
		0	2	4	6	
Berlit	0	0.017 c	0.015 c	0.031 a-c	0.034 a-c	0.024 c
	100	0.022 bc	0.035 a-c	0.042 a-c	0.031 a-c	0.033 bc
	200	0.028 a-c	0.036 a-c	0.038 a-c	0.051 ab	0.038 ab
	300	0.035 a-c	0.048 ab	0.042 a-c	0.036 a-c	0.040 ab
Nefertity	0	0.021 bc	0.045 a-c	0.042 a-c	0.036 a-c	0.036 a-c
	100	0.032 a-c	0.047 ab	0.042 a-c	0.042 a-c	0.041 ab
	200	0.044 a-c	0.048 ab	0.051 a-c	0.047 ab	0.047 a

	300	0.040 a-c	0.044 a-c	0.054 a	0.057 a	0.049 a
4	**Cultivar × Compost**					
Cultivar	**Berlit**	0.025 c	0.033 bc	0.038 a-c	0.038 a-c	
	Nefertity	0.034 a-c	0.046 ab	0.047 a	0.045 ab	
	Humic acid × Compost					
Humic acid (mg.L^{-1})	**0**	0.019 c	0.030 a-c	0.037 a-c	0.035 a-c	
	100	0.027 bc	0.041ab	0.042 ab	0.036 a-c	
	200	0.036 a-c	0.042 ab	0.045 ab	0.049 a	
	300	0.037 a-c	0.046 ab	0.048 a	0.046 ab	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

2.Leaf Zn concentration(mg.L^{-1})

The figure (2) demonstrates that the leaf Zinc content in cultivar Berlit was significantly more than the cultivar Nefertity. Obviously reveals that the effect of soil application of compost at (6 kg.Tree-1) was significantly greater than other levels which recorded (49.583 mg.L^{-1}), and the lowest value was recorded in control (30.5 mg.L^{-1}).The same figure demonstrates that data which obtained from the foliar spray of humic acid at a (300 mg.L^{-1}) was significantly superior which recorded (41.458 mg.L^{-1}), while the lowest values was recorded in control (30.408 mg.L^{-1}).

About interactions in the table (3) shows the interactions between cultivar Berlit with (6 kg.Tree-1) of compost had significantly increase leaf Zn and provided the highest value (58.9 mg.L^{-1}) were compared with control. The results from the interaction between cultivar Berlit plus foliar spray of humic acid at (300 mg.L^{-1}) was the better treatment, were compared with other treatments.

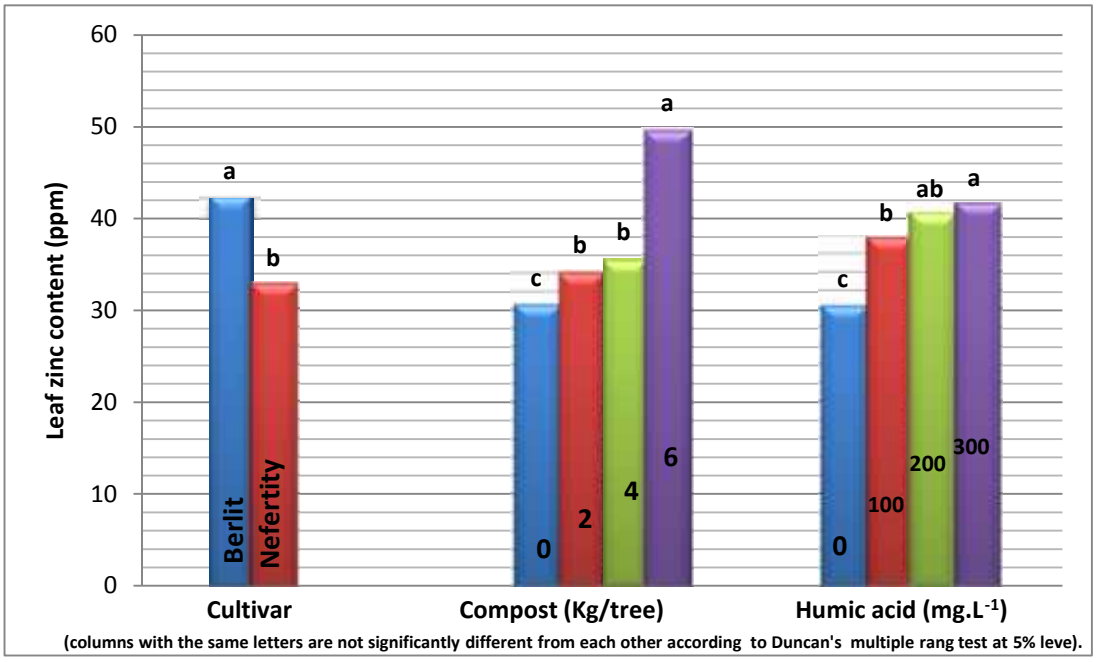


Fig. (2): Effect of cultivar, compost and humic acid on leaf Zn concentration (mg.L^{-1})) of sweet cherry.

The interaction between (6 kg.Tree-1) compost plus (300 mg.L^{-1}) humic acid had the maximum significant leaf Zn (62.4 mg.L^{-1}), while the minimum leaf Zn was observed in control. The same table displays the interaction between cultivar Berlit plus (6 kg.Tree-1) compost plus (300 mg.L^{-1}) humic acid provided the highest value (73.6 mg.L^{-1}) compared with control (24.2 mg.L^{-1}).

Table (3): interactions effect of cultivar, compost and humic acid on leaf Zn (mg.L^{-1}) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg.Tree-1) 0	2	4	6	Cultivar × Humic
Berlit	0	24.2 k	31.4 e-k	34.9 c-h	40.5 cd	32.8 b
	100	38.5 c-f	42.6 c	37.0 c-g	54.5 b	43.1 a
	200	37.2 c-g	40.2 c-e	38.4 c-f	67.2 a	45.7 a
	300	36.9 c-g	38.8 c-f	38.6 c-f	73.6 a	47.0 a
Nefertity	0	24.8 jk	27.4 h-k	28.3 g-k	31.4 e-k	28.0 c
	100	26.0 i-k	30.2 f-k	34.0 c-i	38.4 c-f	32.1 b
	200	27.4 h-k	33.3 d-i	38.4 c-f	39.7 c-e	34.7 b
	300	29.1 g-k	28.6 g-k	34.6 c-i	51.2 b	35.9 b
Cultivar × Compost						
Cultivar	Berlit	34.2 c	38.3 b	37.2 bc	58.9 a	
	Nefertity	26.8 d	29.9 d	33.8 c	40.2 b	
Humic acid × Compost						
Humic acid (mg.L^{-1})	0	24.5 g	29.4 fg	31.6 ef	36.0 de	
	100	32.2 d-f	36.4 de	35.5 de	46.4 c	
	200	32.3 d-f	36.8 de	38.4 d	53.4 b	
	300	33.0 c	33.7 b	36.6 de	62.4 a	

Means of each interaction followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

3. Leaf lead concentration (mg.L^{-1})

The figure (3) indicates that leaf Pb content in cultivar Nefertity significant differences on cultivar Berlit. All level of compost was significantly increasing the concentration of Pb in leaf but best effect which shows were apply (2 kg.Tree-1), which recorded (0.093 mg.L^{-1}), and the lowest value was (0.083 mg.L^{-1}).

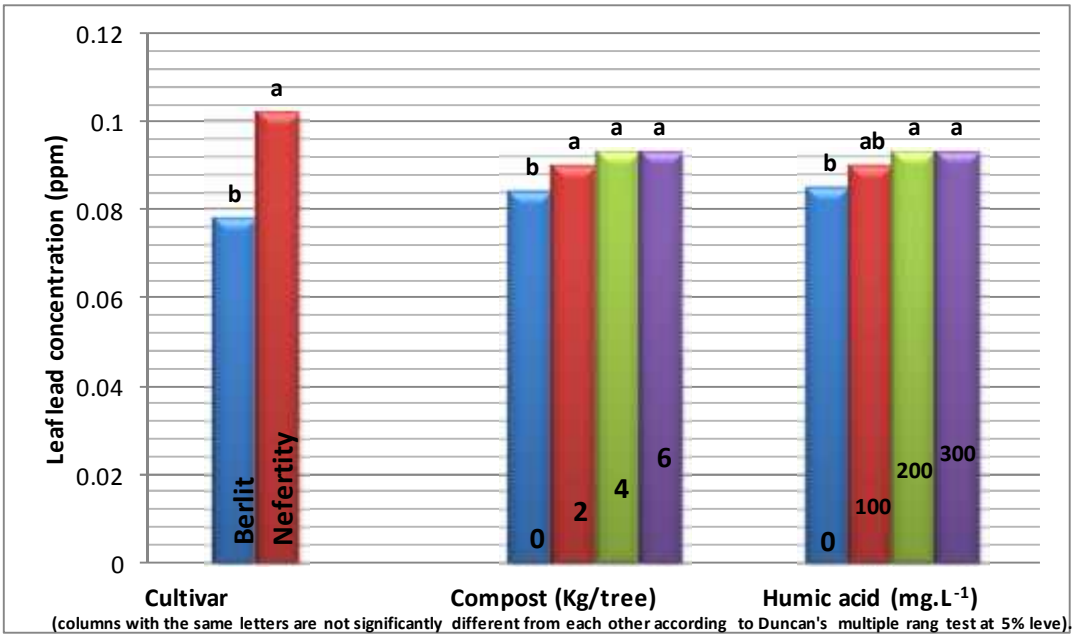


Fig.(3): Effect of cultivar, compost and humic acid on leaf Pb concentration (mg.L^{-1})of sweet cherry.

The similar figure shows the effect of foliar spray of humic acid at a concentration (200 mg.L^{-1}) was better result which recorded (0.093 mg.L^{-1}), while the lowest values were recorded in control (0.093 mg.L^{-1}).

Table (4): Interactions effect of cultivar, compost and humic acid on leaf Pb (mg.L^{-1}) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg.Tree-1) 0	2	4	6	Cultivar × Humic
Berlit	0	0.065 h	0.070 gh	0.078 f-h	0.080e-h	0.073 c
	100	0.070 gh	0.073 gh	0.079 f-h	0.082d-h	0.076 cd
	200	0.078 f-h	0.080e-h	0.083 c-g	0.083 c-g	0.081 c
	300	0.080e-h	0.080e-h	0.083 c-g	0.083 c-g	0.081 c
Nefertity	0	0.090 b-f	0.096a-e	0.098a-d	0.101 ab	0.096 b
	100	0.093 a-f	0.105 ab	0.109 a	0.107 ab	0.104 a
	200	0.096a-e	0.106 ab	0.108 a	0.106 ab	0.104 a
	300	0.099 a-c	0.106 ab	0.107 ab	0.106 ab	0.104 a
Cultivar × Compost						
Cultivar	Berlit	0.073 d	0.076 cd	0.081 cd	0.082 c	
	Nefertity	0.095 b	0.103 a	0.105 a	0.105 a	
Humic acid × Compost						
Humic acid (mg.L^{-1})	0	0.078 c	0.083 a-c	0.088 a-c	0.090 ab	
	100	0.082 bc	0.089 a-c	0.094 a	0.095 a	
	200	0.087 a-c	0.093 ab	0.095 a	0.094 a	
	300	0.089 ab	0.093 ab	0.095 a	0.094 a	

Means of each interaction followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

4. Leaf Iron concentration (mg.L^{-1}):

The figure (4) confirms that the leaf Fe content in cultivar Nefertity had significant differences on cultivar Berlit.

There are no significant differences between compost levels on leaf Fe content. Reveals the data which obtained from the use of humic acid at (300 mg.L^{-1}) was significantly superior which registered (126 mg.L^{-1}), while the lowest value was recorded in control (109 mg.L^{-1}).

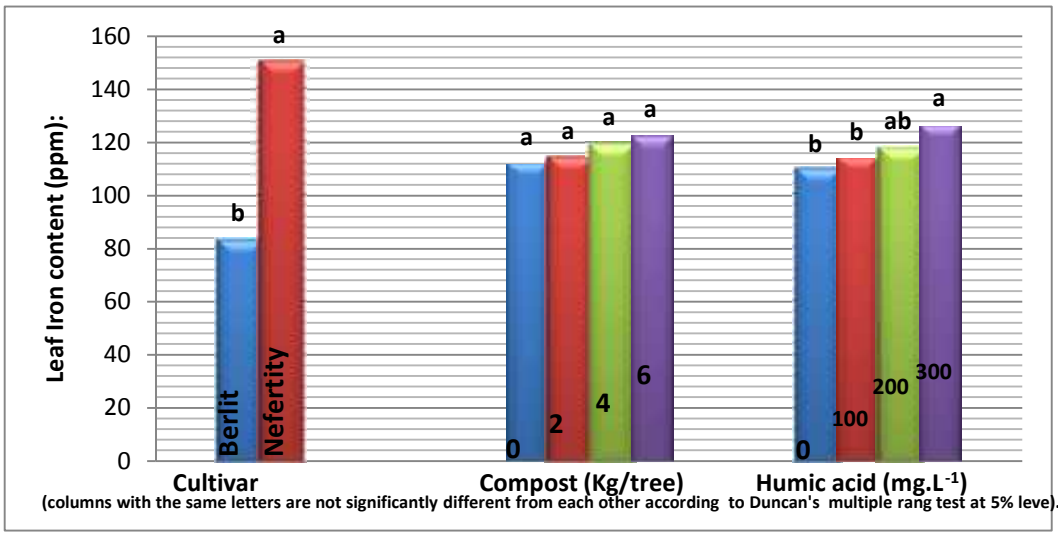


Fig.(4): Effect of cultivar, compost and humic acid on leaf Fe concentration (mg.L^{-1}) of sweet cherry.

Table (3): Interactions effect of cultivar, compost and humic acid on leaf Fe (mg.L^{-1}) of sweet cherry.

Cultivar	Humic acid (ppm)	Compost (Kg.Tree-1) 0	2	4	6	Cultiver × Humic
Berlit	0	70 c	83 c	85 c	87 c	81 c
	100	77 c	73 c	80 c	82 c	78 c
	200	82 c	77 c	83 c	85 c	82 c
	300	98 c	92 c	90 c	87 c	92 c
Nefertity	0	129 b	133 ab	138 ab	149 ab	137 b
	100	137 ab	148 ab	155 ab	158 ab	149 ab
	200	145 ab	151 ab	158 ab	162 ab	154 a
	300	153 ab	154 ab	166 ab	169 a	161 a
Cultivar×Compost						
Berlit		82 c	81 c	85 c	85 c	
Nefertity		141 b	147 ab	154 ab	159 a	
Compost × Humic acid						
Humic acid (ppm)	0	99 b	108 ab	111 ab	118 ab	
	100	107 ab	111 ab	118 ab	120 ab	
	200	114 ab	114 ab	121 ab	123 ab	
	300	126 a	123 ab	128 a	128 a	

Means of each interaction followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

About the interaction in the table (5) the result shows that the interaction between cultivar Nefertity with soil application of compost at a level (6 kg.Tree-1) was the better treatment which gave value (159mg.L^{-1}) were compared with other treatments. Demonstrates the interaction between cultivar Nefertity plus humic acid at (300 mg.L^{-1}) gave the highest value161 mg.L^{-1} . Manifests that the results of interaction between compost at a level (4 kg.Tree-1)with (300 mg.L^{-1}) of humic acid which provided the best treatment (128 mg.L^{-1}), while the lowest leaf iron was observed in control.

The same table shows the triple interaction between cultivar Nefertity plus (6 kg.Tree-1) compost plus (300 mg.L^{-1}) humic acid which provided the highest value (169mg.L^{-1}) were compared with controls.

5. Leaf calcium concentration (%)

Refers the figure (5) shows that leaf Ca content in cultivar Berlit had significant differences were

compared with cultivar Nefertity. The results clearly show the soil application of compost at a level (6 kg.Tree-1) was significantly increasing the leaf Ca content, which documented (2.201 %), were compared with other treatment.

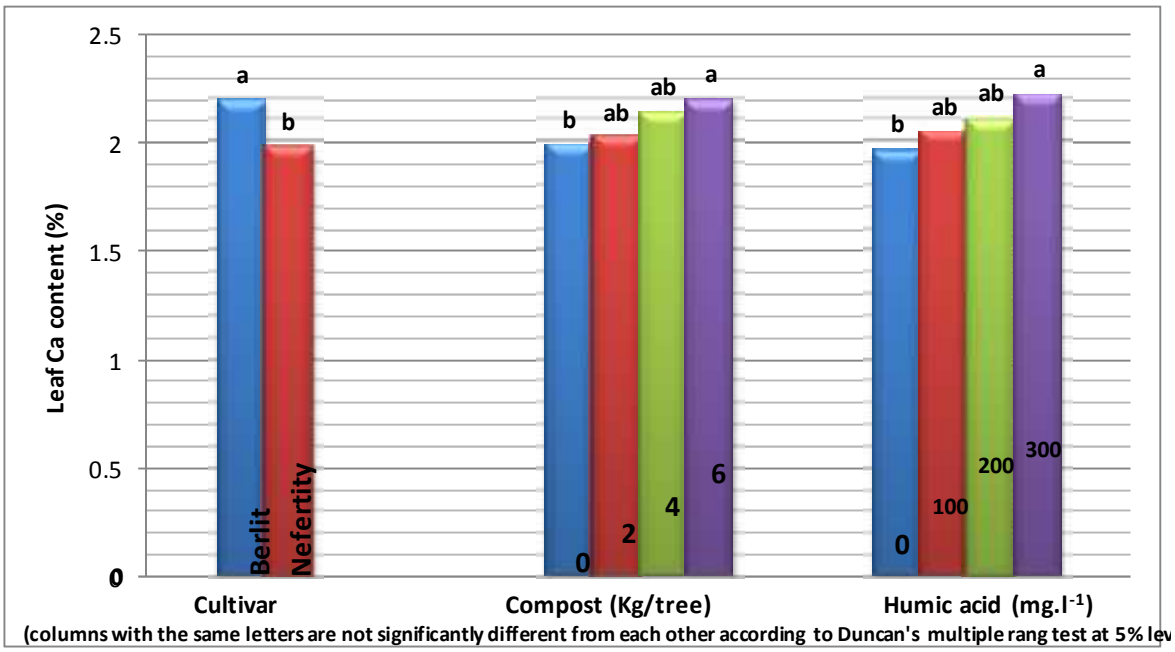


Fig. (5): Effect of cultivar, compost and humic acid on leaf calcium content (%) of sweet cherry.

Table (6): interactions effect of cultivar, compost and humic acid on leaf Ca content (%) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg.Tree-1) 0	2	4	6	Cultivar × Humic
Berlit	0	2.05 b-d	2.08 a-d	2.08 a-d	1.88 cd	2.02 b
	100	2.14 a-d	2.08 a-d	2.18 a-d	2.04 b-d	2.11 b
	200	2.20 a-d	2.15 a-d	2.27 a-d	2.13 a-d	2.18 b
	300	2.30 a-c	2.31 a-c	2.54 ab	2.673 a	2.46 a
Nefertity	0	1.66 d	1.74 cd	1.98 b-d	2.27 a-d	1.91 b
	100	1.78 cd	1.85 cd	2.03 b-d	2.27 a-d	1.98 b
	200	1.84 cd	2.06 a-d	2.04 b-d	2.19 a-d	2.03 b
	300	1.92 b-d	1.89 cd	2.00 b-d	2.12 a-d	1.98 b
Cultivar × Compost						
Cultivar	Berlit	2.17 a	2.15 a	2.27 a	2.18 a	
	Nefertity	1.80 b	1.88 b	2.01 ab	2.21 a	
Humic acid × Compost						
Humic acid (mg.L^{-1})	0	1.86 b	1.91 b	2.03 ab	2.07 ab	
	100	1.96 b	1.96 b	2.10 ab	2.15 ab	
	200	2.02 ab	2.10 ab	2.15 ab	2.16ab	
	300	2.11 ab	2.10 ab	2.27 ab	2.40 a	

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

The same figure indicates the data which obtained from the effect of foliar spray of humic acid at (300 mg.L^{-1}) was better treatments which registered (2.224 mg.L^{-1}), were compared with other treatment. About the interaction in the table (6), the interaction between cultivar Berlit plus (4 kg.Tree-1) of compost was the best treatment were in comparison with other treatments. The results of combining between cultivar Berlit plus humic acid at a (300 %)indicated the highest significant differences were compared with other treatments. Also the interaction between (6 kg.Tree-1) compost plus plus (300 mg.L^{-1}) humic acid produced the best treatment (2.400 mg.L^{-1}), were compared with control. The same table shows the interaction between cultivar Berlit + (6 kg.Tree-1) compost + (300 mg.L^{-1}) humic acid which provided the highest treatment (2.673 %) were compared with other treatments.

DISCUSSION

1. The effect of cultivar on the leaf nutritional state may be ascribed to the differences in genotype characteristics for root growth, nutrient absorption efficiency and photosynthesis process efficiency (Jorda, *et a.l*, 1999). Also, the response of different cultivars to the local environmental condition according to the genetic variation between the cultivars (Gaafar and Saker, 2006 ; Khalifa, 2007).

2. The effect of compost on the leaf heavy metal accumelations may be due to the improvement of soil physical, biological properties and chemical properties resulting more release of nutrient elements available which 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 adequate nutrient quantities of nitrogen, phosphorus, and potassium, which increase both rate of leaf expansion as well as cell division which subsequently leads to larger individual leaves and higher photosynthesis activities (Abd El-Wahab, 2011). 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, attributed to presence of plant growth regulators (Arancon *et.al.,* 2004).

3. The effect of humic acid by acting on mechanisms involved in: cell respiration, photosynthesis, protein synthesis, water and nutrient uptake, enzyme activities. (Ali *et al.*, 2007). The hormone like activities of (HA) is well documented in various papers, in particular auxin-, cytokinin- and gibberellins like effects (Pizzeghello *et.al.,* 2002). Also, the effect of humic acid may be due to the role of (HA) to increase of cation exchange capacity which affects the retention and availability of nutrients,or due to a hormonal effect, or a combination of both.(Chun hua *et.al.*,1998).

CONCLUSIONS

1. The Nefertity cultivar was superior on the Berlit cultivar in increasing in most leaf nutrients which measured.

2. Soil application of compost at a level 4kg.Tree-1 was more than other levels and control in increasing most vegetative growth parameters and most leaf nutrients.

3. Foliar spraying of humic acid at concentration 300 mg.L^{-1} had more effects on the increasing of most leaf nutrients.

4. The interaction of Nefertity cultivar + 4Kg of compost + 300 mg.L^{-1} of humic acid had more effect on increasing in most studied parameter.

Recommendations:

Depending on the conclusions mentioned previously, the following points of view can be recommended:

1.Testing the other cultivars of sweet cherry may lead to better results.

2.Testing the different level and time application of compost may lead obtain preferable results, also testing other organic fertilizer such as animal manure chicken manure and municipal can obtain better results.

3.Testing the effect of spraying with humic acid on the other sweet cherry cultivar or with other factors.

4. Our recommend the farmers to use the compost in their orchards like other organic fertilizer, such as animal manure without any fear of toxic materials, soil pollution and harmful effect of heavy metals.

5.Our recommend the Kawashi manufacture of compost in Duhok city to produce good compost, clean and free from any harmful material, reduces added the toxic materials like expired medicine and car trees and Battery since all of these materials lead to increase the heavy metal concentrations.

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كارتێكرنا توخم وكومپوست وترشێ هيوميك و تێكەلكرنا وان لسەر توخمێت گران لناڤ بەلگێ هەلهەلوكێ (گێلاس)

پوختە

ئەڤ ڤەكولينە هاتە ئەنجامدان لسەر دارا هەلهەلوكا (گێلاسا) شرين(Prunus avium L.), دوەرزى چاندنێ 2012-2013 ل ناف بيستانەكێ كەرتێ تايبەت ل گوندێ بێبادێ نێزيكى دەڤەردارياى ئامێدينێ سەرب پارێزگەها دهوكێ ل هەرێما كوردستانا ئيراقێ.بيستانێ ڤەكولين دناف هاتيە ئەنجامدان ژ دوو جورێن هەلهەلوكا يێت شرن هاتبونە چاندن (نەفەرتيتى و بێرلايت) , كارئينانا زبلێ كومپوست ب سێ ئاستا (0, 2, 4 و 6 كغم بو هەر دارەكێ), رەشاندنا هيوميك ئەسيدى ب سێ تيراتييا (0, 100, 200, 300 mg.L-1).

كارتێكرنا جورى: ئەنجام هوسا دياردكەن كو جورێ نەفەرتيتى كارتێكرنەكا بەرچاف هەبو لسەر جورێ بێرلايت تيراتييا توخما Ca, Cd, Pb, Fe دناف بەلگادا, هەروسا جورێ بێرلايت كارتێكرنەكا بەرچاف هەبو دزێدەكرنا تيراتييا , Ca ,Zn د بەلگا دا. كارتێكرنا زبلێ كومپوست: بكارئينانا زبلێ كومپوستى دناف ئاخێ دا و تايبەت ئاستێ 4 كيلو بو هەر دارەكێ كارتێكرنەكا بەرچاف هەبو لسەر تێرايى Fe , Cd دناف بەلگادا و ئاستێ 2 كيلو يى كومپوستى كارتێكرن د زێدەكرنا Cd , Fe دناف بەلگادا , و ئاستێ 6 كيلو يى كومپوستى كارتێكرن د تيرايێ Zn Fe, Pb , Ca دناف بەلگا دا. كارتێكرنا رەشاندنا هيوميك ئەسيدى: ئەنجام هوسا دياردكەن كو رەشاندنا ب هيوميك ئەسيدى ب تيرايێ 300 ppm بوويە ئەگەرێ زێدەبوونەكا بەرچاڤ ددرێژكرنا تيراتييا Fe Cd , , Zn Ca, دناف بەلگا.و تيراتيا 200 mg.L-1 كارتێكرنەكا بەرچاف هەبو ب , Pb, Zn, Cd دناف بەلگا. سەبارەت سەرەدەريين تێكەل كرنا جورى,زبلێ كومپوست دگەل رەشاندنا هيوميك ئەسيدى: ئەنجام هوسا دياردكەن كو تێكەل كرنا جورێ نەفەرتيتى دگەل ئاستێ 4 كيلويێت زبلێ كومپوست بو هەر دارەكێ دگەل هيوميك ئەسيدى ب تيراتيا 300 mg.L-1 كارتێكرنەكا ئێگجار بەرچاف هەبو تيرلتيا Fe دناف بەلگا دا .

تأثير الصنف و الكومبوست وحامض الهيوميك و تداخل بينهم على العناصر الثقيلة فى اوراق الكرز الحلو

الخلاصة

اجريت الدراسة على اشجارالكرز الحلو (*Prunus avium* L.) خلال موسم النمو 2012- 2013 في بستان أهلى مزروع باشجار الكرز الحلو, الواقع في قرية بيباد قرب مدينة العمادية / محافضة دهوك / اقليم كردستان / العراق.مشروع البحث عبارة عن صنفين من اصناف الكرز (نيفرتيتي وبيرلايت). تم استخدام سماد الكومبوست في 25 كانون الثاني سنة 2012 باربعة مستويات من سماد الكومبوست (0, 2, 4, 6 كغم.شجرة$^{-1}$) و الرش الورقي بالهيوميك اسيد باربعة تراكيز (0, 100, 200, 300 ملغم.لتر$^{-1}$)وكرر نفس التراكيز بعد اسبوعين من الرشة الاولى .

النتائج:كان للصنف نفرتيتي تاثير معنوي و تفوق على الصنف بيرلايت في محتوى الورقة منCd, Pb, Fe . كذالك الصنف بيرلايت له تأثير معنوي في محتوى الورقة من Zn, Ca, . اضافة الكومبوست الى تربة في مستوى 4 كيلو/ شجرة له تاثير معنوي على محتوى الورقة من Fe, Cd وكذالك المستوى 2 كغم.شجرة$^{-1}$كان له تاثير معنوى في محتوى الورقة Pb Cd Fe اما المستوى 6 كغم.شجرة$^{-1}$ كان له تاثير معنوي في محتوى الورقة من Pb, Ca, Zn, Fe . الرش الورقي بهيوميك اسيد بتركيز 300 ملغم.لتر$^{-1}$ له تاثير معنوي في محتوى الورقة من Ca,Zn, Cd, Fe اما التركيز 200 ملغم.لتر$^{-1}$ له تاثير معنوي في محتوى الورقة منZn, Cd, Pb . التداخل الثلاثي بين العوامل الثلاثة كان له تاثير فى زيادة معظم الصفات المدروسة, لكن معاملة التداخل بين صنف نفرتيتي + 4 كغم.شجرة$^{-1}$ كومبوست + المستوى 300 ملغم.لتر$^{-1}$ من هيوميك اسيد حيث كانت المعاملة الاكثر فعلية في محتوى الورقة من(Cd).

EFFECT OF DIFFERENT CONCENTRATIONS OF CYTOKININ AND AUXINS ON *In Vitro* PROPAGATION OF *Paulownia tomentosa* STEUD & ZUCC

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ABSTRACT

***Paulownia tomentosa* Steud. is one of the fast growing tree species with a wide ecological niche range permitting it to occur in a various types of habitat. In addition, this species has a multiple ecological and industrial uses for reforestation, urban area and biomedical purposes. Recently, Paulownia trees were widely propagated by tissue culture methods and planted in cities due to its high importance for infiltration of the air and ornamental. However, in Kurdistan Region this tree was imported and had a high cost. Therefore, the major aim of this investigation is to reach a successful protocol for propagation via tissue culture by testing the effects of growth regulators on the multiplication and rooting stages. The results of this study showed that the most of growth regulators (auxins and cytokinin) had positive effects on the number of leaves, shoot length and number of nodes as compared with the control. Moreover, MS salt strength supplemented with different growth regulators had also a positive effect on both roots number and length as compared with the control. It's worth noting that the half strength of MS medium had more effect in giving a higher number of roots than full MS strength. The results of this study highlighted the importance of this technique's advantages for further future micropropagation projects to forest tree species. Knowing that this protocol should be applicated to propagate other native and introduced tree species and applying further investigations to test other *in vitro* effective factors.**

KEYWORDS: *Paulownia tomentosa* Steud, Growth Regulators, MS Media, *in vitro*, Tissue Culture.

INTRODUCTION

The tree species *Paulownia tomentosa* Steud. is belonging to Paulowniaceae family occurring naturally in China, but it is naturalized in other parts of the world such as Europe and USA (Atiqurrahman *et al.*, 1995). The common name of *Paulownia* is princess tree, royal tree and empress tree. It is considered one of the fast growing tree species by 5-6 m height during the first growing season and usually adds 3 to 4 cm in diameter annually at optimal growing conditions (El-Showk and El-Showk, 2003). Furthermore, it has a wide ecological niche range of growing well in a divers soil type, and a wide climatic conditions. Consequently, this tree is used for reforestation and has been successfully grown in urban areas where air pollution, poor drainage, compacted soil, and drought are common (Yang *et al*., 1996). Princess tree's woods are used for multiple ecological and industrial purposes such as house construction, furniture making, paper pulp, farm implements and musical instruments (Aryan *et al*., 2003). From ethnobotanical standpoint, this tree species has many potential medicinal uses for example the leaves, wood flowers and fruit have been used in Chinese herbal medicine for the treatment of tonsillitis, bronchitis, asthmatic attack and bacterial infections such as enteritis or dysentery (Kang *et al*., 1999, Jiang *et al.*, 2004 and Smejkal *et al*., 2007). Biochemically, extracts of *P. tomentosa* contained many bioactive compounds such as flavonoids and particularly Apigenin. This last one has been found to show a variety of pharmacological activities including hypotensive (Loizzo *et al.*, 2007), anti- inflammatory (Gerritsen *et al.*, 1995, Ko *et al*., 2004), antispasmodic (Capasso *et al*., 1991), anti-oxidant (Cos *et al.*, 1998) and vasorelaxant (Zhang *et al.*, 2000). Because of its wide-spreading root system may be used for phytoremediation of contaminated soils (Loizzo *et al*., 2007, Gerritsen *et al*. 1995, Ko *et al*., 2004, Capasso *et al*., 1991, Cos *et al*., 1998, Zhang *et al*., 2000 and Zhu *et al*., 1988). The genus *Paulownia* is receiving increasing attention as an extremely fast growing, short-rotation woody crop plant (Bergmann, 1998; Ipeckci and Gozukismici, 2003).

*Paulownia tomentosa*is conventialy propagated through seeds or by root cuttings. The methods of propagation through seeds is unreliable because of disease and pest problem, poor germination, and also slower growth than root cuttings (Bergmann and Moon, 1997 and Bergmann, 1998). *In vitro* propagation from axillary buds is a useful technique for producing clonal plantlets while plant regeneration via adventitious bud induction is an interesting tool in order to introduce new characteristics of agronomic value, explore variability and to develop new varieties through genetic transformation. Micropropagation from mature trees of about 15 years old of *P. tomentosa* has been reported via axillary shoot development (Burger, 1989 and Song *et al*., 1989). Whereas adventitious bud regeneration has scarcely been investigated in this species, and limited to those reporting bud formation from hypocotyl (Marcotrigiano and Stimart, 1983) and leaf explants from seedlings, protocols for adventitious shoot regeneration in other different *Paulownia* species and hybrids have been defined (Rao *et al*., 1996; Yang *et al*., 1996 and Bergmann and Moon, 1997). Although the adventitious buds were also initiated from explants taken from juvenile material of unproven value, specifically from *in vitro*-grown seedlings. Yang *et al*. (1996) mentioned that the adventitious shoot induction from mature material has only been reported in *P. catalpifolia* leaf explants isolated from *in vitro* shoot cultures, although the age of the parent tree is not given. Recently, in the most of the countries of the world, planting of *Paulownia* trees around the cities is widely progressed because of its importance in filtration the air. This kind of trees was imported to Iraq and costs a huge amount of money so it is important to find a cheap and reliable way to micropropagate this important tree leading to mass production. The aim of this study is to reach a successful protocol for propagating this type of trees via tissue culture by testing the effect of growth regulators (cytokinin and auxin) on the multiplication and rooting stages of *in vitro* propagation of *Paulownia tomentosa*.

MATERIALS AND METHODS

The current investigation was carried out in plant tissue culture laboratory of the scientific research center, Faculty of science, University of Duhok, Kurdistan Region of Iraq during the period of July 2012 to April 2013. Lateral buds were taken from a mother plant of *P. tomentosa* Steud. (1.5-2 cm long); the explants were rinsed under running tap water for an hour and drops of dishwashing liquid detergent were added every 10 minutes. The explants were transferred to a sterile laminar flow cabinet to complete the disinfestation using 70% of ethanol for 1 minute; washed three times by sterile distilled water after that the explants were sterilized by NaOCl 25% for 15 minutes; and washed three times by sterile distilled water. After disinfestations, explants (containing 2 opposite nodes) were cultured on Murashige and Skooge medium (MS) (Murashige and Skooge, 1962) supplemented with 1 mgl^{-1}Benzyl adenine (BA) and 1mgl^{-1} Gebberellic acid (GA_3). After six weeks of culture, the produced shoots from the initiation stage were cut into several parts, each of which contained 2 opposite nodes to be cultured in multiplication medium. For the multiplication stage, two experiments were carried out at the first experiment the explants were cultured on MS medium supplemented with BA in 0, 0.5, 1.0 and 1.5 mg^{-1} with 0 and 0.1mg^{-1}Naphthalene acetic acid (NAA), Indole-3-butyric acid (IBA) and at the second experiment the explants were cultured on MS medium supplemented with Kinetin at 0, 1.0, 2.0 and 3.0 mg^{-1} with 0.0 and 0.1 mg^{-1} NAA or IBA in addition to their treatment combinations. After six weeks of incubation on multiplication medium, the microshoots were transferred to the rooting medium. To determine the most suitable auxins, concentrations and salt strengths of MS medium for rooting, microshoots were cultured on either full or half strength of MS medium supplemented with 0, 0.5, 1.0 and 1.5 mg^{-1} of NAA, IBA or Indole acetic acid (IAA); After 6 week incubation on rooting medium, the rooted plantlets were taken and washed thoroughly with water to remove adhering medium and then immersed in a beaker containing 1 gm^{-1} Benlet fungicide for 10 minutes and then washed with distilled water. Finally, the rooted plantlet were transferred to pots containing autoclaved peatmoss, loam and Styrofoam (1:1:1) (v:v:v). The pots were placed in a sterilized box and covered by polyethylene cover and during the first week the plantlets were foliar sprayed with quarter strength of MS salts as needed and in the second week the plastic cover was poured and then removed.

In this study, all charts, tables and statistical tests were performed with the ADE-4 (Thioulouse *et al*., 1997) and statistic packages provided with the R 2.15.0. Statistical software program version 2012 (R Development Core Team, 2009).

RESULTS AND DISCUSSION

The results showed that growth regulators play an important role for both establishment and rooting stages as well as for successful propagation of *Paulownia tomentosa* Steud.

A. Effect of growth regulators on Paulownia's shoot traits:

P. tomentosa tree species *in vitro* propagation were successful in this investigation by producing healthy seedlings. The results of this study showed that the most growth regulators had positive effect on the number of leaves as compared with the control (Figure 1).

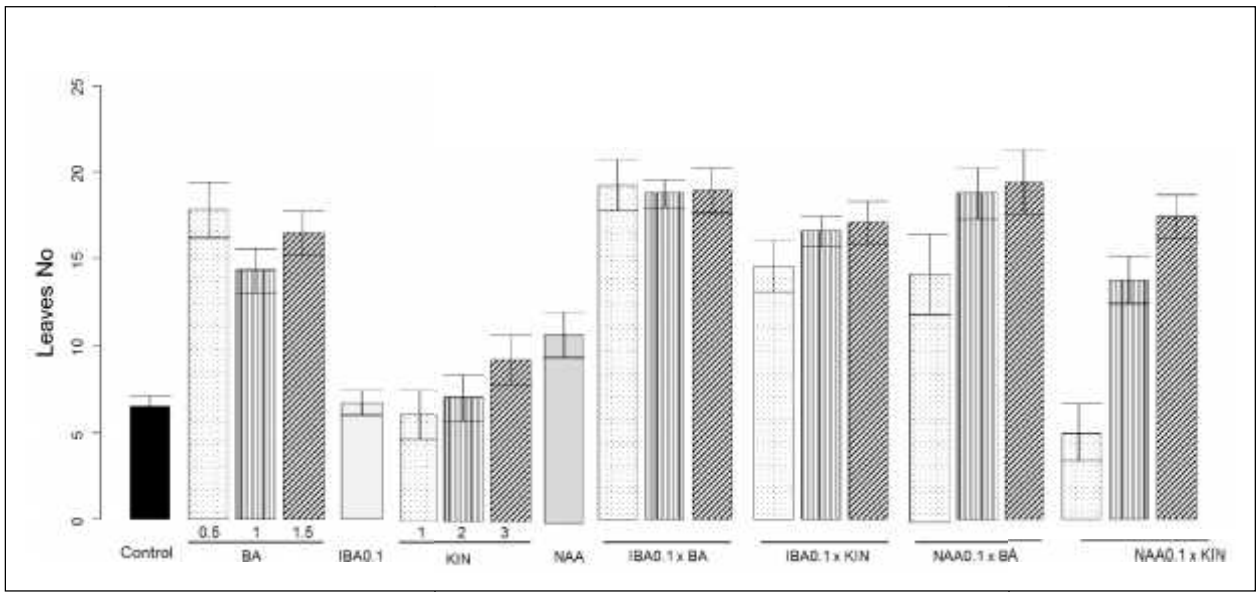

Fig. (1): Effect of growth regulators on *Paulownia tomentosa* leaves number afterfour weeks of culturing .

In fact, when every growth regulator was used alone, the highest number of leaves per explant was achieved. Since, when 0.5mgl^{-1} of BA was used, 17.83 leaves/ explant were recorded as shown in Table (1) followed by 1.5 and 1mgl^{-1} BA (16.5 and 14.3 leaves/explant) respectively. However *Paulownia* had a little positive response to IBA (means of leaves number = 6.66) and Kin (leaves number = 6.16, 7.16, 9.33 according to 1, 2, 3 mgl^{-1} respectively). It is worth noted that the interaction between auxins and cytokinens had the best effect on leaves number as compared with the utilization each one alone. Figure (1) shows that *P. tomentosa* tree species responded more positively to MS medium supplemented with BA 1mgl^{-1} and NAA 0.1mgl^{-1} (19.5 leaves). Furthermore, the combination between Kin with IBA and NAA had also increased the leaves number of paulownia tree species. Neverless, the interaction between Kin (1 mg/l) and NAA was the only one treatment that decreased the number of leaves (5 leaves/explant) as compared with the control (6.5 leaves/explant). Figure (2) as well as Table (1) show the effect of growth regulators on the average length of shoots. For example, the highest length of shoots (2.94 cm) was obtained when 0.5 mgl^{-1} BA was added followed by 1mgl^{-1} BA with 0.1mgl^{-1} NAA (2.91 cm) while the shortest average length (0.72 cm) was obtained from the treatment1mgl^{-1} Kin with 0.1mgl^{-1} NAA.

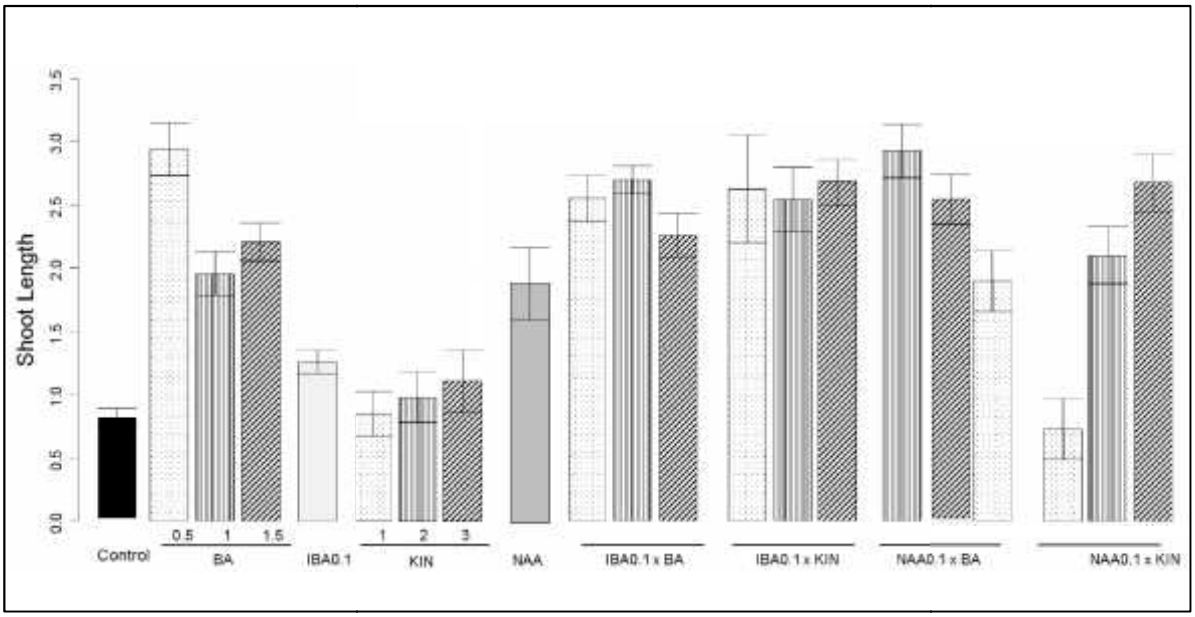

Fig. (2): Effect of growth regulators on *Paulownia tomentosa* shoot length after four weeks of culturing.

Table (1): Effect of growth regulators on shoot multiplication of *Paulownia tomentosa* after four weeks of cultur:

Growth Regulators (mgl $^{-1}$)	Morashige and Skoog Media	Number of leaves / expland	Shoots length (cm)	Number of Noden / explant
Control	0	6.5 (0.55)	0.79 (0.07)	3.25 (0.27)
BA	0.5	17.83 (1.58)	2.94 (0.21)	10.5 (1.42)
	1	14.33 (1.25)	1.95 (0.17)	7.16 (0.62)
	1.5	16.5 (1.25)	2.21 (0.15)	8.25 (0.62)
IBA	0.1	6.66 (0.71)	1.25 (0.09)	3.33 (0.35)
KIN	1	6.16 (1.38)	0.83 (0.18)	3.08 (0.69)
	2	7.16 (1.33)	0.98 (0.19)	3.5 (0.64)
	3	9.33 (1.44)	1.11 (0.24)	4.25 (0.81)
NAA	0.1	10.91 (1.33)	1.9 (0.23)	5.45 (0.66)
IBA x BA	0.1 x 0.5	19.33 (1.46)	2.54 (0.18)	9.66 (0.73)
	0.1 x 1	18.83 (0.83)	2.69 (0.11)	9.41 (0.41)
	0.1 x 1.5	19 (1.29)	2.25 (0.16)	9.41 (0.65)
IBA x KIN	0.1 x 1	14.66 (1.52)	2.62 (0.42)	7.25 (0.78)
	0.1 x 2	16.66 (0.89)	2.53 (0.25)	8.33 (0.44)
	0.1 x 3	17.16 (1.19)	2.66 (0.18)	8.58 (0.59)
NAA x BA	0.1 x 0.5	18.83 (1.48)	2.91 (0.21)	9.5 (0.73)

	0.1 x 1	19.5 (1.86)	2.52 (0.19)	9.75 (0.93)
	0.1 x 1.5	14.33 (2.32)	1.88 (0.28)	7.08 (1.15)
NAA x KIN	0.1 x 1	5 (1.64)	0.72 (0.24)	2.5 (0.82)
	0.1 x 2	13.83 (1.41)	2.11 (0.22)	6.91 (0.71)
	0.1 x 3	17.5 (1.23)	2.67 (0.22)	8.75 (0.61)

The results revealed that the highest number of nodes per explant was obtained when 0.5mgl^{-1} BA was used which gave 10.5 nodes while the lowest number of nodes was achieved when 1mgl^{-1} Kin with 0.1mgl^{-1} NAA was used (2.5 nodes) (Table and Figure 3).

These results confirmed the importance of auxins and cytokinins in plant growth and development especially the latter ones. This is because of the important role of cytokinins in enhancing the synthesis of RNA, protein and enzymes inside the cell which promote bud growth as well (Al-Rifae´e and Al-Shobaki, 2002).

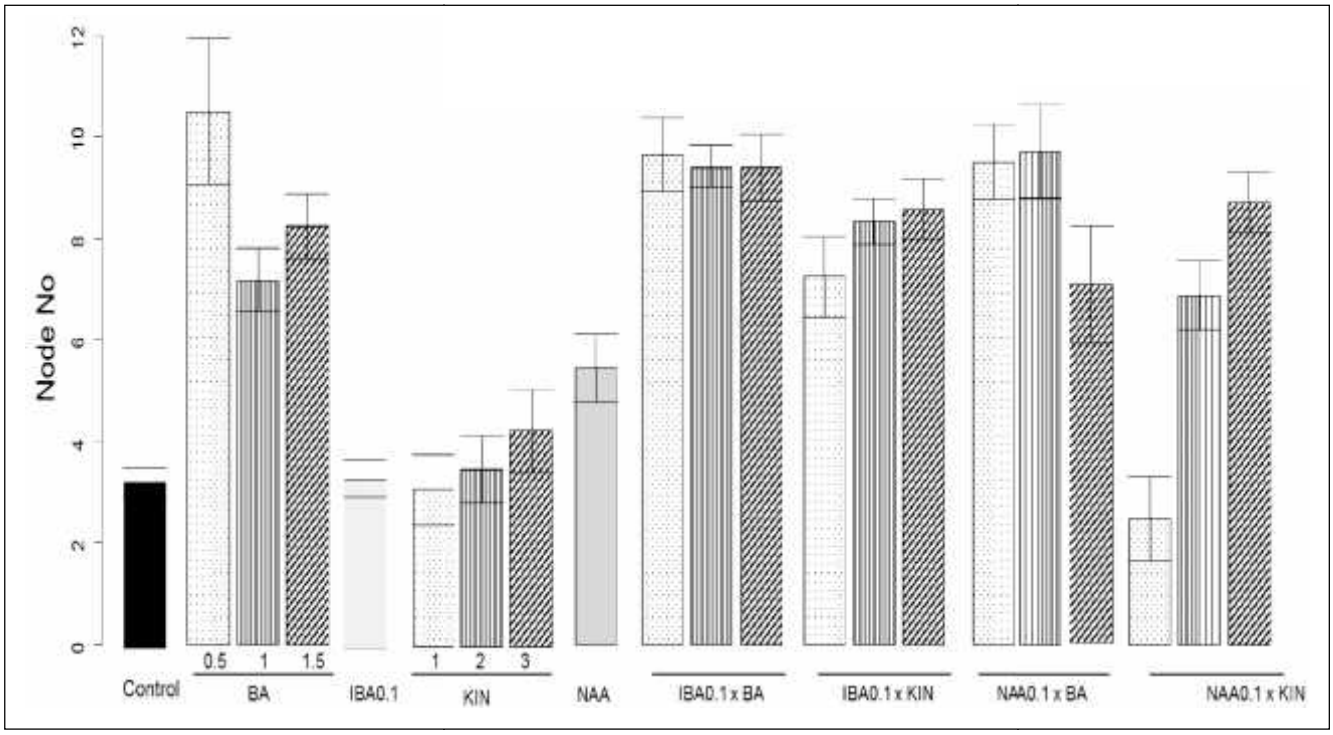

Fig. (2): Effect of growth regulators on *Paulownia tomentosa* Node number after four week of culturing.

The reasons behind the positive role of BA on the multiplication stage might be due to its profound role in releasing lateral buds from the dominance of terminal buds without the need to remove the apical bud by promoting formation of xylem tissues of buds which facilitate the transformation of water and nutrient leading to lateral bud growth (Mohammed and Al-Younis, 1991).

B. Effect of growth regulators and MS salt strength on root traits:

At rooting stage, two MS salts strengths and different concentrations of auxins (NAA, IBA, and IAA) were used. Table (2) shows the effect of

MS salt strength and auxins on the number of roots and mean length of roots.

Generally, the half strength of MS medium had more effect for giving a higher number of roots than full MS strength (Figure 4). In fact, the highest number of roots per explant (11.6 roots) was obtained when half strength of MS medium was supplemented with 0.5 mgl^{-1} NAA followed by the treatment of the same strength of MS medium with 1.5mgl^{-1} IBA (9.33 roots/ explant) while the lowest number of roots (1.5 roots/explant) was obtained when full strength of MS salts medium was enriched with 1.5 mgl^{-1} NAA.

Table 2: Effect of growth regulators and MS salt strength on root traits of *Paulownia tomentosa* after four weeks of culturing.

Murashige and Skoog Media	Growth Regulators (mgl^{-1})	Root number	Root length
1	0	0.16	0.58
0.5	0	3.33 (0.25)	7.08 (0.74)
0.5	IAA 0.5	3.75 (0.88)	5.83 (1.22)
	IAA 1	9 (0.82)	6.16 (1.01)
	IAA 1.5	8.83 (0.88)	7.41 (0.91)
	IBA 0.5	6.41 (0.74)	6.66 (0.88)
	IBA 1	8.5 (0.98)	6.08 (0.82)
	IBA 1.5	9.33 (1.09)	4.66 (0.63)
	NAA 0.5	11.6 (1.38)	7.75 (0.83)
	NAA 1	4.5 (0.61)	2.91 (0.61)
	NAA 1.5	4 (0.67)	3.08 (0.58)
1	IAA 0.5	4.58 (0.71)	7.41 (0.79)
	IAA 1	5.5 (0.84)	6.41 (1.04)
	IAA 1.5	7.41 (1.06)	8.33 (1.29
	IBA 0.5	4.25 (0.65)	5.75 (0.76)
	IBA 1	5.91 (0.35)	6.33 (0.64)
	IBA 1.5	7.91 (0.57)	7.75 (0.61)
	NAA 0.5	5.75 (0.85)	9 (2.01)
	NAA 1	2.5 (0.37)	2.91 (0.83)
	NAA 1.5	1.5 (0.43)	2.87 (0.87)

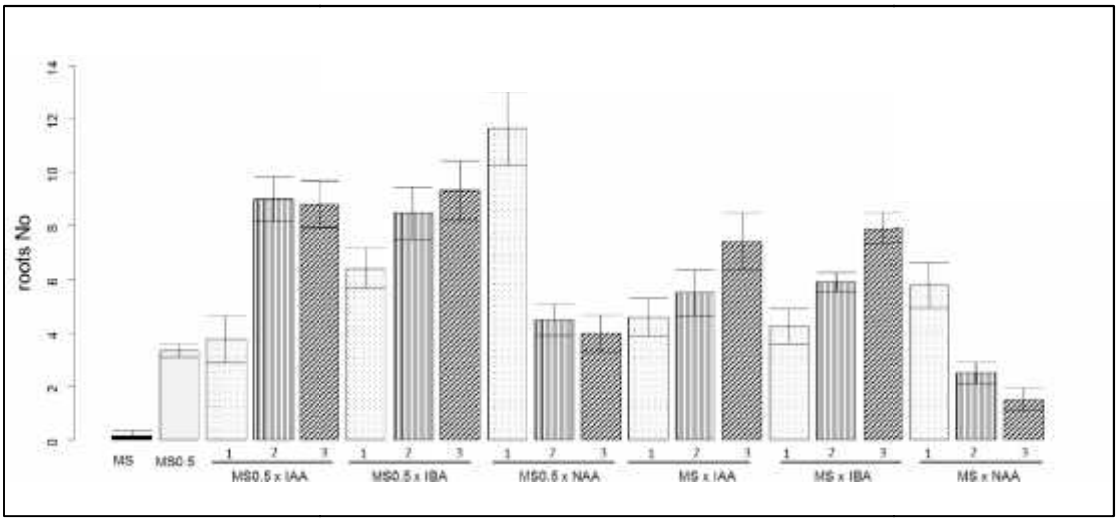

Fig. (4): Effect of growth regulators onroot number of *Paulownia tomentosa* after four weeks of culturing.

Table (2) and Figure (5) show the effect of MS salt strength and auxins on the mean length of roots. The longest roots (9 cm) were obtained when full MS salts medium enriched with 0.5 mgl^{-1} NAA was used followed by the treatment of full MS with 1.5 mgl^{-1} IAA which gave 8.33 cm.

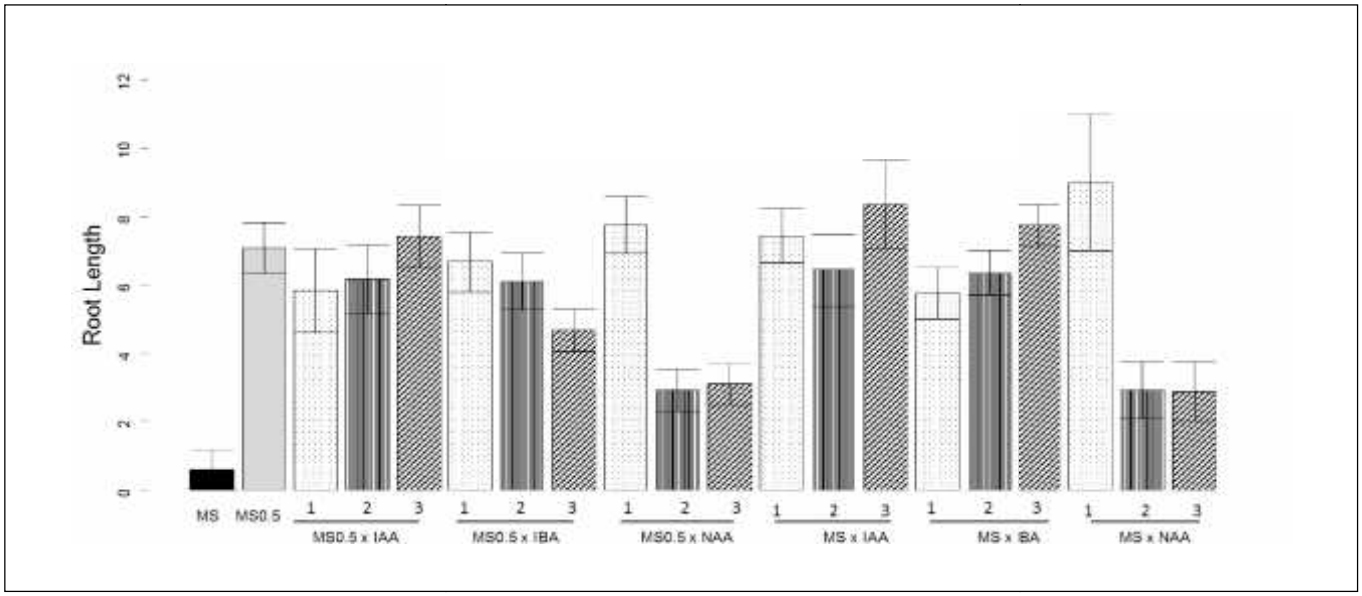

Fig. (5): Effect of growth regulators onrrots length of *Paulownia tomentosa* after four weeks of culturing.

The superiority of half MS salts on the full MS salts in rooting traits is might be due to the higher C/N ratio since the same sucrose was used with both salt strengths. Decreasing the level of salts in the medium means decreasing the level of nitrogen in the medium to half or quarters, this will result in decreasing nitrogen level in the shoots which may result in increasing the percentage of carbohydrates to nitrogen level and this may result in increasing the percentage of root primordial and roots number (Gawel *et al.*, 1990).

The overall conclusion drawn from these results is that this important forest tree can be easily propagated using plant tissue culture technique and get benifit from this technique's advantages for further future micropropagation projects. This protocol was very realizable and producible (Figure 6) and can be progressed more by applying further investigations to test other *in vitro* effective factors.

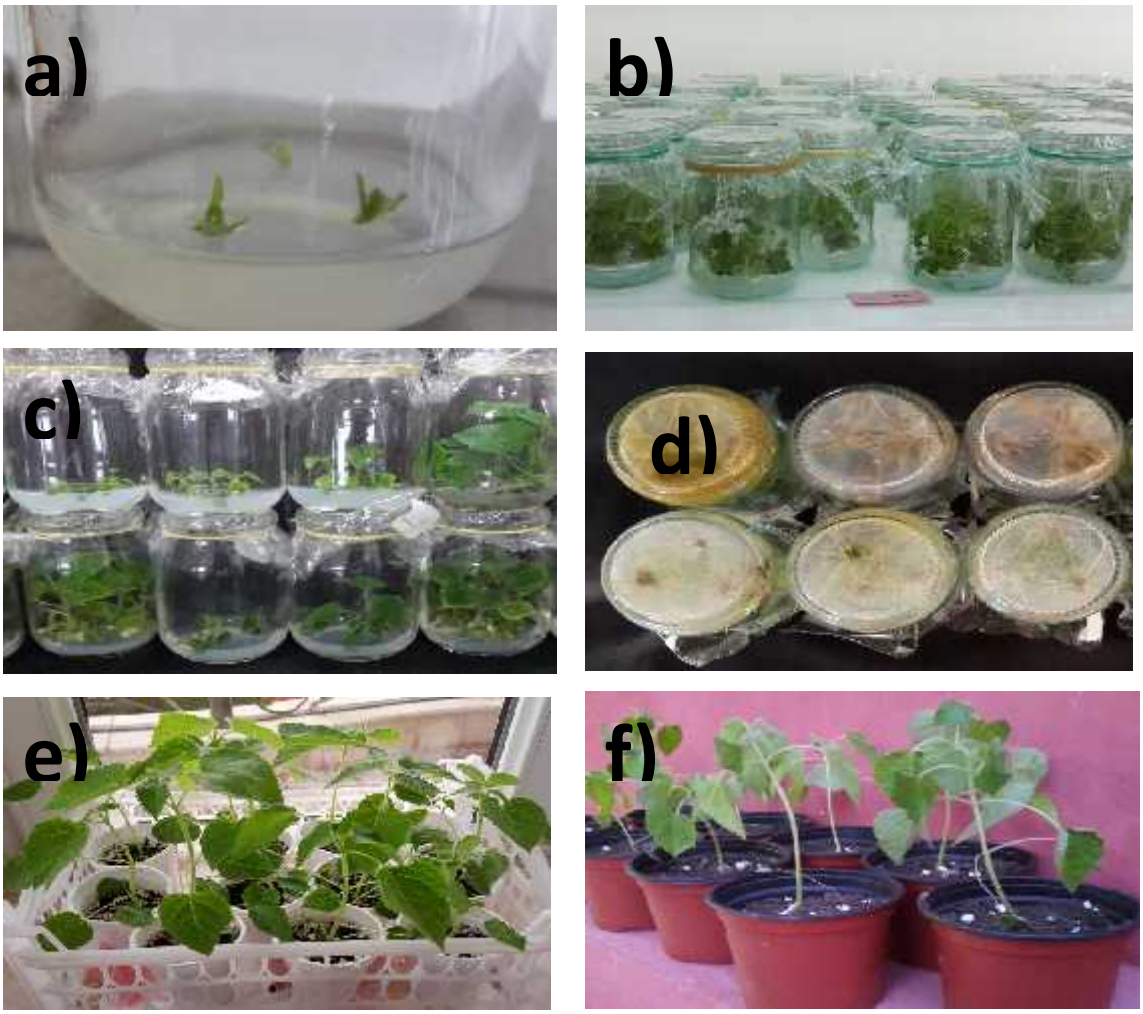

Fig. (6): Show the different stages of *in vitro* propagation of *Paulownia tomentosa*. a) and b) initiation stage; c) multiplication stage; d) rooting stage; e) and f) acclimatization stage.

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EFFECT OF CULTIVARS, COMPOST, HUMIC ACID AND THEIR INTERACTIONS ON YIELD AND FRUIT PHYSICAL CHARACTERISTICS OF SWEET CHERRY (*Prunus avium* L.).

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ABSTRACT

The present study was carried out on sweet cherry tree (*Prunus avium* L.), during the growing season of (2012-2013) on private orchard, located in the Bibad village near Amadi town / Duhok governorate-Kurdistan region-Iraq. The experiment was done in the orchard that contained two cultivars of sweet cherry ("Nefertity" and "Berlit"). The application of compost was done in December 25th 2012, at (0, 2, 4 and 6kg /tree), foliar spray of humic acid done at (0, 100, 200 mg.L^{-1} and 300mg.L^{-1}) and repeated after two weeks of first date of foliar spray of humic acid. The results are summarized as follows: Nefertity cultivar significantly dominated over cv. Berlit in number of fruit/kg, fruit weight, tree yields, fruit length, fruit diameter. Whereas cv. Berlit dominated in Fruit weight, fruit size. Compost application level especially at 4kg/tree has significantly increased number of fruit/Kg, fruit size, tree yield, fruit length, compost at level 2kg/tree significantly increased fruit length, fruit diameter, while 6kg/tree significantly increased fruit fresh weight, fruit length. Humic acid specially at 300 mg.L^{-1} significantly increased the number of fruit/Kg , tree yield, fruit length, fruit diameter, 200mg humic.L^{-1} increased fruit fresh weight, fruit size, while, humic acid at 100 mg.L^{-1} increased the fruit diameter. The interactions of cultivars, compost and humic acid had affected significantly on the most of the studied parameters. The more effective treatment interaction was cv. Nefertity + 4 Kg /tree of compost + 300 mg.L^{-1} of humic acid significantly increased tree yields.

***KEY WORD*:** Cherry cultivar, Compost, Humic acid

1-INTRODUCTION

The sweet cherry (*Prunus avium.* L.) belongs to the Rosaceae family, sub-family Prunidaecea (Rodrigues and Antunes, 2008). It is believed to have originated from the regions between the Black and Caspian Sea of Asia Minor. Seed spreading by birds carried it to Europe, where the earliest cultivation of sweet cherry was reported. Further spread to North America via English colonists occurred in the seventeenth century (Webster and Looney, 1996). Sweet cherry is one of the most popular temperate fruits. According to the (FAO, 2011), cherries produced worldwide, cherries are an important horticultural crop - approximately 2.2 million tons of cherries were produced worldwide in 2009 (Anonymous, 2010).Compost is a resource of converting organic waste material, such as food waste, yard waste and manure, into a matter called humus, a nutrient-rich soil amendment. Humus is an essential element in maintaining healthy soil and plant, making composting a useful tactic for nurturing productive agricultural fields, ornamental plants and grasses (Chiumenti, 2005).

The compost has an important role in the agriculture sector because it contain a high amount of elements necessary for plant growth and soil improvement , the use of compost as a fertilizer for plant in Iraq and Kurdistan has a large space and this is backward in the field of agriculture when we compare with the progressive countries. Thus, I was encouraged to use the compost as a first study in Kurdistan and Iraq in order to encourage our farmer to use the compost as a plant fertilizer. The risks and problems posed by heavy metals in fertilizers and other soil inputs have increasingly drawn the attention of farmers, environmental organizations, consumers, and public policymakers. This study examines a wide spectrum of soil amendments and fertilizers used in organic agriculture, including biosolids, major nutrient fertilizers, industrial wastes, composts, liming materials and micronutrient sources with a

Part of M.Sc.thesis of the second author

focus on inputs used in organic agricultural production in Iraq**.**

Humic substances are no one single chemical recognized as humic acid, since the chemical makeup has never been completely defined. These materials are composed of complicated organic mixtures which are associated together in a random manner, resulting in extraordinarily complex materials, it has been suggested that no two molecules of humus are exactly the same (Mikkelsen, 2005). This investigation aimed to study the responsible of two cultivars to local environmental condition, and their responsibility to fertilized by organic matter (compost and humic acid). However, it also to find a fertilization program that can replace the minerals which will be beneficial for organic production of sweet cherry, since there are little or no studies in Kurdistan about the role of organic fertilization in yield and quality of sweet cherry.

MATERIALS AND METHODS

This study was carried out in the Bibad village near Amadi town/ Duhok governorate Kurdistan region-Iraq. The orchard is situated at latitude: 37.05°N, and longitude 43.29° E and at an altitude of 1202 m above the sea level. The experiment included two cultivar of sweet cherry "Nefertity" and "Berlit", application of compost at different levels (0, 2, 4 and 6 kg /tree), and foliar spray of humic acid at concentrations (0, 100, 200 and 300 $mg.L^{-1}$). The compost which used in this experiment is consisting from resides waste of Dohuk city, is produced in Kawsha manufacture of compost fertilizer. The orchard experiment of compost application was done in December 25th 2012, by working hole around the tree under brunch projection and mixed with the soil in order to investigate the effect of soil application of four levels of compost. (0, 2, 4 and 6 kg /tree). The humic acid which used in the experiment is a liquid content analysis w/w, organic matter 5%, (K_2 O) 1%, total humic + fulvic acid 15%. The foliar spray of humic acid was done in April 15th 2013, after full bloom at four concentrations (0, 100, 200 and 300 $mg.L^{-1}$) and replicated the same concentrations after two weeks of the first spray. All the obtained data were tabulated and statistically analyzed with computer using SAS system (SAS, 1996). The experiment which conducted in this study followed by randomized complete block design in factorial experiment; the experiment comprised of 32 treatments with three replicates, each replicate was presented by one tree of each cultivar. The differences between various treatment means were tested with Duncun multiple range test at 5% level. (Al- Rawi and Khalaf-Alla, 2000).

Fruit and its Components Parameter:

1-Number of fruits (fruits/Kg)
2-Fruit fresh weight (g/fruit)
3-Fruit size (cm^3)
4-Yield per tree (Kg/tree)
5-Fruit length (mm)
6- Fruit diameter (mm)

RESULTS AND DISCUSSIONS

1-Numbers of fruit/ Kg

It is clear from figure (1) cleared the numbers of fruit per Kg in cv. Nefertity significantly more than cv. Berlit. Clearly shows that application of compost especially at (4 kg/tree) significantly increasing number of fruit per Kg. compared to control. The same figure also display the humic acid at (300 $mg.L^{-1}$) was significantly superior which recorded (249.2 fruits/Kg), however the lowest value was recorded in control (215.7 fruits/Kg).

Refers the interaction in table (1) shows that the interaction between cv. Nefertity with (2 kg/tree) of compost was the best treatments to increasing the number of fruits to compare with control.

Demonstrates that interaction between cv. Nefertity with (300 $mg.L^{-1}$) of humic acid significantly increased the number of fruits were compared with all other interactions. Same table manifests the results of interaction between (6 kg/tree) of compost with (300 $mg.L^{-1}$) of humic acid produced the highest significant value in number of fruits (266.8 fruits/Kg) as compared with other treatments. Also the interaction among the cv. Berlit + 6 kg/tree of compost + 300 $mg.L^{-1}$ of humic acid provided the best treatments (278.66 fruits/Kg) were compared with control.

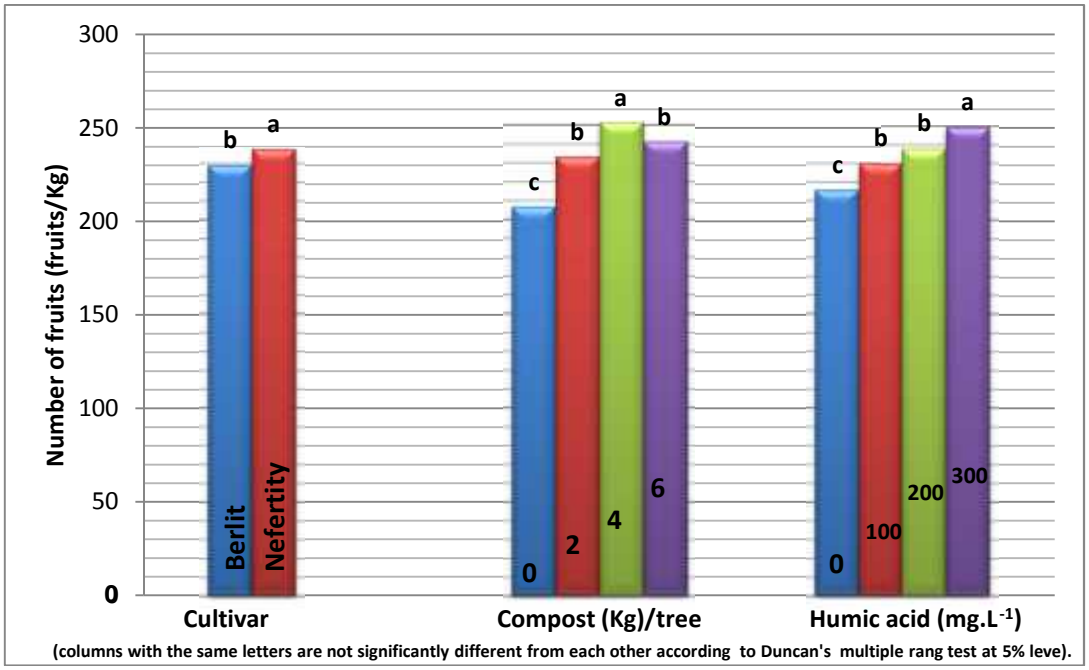

Fig. (1): Effect of cultivar, compost and humic acid on number of fruits (fruits/kg).

Table (1): The interactions effect of cultivar, compost and humic acid on fruit number/kg of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg/tree) 0	2	4	6	Cultivar × Humic
Berlit	**0**	182.6 l	207.6 f-i	247.3b-d	205.0 f-i	210.6 d
	100	191.0 hi	215.6e-h	255.6 ab	254.6 ab	229.2 bc
	200	191.0 hi	218.6e-g	263.3 ab	266.66ab	234.9 b
	300	200.0 f-i	225.3 c-f	260.3 ab	278.66 a	241.0 b
Nefertity	**0**	195.3 g-i	224.0 d-f	219.3e-g	245.0 b-d	220.9 cd
	100	202.0 f-i	259.6 ab	246.0b-d	215.6 e-h	230.8 bc
	200	241.3b-e	252.6 ab	258.6 ab	210.0 f-h	240.6 b
	300	250.6 bc	262.6 ab	261.6 ab	255.0 ab	257.5 a
Cultivar × Compost						
Cultivar	**Berlit**	191.1 d	216.8 c	256.6 a	251.2 a	
	Nefertity	222.3 bc	249.7 a	246.4 a	231.4 b	
Humic acid × Compost						
Humic acid (mg.L^{-1})	**0**	189.0 f	215.8 e	233.3c-e	225.0 de	
	100	196.5 f	237.6 cd	250.8 a-c	235.1 cd	
	200	216.1 e	235.6 cd	261.0 ab	238.3 cd	
	300	225.3 de	244.0 bc	261.0 ab	266.8 a	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

2-Fruit fresh weight (g/fruit)

The figure (2) shows that there were no significant differences between two cultivars on fruit fresh weight. Obviously shows that application of compost at level (6 Kg/tree) was significantly superior which recorded (5.1 g), while the lowest values were recorded with other treatments. Reveals the data which obtained from the humic acid at (200 and 300 mg.L^{-1}) was better treatment compared to other treatments.

Displays the interaction effect in the table (2) the beginning interaction between both cultivar with (6 kg/tree) compost gave the highest values were compared with other treatments. The interaction between cv. Nefertity plus (300 mg.L^{-1}) of humic acid, were significantly differences were compared with other treatments. The interaction between (6 kg/tree) of compost plus (200 mg.L^{-1}) of humic acid was produced the highest significant value in fruit fresh weight (5.9g). The same table demonstrates that the interaction effect of cv. Nefertity + (6 kg/tree) compost + (200 mg.L^{-1}) of humic acid which gave the highest value (6.2 g) compared with most treatments.

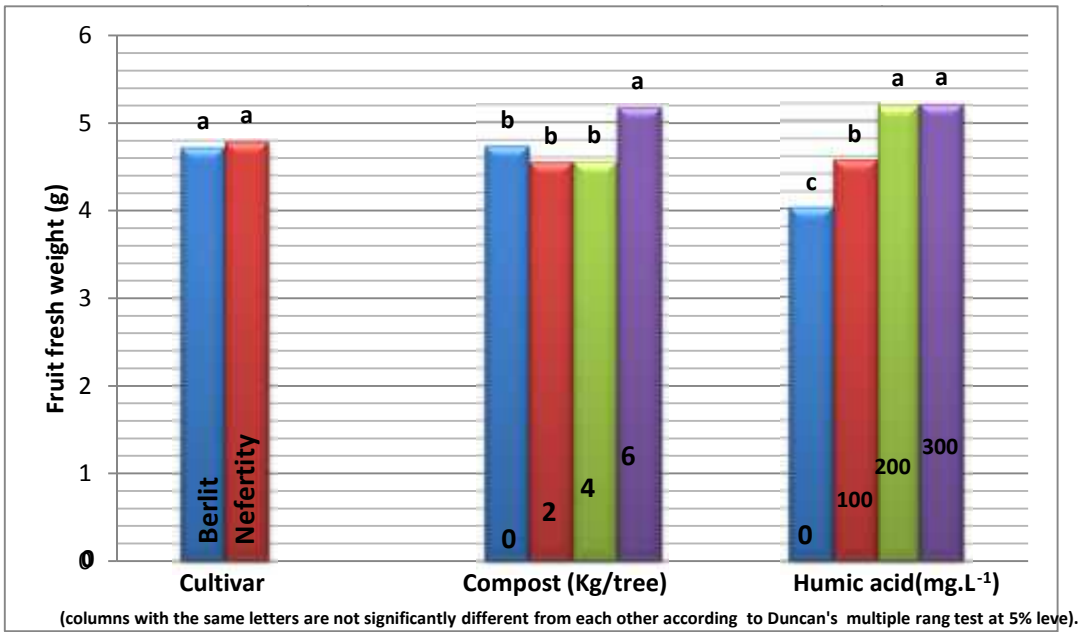

Fig. (2): effect of cultivar, compost and humic acid on fruit fresh weight (g/fruit) of sweet cherry.

Table (2): The interactions effect of cultivar, compost and humic acid on fruit fresh weight (g/fruit) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg/tree) 0	2	4	6	Cultivar × Humic
Berlit	0	3.5 j	3.6 j	4.7 e-h	4.8 d-f	4.1 f
	100	4.8 d-g	4.6 f-h	4.5 e-h	4.5 e-h	4.6 de
	200	5.2 b-e	5.0 c-f	4.4 f-i	5.7 a-c	5.1 bc
	300	5.0 d-f	5.2 b-f	4.1 g-j	5.2 b-e	4.9 bc
Nefertity	0	3.9 h-j	3.6 j	3.6 j	4.0 g-j	3.8 g
	100	4.9 d-f	3.8 ij	4.4 f-i	4.6 e-h	4.4 ef
	200	5.1 c-f	4.9 b-f	4.8 d-f	6.2 a	5.2 ab
	300	5.1 c-f	5.4 b-d	5.5 a-d	5.9 ab	5.5 a
Cultivar × Compost						

Cultivar	**Berlit**	4.6 b	4.6 b	4.4 b	5.1 a
	Nefertity	4.8 b	4.4 b	4.6 b	5.2 a
		Humic acid × Compost			
Humic acid ($mg.L^{-1}$)	**0**	3.7 ij	3.6 j	4.2 hi	4.4 gh
	100	4.8 c-g	4.2 hi	4.5 f-h	4.6 e-h
	200	5.1 b-d	4.9 c-f	4.6 e-h	5.9 a
	300	5.0 c-e	5.3 bc	4.8 d-g	5.6 ab

Means of each interaction followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

3-Fruit size (cm^3)

The figure (3) shows the size of fruit in cv. Berlit had significant differences with the cv. Nefertity .Evidently shows that compost at level (4 kg/tree) was significantly superior, which documented (5.3 cm^3), while the lowest value noted in control (4.4 cm^3). Reveals the data which obtained from the foliar spray of humic acid at (200 $mg.L^{-1}$) was better treatments, which recorded (5.5 cm^3), while the lowest value was recorded in control (4.2 cm^3).

About the interaction effect in the table (3) shows interaction between cv. Berlit with (4 kg/tree) of compost had significantly increasing the fruit size, and provided the best value (5.7 cm3) were compared with control. The interaction of cv. Berlit plus (200 $mg.L^{-1}$) humic acid which gave the highest significant value were compared with control. Also the interaction between (4 kg/tree) of compost with (200 $mg.L^{-1}$) humic acid which provided the highest significant value in fruit size (5.9cm 3).

The similar table indicates that the cv. Berlit plus (4 kg/tree) of compost plus (200 $mg.L^{-1}$) of humic acid which provided the highest value (6.5cm3) compared with control.

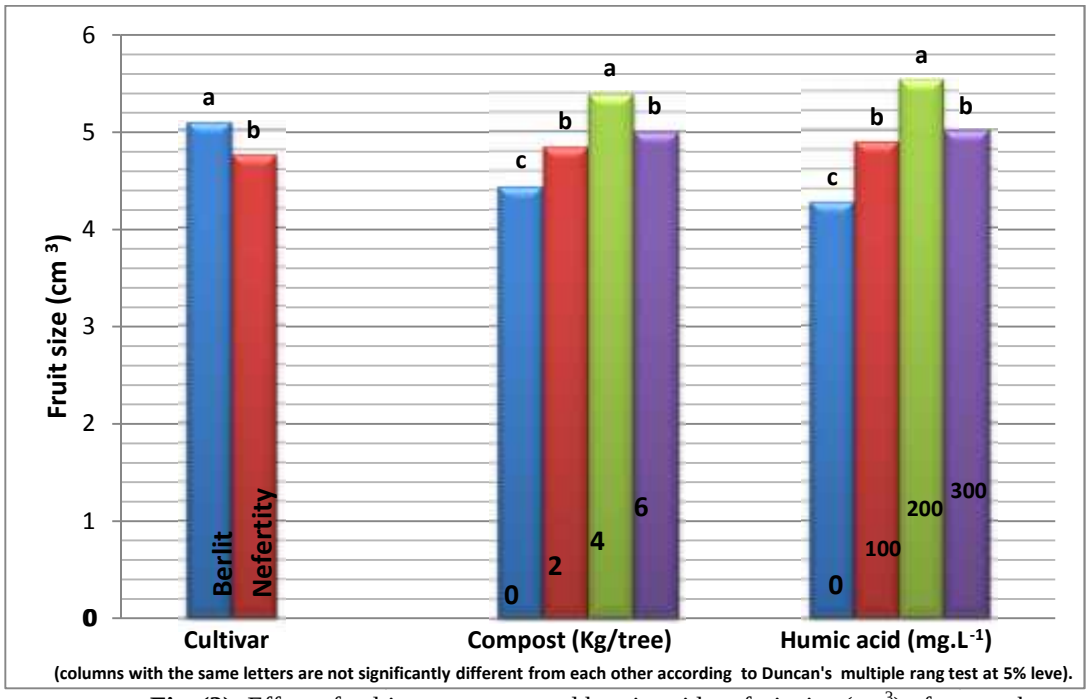

Fig. (3): Effect of cultivar, compost and humic acid on fruit size (cm^3) of sweet cherry.

Table (3): The interactions effect of cultivar, compost and humic acid on fruit size (cm^3) of sweet cherry.

Cultivar	Humic acid ($mg.L^{-1}$)	Compost (Kg/tree)				Cultivar × Humic
		0	2	4	6	
Berlit	0	3.6 j-l	4.5 j-i	5.6 a-g	4.4 h-j	4.5 c
	100	4.8 d-i	4.9 d-i	5.8 a-e	4.5 g-j	5.0 bc
	200	5.8 a-e	6.0 a-c	6.5 a	4.7 e-i	5.7 a
	300	4.8 e-i	5.6 a-f	5.0 c-i	4.2 i-k	4.9 bc
Nefertity	0	3.1 ll	3.3 kl	4.6 f-j	4.6 f-j	3.9 d
	100	4.3 h-k	4.4 h-j	5.0 c-i	5.0 c-i	4.7 c
	200	4.5 h-j	4.8 d-i	5.3 b-g	6.2 ab	5.2 b
	300	4.3 h-k	4.9 c-i	5.0 c-i	5.9 a-d	5.0 bc
Cultivar × Compost						
Cultivar	**Berlit**	4.7 de	5.2 bc	5.7 a	4.5 ef	
	Nefertity	4.0 f	4.4 e	5.0 cd	5.4 ab	
Humic acid × Compost						
Humic acid ($mg.L^{-1}$)	**0**	3.3 f	3.9 ef	5.1 b-c	4.5 de	
	100	4.6 c-e	4.6 cd	5.4 b-c	4.8 b-d	
	200	5.1 b-c	5.4 ab	5.9 a	5.5 ab	
	300	4.5 de	5.3 a-c	5.0 b-c	5.0 b-c	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

4-Tree Yield (Kg/Tree)

The figure (4) shows that there are no significant differences between two cultivar on tree yield. Obviously shows that the compost at level (4 kg/tree) was significantly superior which recorded (20.5 kg/tree), and the lowest value was recorded in control (13.7 kg/tree. Reveals the data which obtained from the effect of humic acid at (300 $mg.L^{-1}$) was better treatment which recorded (19.4 kg/tree), while the lowest value was noted in control (14.7 kg/tree) it means application of (200$mg.L^{-1}$) cased 19.3 % increasing in yield.

Display the interaction effect, the table (4) shows that interaction between cv. Nefertity with (4 kg/tree) of compost gave the highest value (21.0 kg/tree)

compared with control. The interaction between cv. Nefertity with foliar spray of humic acid at (300 $mg.L^{-1}$) was significantly increasing the tree yields; however the lowest value was recorded with control. Also the results which obtained from interaction (4 kg/tree) of compost with (200 $mg.L^{-1}$) of humic acid demonstrates the highest significant value in tree yield (23.3 kg/tree), but the lowest tree yield was observed in control (10.1 kg/tree). The similar table indicants the interaction of cv. Nefertity + (4 kg/tree) of compost with (300 $mg.L^{-1}$) humic acid gave the highest value (24.0 kg/tree) compared with control. It means the mention interaction cased 167% increasing in yield.

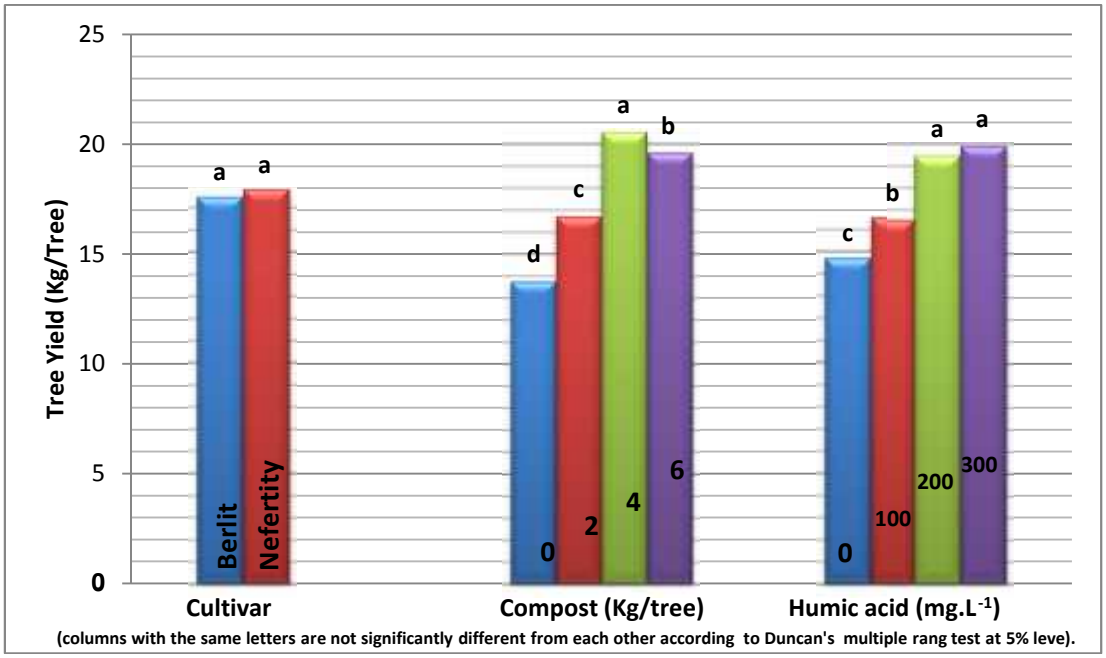

Fig. (4): Effect of cultivar, compost and humic acid on tree yield (kg/tree) of sweet cherry.

Table (4): The interactions effect of cultivar, compost and humic acid on tree yield (kg/tree) of sweet of cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg/tree) 0	2	4	6	Cultivar × Humic
Berlit	**0**	11.3 o	12.6 no	16.0k-m	17.3 h-l	14.3 e
	100	12.0 o	17.0 i-m	21.0 c-f	18.0 g-k	17.0 c
	200	14.6 mn	21.0 c-f	23.0 a-c	19.0 p	19.4 b
	300	20.3 e-g	15.0 l-n	20.0 e-g	21.3 b-d	19.1 b
Nefertity	**0**	9.0 p	13.0 no	18.6 f-j	19.6 d-h	15.0 de
	100	11.3 o	16.0k-m	18.0 g-k	19.0 e-i	16.0 cd
	200	15.0 l-n	19.0 e-i	23.6 ab	20.3 e-g	19.5 b
	300	16.3 j-m	20.0 e-g	24.0 a	22.1 a-d	20.6 a
Cultivar × Compost						
Cultivar	**Berlit**	14.5 d	16.4 c	20.0 ab	18.9 b	
	Nefertity	12.9 e	17.0 c	21.0 a	20.2 a	
Humic acid × Compost						
Humic acid (mg.L^{-1})	**0**	10.1 g	12.8 f	17.3 cd	18.5 bc	
	100	11.6 fg	16.5 d	19.5 b	18.5 bc	
	200	14.8 e	20.0 b	23.3 a	19.6 b	
	300	18.3 bc	17.5 cd	22.0 a	21.7 a	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

5-Fruit length (mm)

Display in the figure (5) the fruit length in cv. Nefertity had significant differences with cv. Berlit. The soil application of compost shows that didn't affect on fruit length. Foliar spray of humic acid at a (300 mg.L^{-1}), significantly increasing fruit length which registered (20.9 mm), while the lowest value was recorded in control (18.5 mm).

Shows the interaction effect in the table (5) between cv. Nefertity with (6 kg/tree) of compost significantly increasing the fruit length, and provided the highest value (20.9mm) were compared with control. Displays the interaction between the cv. Nefertity with humic acid at (300 mg.L^{-1}), was the best treatment were compared with other treatments. The results of interaction between (2 kg/tree) of compost plus humic acid at (200 mg.L^{-1}) produced the better value in fruit length (20.5 mm), were compared with other treatments. Also the interaction of cv. Nefertity plus (6 kg/tree) compost plus (300 mg.L^{-1}) humic acid which provided the highest value (22.1 mm) compared with control.

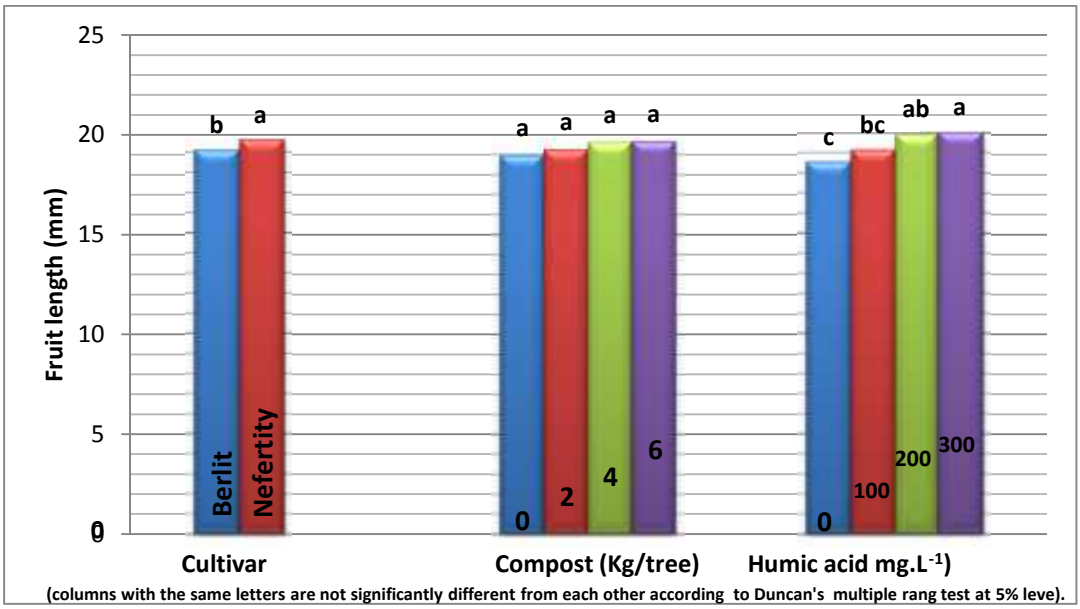

Fig. (5): Effect of cultivar, compost and humic acid on fruit length (mm) of sweet cherry.

6-Fruit diameter (mm)

The figure (6) indicated that there are no significant differences between two cultivar on fruit diameter. The soil application of compost at a level (2 kg/tree) was the best treatments which recorded (20.7 mm) and the lowest value was recorded in control (19.5 mm). Clearly shows that the humic acid at a (300 mg.L^{-1}) was best treatment which registered (20.4 mm), while the lowest value was recorded in control (19.3 mm).

About the interaction in the table (6) shows the cv. Nefertity with (6 kg/tree) of compost which gave the highest value (20.9mm) had significantly affected on fruit diameter were compared with control. Also display the cultivar Berlit with humic acid at (300 mg.L^{-1}) which gave the best treatment was compared with other treatments. The interactions between (2 kg/tree) of compost with (300 mg.L^{-1}) of humic acid produced the highest significant value in fruit diameter (21.9 mm), while the lowest values were observed in control (18.3 mm).The similar table concerning the combination between cv. Berlit + (2 kg/tree) of compost + (300 mg.L^{-1}) of humic acid which provided the highest significant deference fruit diameter were compared with control.

Table (5): The interactions effect of cultivar, compost and humic acid on fruit length (mm) of sweet cherry.

Cultivar	Humic acid (mg.L^{-1})	Compost (Kg/tree) 0	2	4	6	Cultivar × Humic
Berlit	**0**	17.4 g	18.4 fg	19.9 a-g	18.2 fg	18.5 c
	100	18.5 e-g	18.8 e-g	19.4 c-g	18.6 e-g	18.8 c
	200	19.1 c-g	21.4 a-d	19.3 c-g	18.4 fg	19.5 a-c
	300	21.8 ab	18.9 d-g	18.7 e-g	18.3 fg	19.4 a-c
Nefertity	**0**	17.4 g	18.1 hg	19.2 c-g	19.4 c-g	18.5 c
	100	19.1 c-g	18.6 e-g	19.3 c-g	20.5 a-f	19.4 bc
	200	19.1 c-g	19.6 b-g	19.9 a-g	21.5 a-c	20.0 ab
	300	19.1 c-g	19.9 a-f	21.0 a-e	22.1 a	20.5 a
Cultivar × Compost						
Cultivar	**Berlit**	19.2 bc	19.4 bc	19.3 bc	18.4 c	
	Nefertity	18.7 c	19.1 bc	19.8 b	20.9 a	
Humic acid × Compost						
Humic acid (mg.L^{-1})	**0**	17.4 d	18.2 cd	19.5 a-c	18.8 a-d	
	100	18.8 a-d	18.7 b-d	19.3 a-c	19.6 a-c	
	200	19.1 a-c	20.5 a	19.6 a-c	19.9 a-c	
	300	20.4 a	19.4 a-c	19.9 a-c	20.2 ab	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

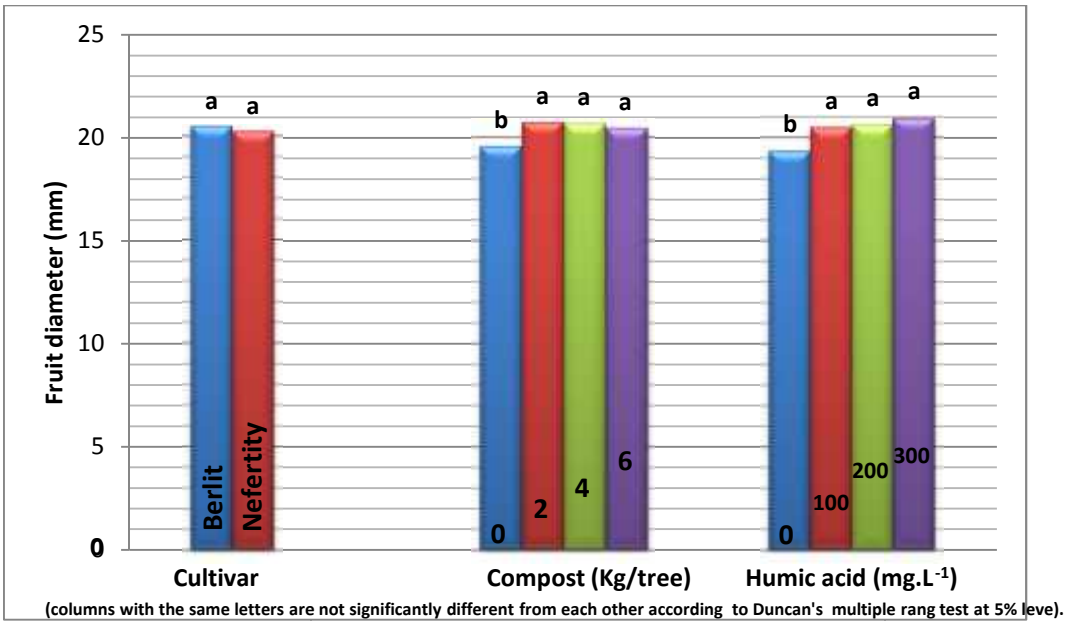

Fig. (6): Effect of cultivar, compost and humic acid on fruit diameter (mm) of sweet cherry.

Table (6): The interactions effect of cultivar, compost and humic acid on fruit diameter (mm) of sweet cherry.

Cultivar	Humic acid ($mg.L^{-1}$)	Compost (Kg/tree)				Cultivar × Humic
		0	**2**	**4**	**6**	
Berlit	**0**	18.2 k	19.6 e-k	20.3 b-h	20.3 b-i	19.6 bc
	100	19.6 e-k	21.1 a-f	21.7 ab	20.1 b-j	20.6 a
	200	21.6 a-c	20.8 a-g	20.4 b-h	19.8 c-k	20.6 a
	300	21.7 ab	22.5 a	19.7 d-k	19.4 f-k	20.8 a
Nefertity	**0**	18.5 i-k	18.7 h-k	19.8 c-k	19.1 g-k	19.0 c
	100	18.3 jk	20.7 a-g	20.7 a-g	21.2 a-f	20.2 ab
	200	18.3 jk	20.8 a-g	21.4 a-e	21.5 a-d	20.5 a
	300	19.8 c-k	21.2a-f	21.8 a-f	21.8 ab	21.0 a
Cultivar × Compost						
Cultivar	**Berlit**	20.3 ab	21.0 a	20.5 ab	19.9 b	
	Nefertity	18.7 c	20.3 ab	20.7 ab	20.9 a	
Humic acid × Compost						
Humic acid ($mg.L^{-1}$)	**0**	18.3 f	19.1 d-f	20.0 b-d	19.7 c-e	
	100	19.0 ef	20.9 a-c	21.2 ab	20.7 a-c	
	200	19.9 b-e	20.8 a-c	20.9 a-c	20.7 a-c	
	300	20.8 a-c	21.9 a	20.3 b-d	20.6 bc	

Means of each interactions followed by the same letters are not significantly different from each others according to Duncans multiple ranges test at 5% level.

In the present study clearly show that the effect of cultivar, compost and humic acid was significantly affected on the physical properties of the sweet cherry. Nefertity had significantly higher number of fruit/kg, fruit length. Physical-chemical properties of the sweet cherry fruit depend on the culture area, time of harvest may be ascribed to the differences in genotype characteristics for root growth, nutrient absorption efficiency and photosynthesis process (Jorda *et al.*, 1999), In addition, the genetic integrity of the plant species might influence particular nutrient uptake efficiency (Kalyoncu *et al.*, 2009). Also, the response of different cultivars to the local environmental condition according to the genetic variation between the cultivars (Sîrbu *et al.*, 2012).

The effect of compost on the physical properties clearly shows that the level (4 kg/tree) had significantly effected on the number of fruit/kg, Size of fruit, tree yield. However, (6 kg/tree) had significantly affected on fruit yield, in our experiment could be explained by the increase of the microbial populations resulting from adding compost in soils. These microorganisms can produce materials that might affect plant growth such as substances acting as plant hormone analogues or growth regulators (Tomo *et al.*, 2013).

The effect of foliar spray of humic acid at concentration 200 $mg.L^{-1}$ had significantly affected on the physical (the fruit fresh weight, size of fruit, tree yield) of the sweet cherry. In many studies, humic acids were reported to promote the quantitative properties of fruit, such as yield, fruit weight, width, length and diameter, thereby improving the quantitative status of the plant (Ahmad A. and M. Babaeian 2012). The application of organic acids increases the fruit weight by activating hormones like auxin and cytokinine and result in high weight of fruits. These results corroborate findings of (Shehata *et al.*, 2011). The application of organic acids increase the fruit width by increasing the cell division and enlargement and result in more width of fruits. These results approves the findings of (Ahmad and Babaeian, 2012) seaweed extracts as

a neutral growth regulator contain numerous basic nutrition elements, Auxins and Gibberellins which increase capability photosynthesis process and stimulate the plant vegetative growth. The humic acids substances enhance uptake of some mineral nutrients and reduce the uptake of certain toxic elements, one might reason that application of (HA) could improve and increase the fruit quantity. Similar results were found by (Mehdi *et al.*, 2013; 2013 and Hagagg *et al.*, 2013).

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کارتێکرنا توخم و کومپوست وترشێ هیومیك و تێکەلکرنا وان لسەر بەرهەم و سەخلەتێت بەرهەمێ هەلهەلوکا شرین (گێلاس)

پوختە

ئەڤ ڤەکولینە هاتە ئەنجامدان لسەر دارا هەلهەلوکا (گێلاسا) شرین(Prunus avium L.), د وەرزێ چاندنێ 2012-2013 ل ناف بیستانەکێ کەرتێ تایبەت ل گوندێ بێبادێ نێزیکی باژێرێ ئامێدیێ سەرب پارێزگەها دهوکێ ل هەرێما کوردستانا ئیراقێ.بیستانێ ڤەکولین دناف هاتیە ئەنجامدان ژ دوو جورێن هەلهەلوکا یێت شرین هاتبونە چاندن (نەفەرتیتی و بێرلایت) , کارئینانا زبلێ کومپوست ب سێ ئاستا (0, 2, 4 و 6 کغم بو هەر دارەکێ), رەشاندنا هیومیك ئەسیدی ب سێ تیراتییا (0, 100, 200, 300 mg.L-1). کارتێکرنا جوری: ئەنجام هوسا دیاردکەن کو جورێ نەفەرتیتی کارتێکرنەکا بەرچاف هەبو لسەر جورێ بێرلایت ژمارا تلێت فێقی د کیلویەکێ دا ,بەرهمێ دارەکێ , درێژیا تلیا فێقی ,فرهیا فیقی , هەروسا جورێ بێرلایت کارتێکرنەکا بەرچاف هەبو دزێدەکرنا سەنگا فیقی, قەپارێ فیقی . کارتێکرنا زبلێ کومپوست: بکارئینانا زبلێ کومپوستی دناف ئاخێ دا و تایبەت ئاستێ 4 کیلو بو هەر دارەکێ کارتێکرنەکا بەرجاف هەبو لسەر ژمارا تلێن فێقی د کیلویەکێ دا, قەپارێ فیقێ, بەرهەمی هەر دارەکێ و ئاستێ 2 کیلو یی کومپوستی کارتێکرن د زێدەکرنا فرەهیا تلیا فێقی, درێژیا تلیا فێقی و ئاستێ 6 کیلو یی کومپوستی کارتێکرن د زێدەکرنا درێژیا فیقی. کارتێکرنا رەشاندنا هیومیك ئەسیدی: ئەنجام هوسا دیاردکەن کو رەشاندنا ب هیومیك ئەسیدی ب تیراین 300 mg.L-1 بوویە ئەگەرێ زێدەبوونەکا بەرچاڤ د ژمارا تلێت فێقی د کیلویەکێ دا, بەرهمێ دارەکی, درێژیا فێقی , فرەهیا فێقی رێژا . سەبارەت سەرەدەریین تێکەل کرنا جوری,زبلێ کومپوست دگەل رەشاندنا هیومیك ئەسیدی: ئەنجام هوسا دیاردکەن کو تێکەل کرنا وان بو ئەگەرێ زێدەبوونەکا بەرچاڤ دهەمی ساخلەتێن شینکاتی وبەرهەمی وپیکهاتێن وی وساخلەتێن کوالیتیێ و جەندیێ دا, بەس یێ ژ هەمیا کارتێکر تر جورێ نەفەرتیتی دگەل ئاستێ 4 کیلوییێت زبلێ کومپوست بو هەر دارەکێ دگەل هیومیك ئەسیدی ب تیراتیا 300 mg.L-1 کارتێکرنەکا ئێگجار بەرچاف هەبو د زێدەکرنا بەرهەمی

THE COMBINED EFFECT OF BLACK AND FENUGREEK SEEDS SUPPLEMENTATION ON GROWTH PERFORMANCE AND SOME BLOOD BIOCHEMICAL ATTRIBUTES IN KARADI LAMBS *

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ABSTRACT

this experiment was designed to study the combined effect of black and fenugreek seeds on growth performance and some blood metabolites of Karadi lambs. Twenty Karadi lambs averaged 37.97±0.63kg in weight were randomly divided equally into four treatments and individually penned. All lambs received standard isonitrogenous and isoenergetic ration(14.3% crude protein and 10.628 ME/MJ/kg DM). The control group received basal diet, Treatment 1 supplemented with *Nigella sativa* seeds(25gm /day), treatment 2 diet supplemented with fenugreek seed powder (40gm/day) and treatment 3 lambs diet supplemented with *Nigella sativa* seeds(12.5gm/day) and fenugreek seed powder (20gm/day). Results revealed that lambs in T1 group recorded the highest daily gain in weight (0.32±0.03 kg) and significantly higher feed conversion (5.70±0.28 kg/kg) compared with other treated groups. **It can be concluded that diet supplemented with Nigella sativa improved daily gain and lamb had a better feed conversion.**

KEYWORDS: Karadi lambs, fenugreek seed, black seed, growth performance.

INTRODUCTION

Livestock production is considered an important sector of agriculture locally and internationally. In Iraq, meat production from small ruminants represent one of the main sources of red meat which is highly desirable by consumers when compared with other types of meat. Furthermore, sheep production in Iraq will continue to maintain its importance in the future due to increasing human population, and the increasing demand for meat production, particularly lamb and mutton (Juma and Alkass, 2000).

Medicinal plants are of great importance to the health of individuals and communities (Edeoga*et al.*, 2005). The value of these plants depends on some chemical substances that produce a definite physiological action on the body and the most bioactive constituents of plants are alkaloids, tannins, flavonoids, and phenolic compounds (Hill,1952).

MATERIALS AND METHODS

This experiment was conducted at the Animal Project, Animal Production Department, Faculty of 20 Karadi lambs, 5-6 month old and averaged 37.97± 0.63kg in weight were randomly divided equally into four treatments and individually penned.

All lambs received standard isonitrogenous and isoenergetic ration (Table1.). The lambs of the control group received basal diet, the treated groups received basal diet with the supplementation of medicinal plants purchased from local market of Duhok city. Treatment 1 supplemented with *Nigella sativa* seeds(25gm /day), treatment 2 diet supplemented with

*Part of M.Sc. thesis submitted by second author

*Part of M.Sc. thesis submitted by 2nd author

Thus, herbs could be expected to serve as safer alternatives as growth promoters due to their suitability and preference, lower cost of production, reduced risk of toxicity, minimum health hazards and environment friendliness (Devegowda, 1996).

Among herbs, it has been found that supplementation of black seed (*Nigella sativa L.*) had a beneficial effect on the feed utilization as a result of improving digestion of different nutrients in the diet (Abdullah *et al.*, 2012; Nasser *et al.*, 2009), increasing body weight gain of lambs (Hassan and Hassan 2009; Al-Khauzai*et al.*, 2012), sheep (Zahir, 2009) and cattle (Abdel-Magid*et al.*, 2007).

Also, studies were strictly conducted to investigate the effect of fenugreek seed on lactation performance of ruminant animals (Al-Shaikh *et al.*,2002; Alamer and Basioni 2005; Abo El-Nor *et al.*, 2007; Al-Saiady*et al.*,2007; El-Rawi, 2012; Al- Janabi, 2012). However, information on the effect of fenugreek seed on performance of lambs is very scare.

Therefore, the objective of this study was to investigate the effect of supplementation Black seed (*Nigella Sativa*), Fenugreek seed (*TrigonellaFoenumGraecum*) and their combination upon live-weight gain, feed conversion ratio, and some biochemical blood parameters of Karadi lambs.

fenugreek seed powder (40gm/day) and treatment 3 lambs diet supplemented with *Nigella sativa* seeds(12.5gm/day) and fenugreek seed powder (20gm/day). Clean water and mineral blocks were available constantly.

After formulation of the diet, samples were collected and chemicallyanalyzed according to AOAC (1984) to determine dry matter, ash, organic matter and ether extract. Neutral detergent fiber (NDF) was determinedaccording to MAFF (1993) (Table 1.).General linear model of SAS (2002) was used to study the effect of treatments in studied trait by using CRD (Completely Randomized Design).Duncan (1955) within SAS was used to detect differences among treated groups.

RESULTS AND DISSECTION:

Feed Intake

The overall means of daily feed intake, dry matter intake (DMI), organic matter intake (OMI), crude protein intake (CPI) and metabolizable energy intake (MEI) were 1783.33± 24.34, 1662.60± 22.69, 1673.47± 22.84, 237.75± 3.24 gm/d and 17.67± 0.24 MJ/d, respectively (Table 2).

Results of the present work showed that there was no significant differences in DFI, DMI, CPI and MEI among treated groups. This result is in agreement with others studies that investigated the effect of medicinal plants on Hamdani lambs (Al-Sherwany, 2010), Karadi lambs, (Hassan *et al*., 2011; Al-Rubeii and Zahir 2012), and Awassi lambs, (ALKhauzai*et al.,* 2012; Qasha 2012; Abdallah*et al.*,2012).

Growth Performance

Data pertaining to growth performance and feed efficiency are given in Table (3). In the current study, the overall mean of daily gain was 0.29± 0.02 kg. This value is higher than those recorded earlier in Karadi lambs by Alkass*et al*., (1987), Sefdeen (2008), Hassan and Hassan (2009), Hassan and Hassan (2010), Hassan *et al*., (2011), Dahal and Darwesh (2011) and Al-Rubeii and Zahir (2012). Such variation in daily gain could be due to genetic and feeding practices (Mahmud, 2013). Although there was no significant differences among treatments, however, the highest value (0.32± 0.03 kg) and the lowest value (0.25± 0.02 kg) was attained by lambs in T1 and T2, respectively. Such increase in daily gain with supplement Nigella sativa in T1 could be due to anti inflammatory and anti microbial effect of *Nigella sativa* that improved body health (Ali and Blunden, 2003). Such result resemble those of Hassan *et al*., (2011) and Zanouny*et al*., (2013) who fed lambs with *Nigella sativa* and reported no significant increase in daily weight gain was noticed.

Also, supplementation of Fenugreek seed to the diet had no significant effect on daily weight gain. This result is in accordance with finding of Al-Isawi, (2012) who noticed no significant difference in average daily gain. The lowest value of daily gain attained by T2 (0.25± 0.02) kg could be due to a high content of saponin in fenugreek seed. Such high dose of saponin are known to cause damage to the villi tips of the intestinal epithelium (Gee *et al.,* 1996), which in turn cause a decrease in the digestive capability of the animal as the absorptive area and mucosal enzyme production is suppressed (Ilsley*et al.,* 2005).

In the present study, lambs in T1 group recorded significantly ($P<0.05$) a better feed conversion ratio 5.68±0.27 Kg/Kg compared with T2 (7.05±0.55Kg/Kg). Such improvement in feed conversion could be due to the effect of *Nigella sativa* on improving the digestibility coefficient of the nutrients (Zanouny*et al.,* 2013; Abdel-Magid*et al.,* 2007). The results of this work are in agreement with previous results obtained by Hassan and Hassan (2009), Hassan *et al* ., (2011) and Al-Sherwany (2010) who observed a significant improvement in feed conversion ratio for the *Nigella sativa* treated group in Karadi and Hamdany lambs, respectively.

Biochemical Blood Parameters

It appears from the results (Table 4) that there was no significant difference in blood cholesterol level between different treated groups. This findings is in agreement with previous studies conducted by Qasha, (2012), on Awassi lambs, Hidayat (2011) on Karadi ewes, Al-Isawi (2012) on Hamadani lambs and El-Rawi (2012) on Awassi ewes.

The overall mean of blood glucose was 75.29± 1.90 mg/100 ml (Table 4). This value is within the range obtained earlier by Hassan and Hassan (2009), Hassan and Hassan (2010), Al-Sherwany (2010) and Hidayat (2011). It appears from the results that glucose level was significantly ($P<0.05$) higher (82.34± 3.62 mg/100 ml) in T1 as compared with T2 (70.42± 2.54 mg/100 ml) and T3 (70.59± 3.11 mg/100 ml). Similar results have

been obtained earlier by Hassan and Hassan (2009) and Al-Sherwany (2010) in Karadi and Hamadani lambs, respectively. The lowest value of glucose level (70.42± 2.54 mg/100 ml) recorded in T2, could be due to that Fenugreek seed has a hypoglycaemic action because of the presence of saponin that causing a suppression of transfer of glucose from the stomach to the small intestine and the inhibition of glucose transport across the brush border of the small intestine (Francis *et al.,* 2002), or could be due to the content of fenugreek fibers and pectin and gelatinous material which combine with water to form colloidal which reduce the time of nutrient in the intestine and delay the absorption of glucose, leading to hypoglycaemic action (Khosla*et al.,* 1995; Heafele*et al.,* 1997 and Sauvaire*et al.,* 1998).

The overall mean of blood triglyceride level was 31.37± 1.98 mg/100 ml (Table 4). In the present work no significant differences were observed between treated groups. These results are in agreement with findings of Qasha (2012) and Habeeb and El-Tarabany., (2012) who added *Nigella sativa* meals to the ration of Awassi lambs and Zaraibi goats, respectively.

The overall mean of blood urea level was 44.97± 2.35 mg/100 ml (Table 4). Results showed that there was no significant difference among treatments. Such result are in agreement with findings of Al-Sherwany (2010) on Hamdany lambs, Hidayat, (2011) on Karadi ewes and Qasha (2012) on Awassi lambs. However, the lowest urea level was attained by T2 (43.98± 4.51mg/100ml) which could be due to the presence of saponin in fenugreek seed that binding with ammonia and caused a decrease in ammonia level and in turn decrease the expelling ammonia (Tekeli*et al.,* 2007 and Makkar*et al.,* 1998).

CONCLUSION

It can be concluded that supplementation of black seed resulted in an improvement in daily gain in weight of lambs as well as feed efficiency. With the exception of serum glucose level, no significant differences were observed among groups in the values of serum cholesterol, triglyceride and urea.

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Table (1):- Experimental Diet Ingredient Chemical Composition

Ingredient % the basal diet		Chemical Composition	
Barley	55	Dry Matter %	93.23
Wheat bran	19	Organic Matter %	93.84
Corn	10	Ether Extract %	4.44
Soy bean meal	10	Ash %	6.16
Straw	5	Crude Protein* %	14.3
Salt	0.5	NDF %	21.40
Vitamins and minerals	0.5	ME (MJ/kg DM) **	10.628

* Carried out atHarper Adams University U.K.

** Determined according to Al-Khawaja *et al.,* (1978).

Table(2):- Effect of supplementation Black seed (*Nigella sativa*), Fenugreek seed (*TrigonellaFoenumGraecum*) and their combination on daily Feed Intake, (DMI), (OMI), (CPI) and (MEI) in Karadi lambs.

Traits	Overall mean	C	T1	T 2	T 3
Feed intake (gm /day)	1783.33± 24.34	1825.02± 51.33	1774.74± 47.73	1712.43± 49.46	1821.12± 42.81
DMI (gm /day)	1662.60± 22.69	1701.47± 47.85	1654.59± 44.50	1596.51± 46.11	1697.83± 39.91
OMI (gm / day)	1673.47± 22.84	1712.60± 44.69	1665.42± 44.79	1606.95± 46.41	1708.96± 40.17
CPI (gm /day)	237.75± 3.24	243.31± 6.84	236.61± 6.36	228.30± 6.59	242.79± 5.71
MEI (MJ /day)	17.67± 0.24	18.083± 0.51	17.585± 0.47	16.97± 0.49	18.05± 0.42

C the Basal diet, T1 Black seed 25gm/h/day, T2 Fenugreek seed 40gm/h/day, T3 Black seed 12.5gm/h/day and fenugreek seed 20gm/h/day

Table (3) :-Effect of supplementation Black Seed (*Nigella sativa*), Fenugreek Seed (*TrigonellaFoenumGraecum*) and their combination on growth performance and feed efficiency in Karadi lambs.

Traits	Overall mean	C	T1	T 2	T 3
Initial weight (kg)	37.97± 0.63	38.10± 0.87a	37.96± 1.56a	37.80± 1.73a	38.04± 1.15a
Final weight (kg)	55.79± 1.09	55.82± 2.43a	57.50± 2.41a	53.08± 1.79a	56.74± 2.19a
Average Daily gain (kg)	0.29± 0.02	0.29± 0.05a	0.32± 0.03a	0.25± 0.02a	0.30± 0.03a
Feed conversion ratio (kg/kg)	6.46± 0.22	6.93± 0.44ab	5.70± 0.28b	7.05± 0.55a	6.14± 0.25ab

Means with different letters within each row differ significantly (P≤0.05).
C the Basal diet, T1 Black seed 25gm/h/day, T2 Fenugreek seed 40gm/h/day, T3 Black seed 12.5gm/h/day and fenugreek seed 20gm/h/day

Table(4):- Effect of Supplementation Black Seed (*Nigella sativa*), Fenugreek Seed (*TrigonellaFoenumGraecum*) and their combination on some blood biochemical parameters in Karadi lambs.

Traits	Overall mean	C	T1	T 2	T 3
Cholesterol (mg/100ml)	57.53± 2.65	59.28± 5.19a	51.02± 6.46a	57.35± 3.16a	62.47± 6.11a
Glucose (mg/100ml)	75.29± 1.89	77.83± 3.72ab	82.34± 3.62a	70.42± 2.54b	70.59± 3.11b
Triglyceride(mg/100ml)	31.37± 1.98	29.88± 5.68a	33.33± 3.77a	32.86± 2.91a	27.41± 3.29a
Urea (mg/100ml)	44.97± 2.35	46.67± 3.06a	51.53± 6.11a	43.98± 4.51a	37.69± 3.54a

Means with different letters within each row differ significantly (P≤0.05).
C the Basal diet, T1 Black seed 25gm/h/day, T2 Fenugreek seed 40gm/h/day, T3 Black seed 12.5gm/h/day and fenugreek seed 20gm/h/day

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كارتێكرنا هەڤپشك يا زێدەكرنا تۆڤێ رەشرەشكا و شەمبليلى ل سەر گەشێ و هندەك سالۆخەتێن خوينێ ل بەرخێت كوردى

پوختە

ئەف ڤەكۆلينە هاتە ئەنجام دان بۆ شگۆڤەكرنا كارتێكرنا هەفپشك يا زێدەكرنا تۆڤێ رەشرەشكا و شەمبليلێ ل ئاليكێ ل سەر گەشێ ۆ هندەك شلۆڤەكرنێت خوينێ ل بەرخێت كۆردى. بيست بەرخێت كوردى ب كێشا (37.97± 0.63 كغم) هندى ئێك هاتنە دابەشكرن هەرەمەكى ل سەر چار گرۆپان. هەمى بەرخا ئاليكا وەك هەڤ ژ پرۆتين ۆ وزە وەرگرت (14.3% بروتينا خاڤ و 10.628 وزا ميتابوليك كغم/كغم متايى هشك). گرۆپێ كۆنترۆلى ئاليكا سادە خار و گرۆپێ ئێكێ 25 گم/ رۆژ ژ تۆڤێ رەشرەشكا لسەر ئاليكێ دايێ و گرۆپێ دووێ 40 گم/ رۆژ ژ تۆڤێ شەمبليلا لسەر ئاليكێ دايێ و گرۆپێ سێيێ 12.5 گم/ ژ تۆڤێ رەشرەشكا و 20گم ژ تۆڤێ شەمبليلا لسەر ئاليكێ دايێ . ئەنجامێت ڤەكۆلينێ ديار كر كۆ گرۆپا ئێكێ سەنگا رۆژانە زێدەتر بۆ (0.32 ± 0.03 كگم/رۆژ) بەلێ چ كارتێكرنێن بەرچاڤ نەبۆن. و كارتێكرنا بەر چاڤ (P<0.05) ل مفا ژ وەرگرتنا خارنێ هەبۆ ل گرۆپا ئێك (5.68 كگم/كگم). ديار دبيت كۆ زێدەكرنا تۆڤێ رەشرەشكا سەنگێ رۆژانە ۆ مفا وەرگرتن يێ بەرخێت كۆردى باش دكەت.

التأثير المشترك لاضافة بذور الحبة السوداء والحلبة في النمو وبعض صفات الكيموحيوية للدم في الحملان الكرادية

الخلاصة :

اجريت هذه الدراسة لبيان التاثير المشترك لاضافة بذور الحبة السوداء والحلبة في النمو وبعض صفات الدم الكيموحيوية في الحملان الكرادية. استخدم عشرون حملا كراديا بمعدل وزن (37.97± 0.63 كغم) اذ وزعت عشوائيا الى اربع معاملات ووضعت في اقفاص فردية. غذيت المجاميع الاربعة على عليقة اساسية متساوية في الطاقة والبروتين (14.3% بروتين خام و10.628 طاقة متأيضة كغم/كغم مادة جافة). غذيت مجموعة السيطرة على العليقة الاساس بينما تم اضافة بذور الحبة السوداء (25 غم/يوم) الى عليقة المعاملة الاولى وبذور الحلبة (40 غم/يوم) الى عليقة المعاملة الثانية وبذور الحبة السوداء (12.5 غم/يوم) والحلبة(20غم/يوم) الى عليقة المعاملة الثالثة. بينت النتائج ان اعلى معدل زيادة وزنية يومية (0.32± 0.03 كغم/ يوم)كانت لحملان المعاملة الاولى كذلك تفوقت هذه المعاملة معنويا (P<0.05) في كفاءة التحويل الغذائي(5.68 كغم/كغم) مقارنة بالمعاملات الاخرى. نستنتج مما تقدم ان اضافة بذور الحبة السوداء والحلبة تؤدي الى تحسن معدل الزيادة الوزنية اليومية وكفاءة التحويل الغذائي في الحملان.

EFFECT OF NPK, HUMIC ACID, AND GA_3 ON PISTACHIO GROWTH AND MINERAL CONTENT.

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ABSTRACT

This nursery study was conducted during growing season 2013, to investigate the effects of NPK (0, 15 and 30g/seedling), and humic acid (0, 3 and 6 ml/L) with three spray concentrations of GA_3 (0, 100 and 200 ppm) on seedlings growth of *Pistacia vera* L. Antep cv. The results showed that the treatment of 15g NPK/seedling + 6ml/L humic acid and 100ppm GA_3 increased significantly the height of seedlings, dry matter of leaves and potassium content in leaves. While the treatment 15g/ seedling NPK + 3ml/L humic acid increased noticeably the diameter of seedlings. On the other hand, the treatment 200ppm GA_3 augmented considerably the number of branches. However, the total chlorophyll content in leaves was increased significantly when treated with 30g NPK/seedling. The dry matter of roots and P content in leaves were remarkable when treated with 30g NPK /seedling+ 3ml/L humic acid +200ppm GA_3. Regarding the increasing of N content in leaves, thus the best treatment was 30g NPK/seedling + 6ml/l humic acid.

KEY WORDS: *Pistacia vera*, NPK, Humic acid,Gibberellic acid, Seedlings.

INTRODUCTION

Pistachio(*Pistacia vera* L.) is one of the most suitable nut fruit in Kurdistan Region of Iraqi. However, its culture is very limited and only a limited number of orchards are present in Duhok and Sulimania Governorates. This is due to its difficult propagation, slow growth, late starting in commercial yielding and highly alternate bearing (Salieh, 2004).The Iraqi Kurdistan Region is a major center of diversity for the genus *Pistacia*, where major species (atlantica, khinjuk and terebinthus) are naturally grown and distributed throughout the region (Al-Dawoody, 1979 and Townsend and Guest, 1980).

Antep variety of pistachio is an important product in Turkey has strong competitive edge in the world markets in the hard-shelled fruits category. This variety of pistachio is an indispensable product both for the retailing sector and food industry as it stands out with its distinct taste, aroma and quality in the intensely competitive global pistachio trade. As it combines diverse appetites in an exclusive flavor, the Antep pistachio appeals to test exported to approximately 70 countries, mainly to the European Union countries, Israel and USA. Up to 90% of the exports are shell pistachios, while the rest are pistachio kernels (Tuik,2002-2010).

NPK is considered as an essential compound fertilizer containing the elements most important for plant growth and development. The effects of phosphorus levels (0, 50 and 100 P mg kg^{-1}) on the chemical composition of pistachio seedling, conducted by Fekri and Gharanjig (2009), revealed significant increases of P, K, Ca and Mg in leaves and roots. Whereas Fe, Mn and Cu concentrations decreased in leaves, stems and roots.

As to the non-conventional sources of organic matter suitable for soil amendments, different humic acids- derived substances have improved soil characteristics and plant growth (Obreza and Biggs, 1989). Humic acid is a complex organic compound derived from organic matter decomposition. Agricultural humic acid are reputed to enhance nutrient absorption, drought tolerance, seed germination and overall plants performance (Chen and Aviad, 1990 and Sanchez-Andreu *et al*., 1994).

Seeds of pistachio are used in commercial production as rootstocks (Hartmann *et al*, 2002). Generally, pistachio does not propagate well from cuttings, therefore they are budding or grafting on different rootstocks due to difficulties in rooting of soft and hard cuttings (Sakoury, 1976; Onay, 2000).

Many scientists use gibberellins to promote germination rates, buds dormancy break, stem elongation, and to delay of leaf senescence, (Ayfer and Serr1, 1961; Casini and Conticini, 1979; Frutos and Barone, 1988; Romero *et al.*, 1988; Ak *et al.*, 1995 and Hans, and Jan, 1997). The seeds which are taken from pistachio plants grow slowly. Thus, gibberellic acid used to stimulate seedling growth. In spite of more than 100 types of gibberellins, only few of them has important physiological effects in plant such as GA_3 which is the one mostly used in a commercial level (Hartman *et al.*, 2002).

The aim of this study was to determine the effects of NPK, Humic acid, and GA_3 on pistachio seedlings growth (*Pistacia vera* L.) cv. Antep and to enhance growth of seedling to reach budding size in the same season.

MATERIALS AND METHODS

The present study was carried out during 2013 season on pistachio seedlings cv. Antep planted in horticultural department nursery at the Faculty of Agriculture / Duhok University. The seeds of Antep pistachio were brought from a commercial orchard in 2 October, 2012. The seeds were directly sown on depth of 3cm in clay loam soil in black poly-ethylene bags 30x40 cm at the 2/ February 2013.

An experiment according to Random Complete Block Design (RCBD) with six replications.

NPK (18: 45: 18) was used three levels in three monthly applications from 15/4/2013 to 15/6/2013, Humic acid also was used at three levels in three monthly application (100ml plant^{-1}) from 7/4/2013 to 7/6/2013, and GA_3 seedlings were sprayed with GA_3 at three concentrations as three sprays monthly from 18/4/2013 to 18/6/2013.

At the end of the experiment (1/11/2013), the stem height, stem diameter, number of branches, root length, total chlorophyll, leaves dry weight, root system dry weight and leaf NPK content were measured for all seedlings. The data was statistically analyzed by SAS program (SAS Institute Inc., 2001) as randomized complete block design with six replicates (10 seedlings per replicate). Analysis of variance and Duncan's multiple range tests at 5% level was used (Roger Mead and Hasted, 2003).

RESULTS AND DISCUSSION

Seedling height (cm)

The effect of treatments on seedling height was significant, and the superior treatment was NPK 15g + Humic acid 6ml l^{-1} + GA_3 100ppm, while it did not differ from GA_3 200ppm treatment, but it differed from the other treatments (Table 1).

Seedling diameter (mm)

The treatment of NPK 15g + Humic acid 3ml l^{-1} was significantly effective in increasing seedling diameter as compared with control and with each of NPK 15g + Humic acid 6ml l^{-1} and NPK 15g + Humic acid 3ml l^{-1} +GA_3 100ppm (Table 1).

Number of branches

It is clear from Table (1) that the pistachio seedlings sprayed with GA_3 of 100ppm significantly gave the highest number of branches as compared with the other treatment except those treatment of (NPK 15g + Humic acid 3ml l^{-1} +GA_3 100ppm); (NPK 15g + Humic acid 6ml l^{-1} +$GA_3$100ppm) and (NPK 30g + Humic acid 3ml l^{-1} +GA_3 200ppm) that gave a similar effect.

Total chlorophyll (SPAD)

Table (2) shows that the total chlorophyll was significantly affected when Pistachio seedlings were treated with NPK 30g seedling^{-1} and NPK 30g + Humic acid 6ml l^{-1} 65.99 and 64.85 SPAD respectively as compare with control and some other treatments.

Leaf dry matter (%)

The data displayed in Table (2) clearly shows that the treatment NPK 15g + Humic acid 6ml l^{-1} + GA_3 100ppm had significant effect on leaf dry matter which gave the highest value (49.18%) as compared with control and with some other treatments

Table (1): Effect of NPK, humic acid and GA_3 on seedling height, seedling diameter and number of branches of pistachio seedlings.

Treatments	Seedling height (cm)	Seedling diameter (mm)	Number of Branches/ seedling
Control	25.42 ef	9.01 c	2.27 de
NPK 15g	26.83 c-f	11.07 ab	1.67 e
NPK 30g	27.09 c-f	10.92 ab	3.58 c-e
Humic acid 3ml l^{-1}	32.03 b-e	10.84 ab	2.42 de
Humic acid 6ml l^{-1}	26.03 d-f	11.21 ab	2.58 de
GA_3 100 ppm	34.78 bc	11.30 ab	4.25 b-e
GA_3 200 ppm	37.65 ab	10.41 a-c	7.67 a
NPK 15g + Humic acid 3ml l^{-1}	27.98 c-f	11.96a	2.83 c-e
NPK 15g + Humic acid 6ml l^{-1}	21.09 f	10.24 bc	3.08 c-e
NPK 30g + Humic acid 3ml l^{-1}	27.12 c-f	10.55 ab	3.17 c-e
NPK 30g + Humic acid 6ml l^{-1}	24.77 ef	10.51 a-c	2.58 de
NPK 15g + Humic acid 3ml l^{-1} +GA_3 100ppm	30.61 b-e	10.29 bc	5.58 a-c
NPK 15g + Humic acid 6ml l^{-1} +GA_3 100ppm	43.67 a	11.13 ab	6.62 ab
NPK 30g + Humic acid 3ml l^{-1} +GA_3 200ppm	30.28 b-e	11.26 ab	5.17 a-d
NPK 30g + Humic acid 6ml l^{-1} +GA_3 200ppm	34.03 b-d	11.56 ab	3.92 b-e

Roots dry matter (%)

The results indicated that the treatment of NPK 30g + Humic acid 3ml l^{-1} +GA_3 200ppm significantly affected the roots dry matter which gave the highest root dry matter (47.82) as compared with NPK 15g and NPK 30g + Humic acid 6ml l^{-1} (Table 2) and the lowest root dry.

Table (2): Effect of NPK, humic acid and GA_3 on total chlorophyll, leaf dry matter and root dry matter of pistachio seedlings.

Treatments	Total chlorophyll (SPAD)	Leaf dry matter (%)	Root dry Matter (%)
Control	46.86 d	40.42 h	42.79 ab
NPK 15g	60.02 ab	42.01 f-h	40.72 b
NPK 30g	65.99 a	41.58 gh	47.33 ab
Humic acid 3ml l^{-1}	55.63 bc	45.35 b-e	45.88 ab
Humic acid 6ml l^{-1}	55.01 bc	44.23 c-g	49.73 ab
GA3 100 ppm	58.15 ab	45.34 b-e	42.48 ab
GA3 200 ppm	59.9 ab	43.22 e-g	45.66 ab
NPK 15g + Humic acid 3ml l^{-1}	52.69 b-d	44.56 c-f	42.73 ab
NPK 15g + Humic acid 6ml l^{-1}	59.12 ab	43.97 d-g	46.28 ab
NPK 30g + Humic acid 3ml l^{-1}	58.72 ab	46.59 a-d	43.13 ab
NPK 30g + Humic acid 6ml l^{-1}	64.85 a	46.64 a-d	40.89 b
NPK 15g + Humic acid 3ml l^{-1} +GA_3			

100ppm	52.53 b-d	46.90 a-c	43.72 ab
NPK 15g + Humic acid 6ml l^{-1} +GA_3 100ppm	49.58 cd	49.18 a	46.45 ab
NPK 30g + Humic acid 3ml l^{-1}+GA_3 200ppm	58.73 ab	47.76 ab	47.82 a
NPK 30g + Humic acid 6ml l^{-1} +GA_3 200ppm	58.44 ab	47.75 ab	46.41 ab

Leaves nitrogen content (%)

The results tabulatedin Table (3) revealed that the application of NPK 30g and humic acid 6ml l^{-1} to pistachio seedlings had significant effect on leaves nitrogen content, which gave the highest content (2.91 %) as compared with control and the most of other treatments.

Table (3): Effect of NPK, humic acid and GA_3 on leaf nitrogen content, leaf phosphorus content and leaf potassium content of pistachio seedlings.

Treatments	Leaf nitrogen Content (%)	Leaf phosphorus content (%)	Leaf potassium content (%)
Control	1.98 f	0.249 f	0.773 b
NPK 15g	2.32 e	0.260 ef	0.809 ab
NPK 30g	2.40 cde	0.291 c-f	0.803 ab
Humic acid 3ml l^{-1}	2.37 de	0.319 cde	0.904 a
Humic acid 6ml l^{-1}	2.51 b-e	0.269 def	0.821 ab
GA3 100 ppm	2.27 e	0.323 cde	0.909 a
GA3 200 ppm	2.32 e	0.326 bcd	0.883 ab
NPK 15g + Humic acid 3ml. L^{-1}	2.61 bcd	0.326 bcd	0.880 ab
NPK 15g + Humic acid 6ml L^{-1}	2.59 bcd	0.299 c-f	0.844 ab
NPK 30g + Humic acid 3ml L^{-1}	2.64 bc	0.350 abc	0.904 a
NPK 30g + Humic acid 6ml L^{-1}	2.91 a	0.317 cde	0.833 ab
NPK 15g + Humic acid 3ml L^{-1}+GA_3 100ppm	2.69 ab	0.330 bcd	0.827 ab
NPK 15g + Humic acid 6ml L^{-1}+$GA_3$100ppm	2.72 ab	0.387 ab	0.916 a
NPK 30g + Humic acid 3ml L^{-1}+$GA_3$200ppm	2.72 ab	0.400 a	0.844 ab
NPK 30g + Humic acid 6ml L^{-1}+$GA_3$200ppm	2.48 b-e	0.404 a	0.827 ab

Leaves phosphorus content (%)

The results indicated that the treatment NPK 30g + Humic acid 6ml L^{-1} +GA_3 200ppm was significantly superiored on the most of other treatments in increasing leaves phosphorus content which gave the highest value (0.404 %) (Table 3).

Leaves potassium content (%)

The data in Table 3, show that the all treatments had significant effects on leaves potassium content as compared with control, especially at NPK 15g + Humic acid 6ml l^{-1} +$GA_3$100 ppm treatment which gave the highest value (0.916 %).

RESULTS

Spraying pistachio seedlings with GA_3 at 100 and 200ppm alone or with NPK and humic acid was significantly effected in increasing seedling height, number of branches (Table 1), dry matter

of leaves and roots (Table 2), and leaves content of phosphorus and potassium (Table 3), these results are in accordance with those obtained by Ak and Nikpeyma (1995) on turpintine seedlings; Shanmugavelu (2000) on tamarix trees; Akca *et al.* (2001) on walnut seedlings; Al-Hamadany (2004) on olive seedlings; Al-Imam (2007) and Al-Jubury (2007) on Aleppo pistachio seedlings. Thus, the increase in each of seedling height, number of branches, dry matter of leaves and roots, as result of seedlings spray with GA_3 alone or in combination with NPK and humic acid may be attributable to effect of GA_3 on cell division in sub-apical meristem zone and opining stimulate of laterals buds and improving elongation and expanding of cells, consequently it is important in increase growth parameters and dry matter of shoots and roots of pistachio seedlings (wasfy, 1995;Hartmann *et al.,* 2002; Hopkins and Hüner 2004 and Harris *et al.,* 2004). Increasing leaves content of some nutrients (P and K), may not be due to the role of GA_3 but due to the role of NPK and humic acid. Where, there are many research workers thinking that the spray with GA_3 may leading to decries leaf content of nutrients like Hassan,(2002) on grapevines and Al-Jubury (2007) on Aleppo pistachio seedlings, this may be due to of elongation and expanding of cells and increase vegetative growth consequently leaf nutrients diluted.

Application of humic acid on pistachio seedlings at 6ml l^{-1} and 3ml l^{-1} in interaction with NPK and GA_3 was of significant effect on increasing each of seedling height, seedling diameter (Table 1), dry matter of leaves and roots (Table 2), and leaves content of Nitrogen, phosphorus and potassium (Table 3); these results are in agreement with those published by Mayi *et al.*,(2014) on olive seedlings; Fernández-Escobar *etal.,* (1999) on olive seedlings; Yousef *et al.*,(2011) on olive seedlings and Hagag *et al*., (2011) on olive seedlings. This might be due to the effect of humic acid in increasing root growth in a manner similar to auxin (Donnell, 1973).Zhang andErvin (2004) extracted cytokinin and gibberellic acid from the humic acid. They revealed that different levels ofthe drought stress and humic acid had significant influenced on dry weight of roots. The stimulating effects of humic acid were, thus, attributed to its hormone-like properties, because some of the humic acid effects were similar to plant hormones such as auxins, cytokinins and gibberellins (Nardi *et al.,* 2002; Pizzeghello *et al*., 2002; Chen *etal*., 2004). Gang and Evans (2000) reported that foliar spray of humic acid on seedlings of cucumber, marigold, violet, pelargonium, and henna had led to an increase in the leaf's relative water content, as well as in the fresh and dry weight of roots.//////Application of NPK on pistachio seedlings at 15 and 30g seedling^{-1} alone or in interaction with humic acid and GA_3 was significant effect in increasing seedling height, seedling diameter (Table 1), total chlorophyll and dry matter of leaves and roots (Table 2), and leaves content of Nitrogen, phosphorus and potassium (Table 3). These results are in agreement with thosegot by Hagag*et etal.*, (2011); Xiloyannis *et al.* (2000); Yousef *et al.*(2011). NPK is considering being essential elements for plant growth and development. The 16 g NPK and 32 g N significantly gave the highest shoot and root dry weight, this probably due to nitrogen concentration which increased dry matter accumulation in roots (Ferihat and Masa`deh, 2006). Nitrogen is one of the most important nutrients for fruit trees growth, generally required in greater amounts than any other plant nutrient to promote tree growth and development(Thompson *et al.,* 2002). Indeed, nitrogen is a major constituent of proteins and therefore, plays an important role on plant metabolism and growth.

According to the above results, the interaction treatments of NPK, humic acid and GA_3 was better as compared with control and individual treatments, especially at interaction treatment of NPK 15g + Humic acid 6ml l^{-1} +$GA_3$100ppm which in enhanced of seedling height, leaf dry matter and leaf potassium content.

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كارتێكرنا (NPK) و ترشێ هيوميك و GA3 (جبريلين) ل سەر گەشەكرنا نەمامكێن فستەقا ژ نفشێ عنتاب(Pistacia vera L.)

پوخته

من ئەڤ ڤەكولينە كر دوەرزێ گەشەكرنێ دا (2013) ێ ژبو خاندنا زيانێت نايتروجين و فسفور و بوتاسيوم ب تركيزا (سفر ، 15 ، 30) گم بو هەمى شتلا و ترشێ هيوميك ب تركيزا (سفر ، 3، 6) مل / لتر دگەل سێ رەشاندنێت جبريلين (GA3) ب تركيزا (سفر ، 100، PPM200) ل سەر شتلێت فستقێ ژ جورێ عنتابێ . دياربوون ئەنجام كو كريار (15) گم ژ (NPK) / شتل + 6 ملم بو هەر لترەكێ ژ ترشێ هيوميك و PPM (100) ژ (GA3) زێدەبوون ب رەنگەكێ معنوى خر ژ بلنديا شتلێ و كێشە يا هشك يا بەلگا و بەلگ پێك دێت ژ بوتاسيوم. بەلێ كريارا (15) گم بو هەر شتلەكێ + 3 مل بو هەر لترەكێ ژ جورێ (ترشێ هيوميك) تيرێ شتلا ب شێوەكێ معنوى . ژبەر هندێ كريارا (پيككرن) سەرككەفتى چێبيت د هەر وى وەرزيدا و ژ لايەكێ ديڤە كريارا (PPM 200) ژ (GA3) زێدە دبيت ب شێوەكێ معنوى پشتى بكارئينانا رووەكى ب (30) گم ژ (NPK) ى بو هەر شتلەكێ كێشا هشك يا ريها و هەروەسا پێك دێت ژ فسفورى و زێدە دبيت وەختێ ب كارئينانا ب (30) گم ئێت (NPK) بو هەر شتلەكێ + 3 مل بو هەر لترەكێ ژ (ترشێ هيوميك) + PPM (200) ژ (GA3) رێژەيا زێدەبوونا بكارئينانا بەلگا ژ نايتروجينى باشترين كريار بوو يا (30) گم (NPK) بو هەر شتلەكێ + 6 مل بو هەر لترەكێ ژ (ترشێ هيوميك).

تأثير (NPK) وحامض الهيوميك وGA_3 (الجبرلين) على نمو شتلات الفستق صنف عنتاب(*pistacia vera L .*)

الخلاصة

طبقت هذه التجربة في موسم النمو 2013 لدراسة تأثير كل من النتروجين والفسفور والبوتاسيوم بتركيز (صفر,15, 30) غم لكل شتلة وحامض الهيوميك بتركيز(صفر, 3 ,6 مل/لتر) مع ثلاث رشات من الجبرلين (GA_3) بتراكيز(صفر, 100, 200 جزء من المليون) على شتلات الفستق صنف عنتاب. بينت النتائج بأن المعاملة 15 غم من ال NPK/شتلة + 6 ملم لكل لتر من حامض الهيوميك و100 جزء من المليون من ال GA_3 زادت بشكل معنوي كل من ارتفاع الشتلات والوزن الجاف للأوراق ومحتوى الأوراق من البوتاسيوم . بينما المعاملة 15 غم لكل شتله + 3 مل لكل لتر من حامض الهيوميك زادت بشكل معنوي قطر الشتلات. لذلك فان عملية التطعيم الناجحة يمكن ان تجرى في نفس الموسم ومن جانب اخر فان المعاملة 200 جزء من المليون من ال GA_3 زادت بشكل ملحوظ من عدد الفرع. على الرغم من ان محتوى الأوراق الكلي من الكلوروفيل زادت بشكل معنوي عندما عوملت النباتات بـ 30 غم من NPK لكل شتلة الوزن الجاف للجذور وكذلك محتواها من الفسفور قد ازدادت عندما عوملت بـ 30 غم NPK لكل شتلة + 3 مل لكل لترمن حامض الهيوميك + 200 جزء من المليون من GA_3 بالنسبة لزيادة محتوى الأوراق من النتروجين. فان احسن معاملة كانت 30 غم NPK لكل شتله + 6 مل لكل لتر من حامض الهيوميك.

STUDIES ON THE EFFECT OF SELENIUM AND VITAMIN E ON 1. ATTAINMENT OF PUBERTY IN FEMALE MERIZ GOATS

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ABSTRACT

This investigation was conducted at the Animal farm, Faculty of Agriculture, University of Duhok, where 30 weaned female Meriz kids were alloted randomly into three equal groups. The 1st group was injected weekly with saline and considered as a control (T_1), the 2nd group was injected weekly with 4 mg vitamin E + 80 µg Sodium Selenite / kg body weight (T_2), and the 3rd group was injected with 2 mg Vitamin E+40 µg Sodium selenite / kg body weight (T_3) . Detection of estrus was carried out twice daily by introducing a proven bucks, and monteering progesterone concentration.

Results revealed that body weight at puberty, and daily gain in weight of Meriz kids averaged 24.39 ± 0.46 kg and 0.116 ± 0.003 kg, respectively. Treatment kids with Selenium and vitamin E had no significant effect on both traits. However, kids of T_2 group exhibited estrus earlier than T_1 and T_3 groups.

***KEY WORDS*:** Female Meriz goat, Selenium, vitamin E, Puberty.

INTRODUCTION

Like other livestock, puberty is an important reproductive trait in goat that will determine the age at first kidding and therefore initiate the start of the reproductive career of the animal . Moreover, early puberty is an important indicator of lifetime performance of farm animals, due to higher reproductive efficiency in the adult animal and a shorter generation interval which could lead to higher rate of genetic improvement (Dyrmundsson, 1987; Hafez, 1993).

It is well known that body weight is of critical importance to the attainment of puberty in the young doe. Additionally, it has been reported that supplementation of Selenium resulted in a significant improvement in daily gain of kids (Yue *et al*,2009) and lambs (Gabryszuk and Klewiee, 2002). Also, the injection of Selenium and vitamin E significantly increased the daily gain of ewes (koyuncu and Yerlikaya, 2007). Therefore, this study aimed to investigate the effect of Selenium and vitamin E on the attainment of puberty in Meriz female goat.

MATERIALS AND METHODS

This study was carried out at the Animal farm, Faculty of Agriculture, University of Duhok, where 30 weaned (90 – 105 days old) female Meriz goats weighing 9.31 ± 0.18 kg were allotted randomly into 3 equal groups. The 1st group was injected weekly with normal saline subcutaneously (s/c) and considered as a control (T_1). The 2nd group was injected weekly with Tocovit-S* s/c at a rate of 4 mg vit. E + 80 µg Sodium selenite / kg body weight (T_2) and the 3rd group was injected weekly with Tocovit-S s/c at a rate of 2 mg vit. E and 40 µg Sodium Selenite / kg body weight (T_3) and the dose was adjusted according to their body weights for duration of 18 weeks.

Each group was housed in a separate pen, and fed *ad libitum* a concentrate diet containg 14.37 % crude protein and 2538.49 kcal . Clean water and mineral blocks were available constantly . All kids were weighed at weekly interval before feed is offered.

Signs of estrus were detected twice daily for 1 hour by introducing a proven bucks, and the doeling was considered in estrus when it showed overt oestrus signs, waggling its tail, bleating, mounting others and / or allowed the bucks or

other goats to mount her (Mackenzie, 1967). Detection of estrus was further confirmed by measuring serum progesterone concentration. The doeling that showed overt oestrus signs and serum progesterone concentration of 0.5 ng/ ml or above was considered at oestrus (Mavrogenis, 1987).

General linear model (GLM) within the statistical program SAS (2002) were used to analyze the effect of treatment on weight at puberty. Also, correlation coefficients between body weight at puberty and each of body weight at different ages were computed.

RESULTS AND DISCUSSION

Daily gain in weight

In the current work, the overall mean of daily gain in weight was 0.116 ± 0.003 kg (Table 1). The growth rate recorded here in it is comparable to those reported earlier for Meriz male kids by Mayi and Alkass (2010) and Alkass *et al* (2010). Moreover, kids received high level of Se + vitamin E had numerically higher daily gain (0.122 kg) in comparison with the control (0.116 kg) and those injected low level of Se + vitamin E (0.110 kg). Similar results were observed in goat kids (Tufarelli and Laudadio, 2011; Shokrollahi *et al*., 2013) and calves (Afzal *et al*., 1988 ; Mohri *et al*., 2005).

Table (1):- initial weight, daily gain in weight and weight at puberty of Meriz kid (x± s.e.)

Trait	Over all mean	Treatment		
		Control T_1	40 vit. E+ Se. T_2	vit. E+ Se. T_3
No. animal	30	10	10	10
Initial weight	9.31 ± 0.18	9.53 ± 0.40 a	9.35±0.24 a	9.05±0.31 a
Weight at puberty	24.39± 0.46	24.79 ± 0.92 a	24.90 ± 0.75 a	23.48±0.70 a
Daily gain	0.116 ± 0.003	0.116± 0.005 a	0.122±0.007a	0.110±0.004 a

Means with the same letters within each row are not differ significantly (p>0.05) .

Body weight at puberty

In the present study, the average body weight at puberty of Meriz was 24.39 ± 0.46 kg (Table 1). In Iraq, however, lighter body weights of 18.8 and 17.5 kg were noticed respectively by Al-Wahab *et al* (1981) and Juma *et al* (2002) for native goat, as well as 17.7 kg was recorded by Nashat *et al* (2005) for local × Damascus goat. Such differences might be due to breed as well as individual variation within breed (Dyrmundsson, 1987), environmental conditions including month of kidding and feeding practices in particular (Dyrmundsson and Lees, 1972).

Body weight at puberty averaged 24.79± 0.92, 24.90± 0.75 and 23.48±0.70 kg for T_1,T_2 and T_3 , respectively(Table 1) , and the differences among them was not significant, However, it is worth to note that 40 % of does received 4 mg vitamin E + 80 µg Se (T_2) exhibited estrus during September compared with 10 and 20 % in T_1 and T_3, respectively, and the remaining kids in all groups exhibited estrus during October.

Correlations between body weight at puberty and weight at different ages

The correlation coefficients between weight at puberty and each of initial weight, daily gain and total gain were 0.43, 0.88 and 0.91, respectively (P <0.01).Such correlations indicate that doe kids that grow more rapidly during post weaning tended to be heavier and younger at puberty. These observations are similar to those of Fuentes *et al* (1987) and Bathaei and Leory (1997).

In this study, determining the age at puberty of Meriz does was not possible because the extract date of kidding was unknown. However, when weaned kids were purchased from the farmer, they are between 90-105 days old. Therefore, roughly speaking, the age at puberty ranged between 200-225 days. The average age at puberty for local goats in Iraq was 252.6 days (Al-Wahab et al., 1981); 207.3 days (Khudayeer et al ., 1989); 307.3 days (Juma et al., 2002) and 204.7 days (Nashat et al., 2005). Such differences could be attributed to the differences in the genetic make up as well as environmental factors including season of birth and feeding practices. However, further studies for determination the extract age at puberty of both males and females for this uncharacterized breed is needed.

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ارتێکرنا سلینیوم و ڤیتامین E سەر هەرزەکارییا رەگەزی لبزنێن مەرەز ئین مێ

پوختە

ئەف ڤەکولینە هاتییە ئەنجامدان ل پرۆژێ رهەمێ گیانەوەری ل فاکولتییا چاندن / زانکویا دهوك ژ ماوێ 5/23 تاکو 2013 /10/3, کو سی (30) رکێت مەرەز یێت شیرقەکری (90-105 روژ) برێژا سەنگی یا وان یا دەستپێکی 9,31 ± 0.18 م هاتنە دابەشکرن ب شێوەی رەمەکی لسەر سێ روپێن یەکسان (10 کار بو هەر گروپەك). گروپا کونترۆلی (T1) ە ب دەرزی دانێ ژبن پیستی ب نورمال سەلاین هەمی هەفتیا, گروپا معامامەلا ئێکێ (T2) معامەلە کرن ب دەرزی دانێ ب سلینیوم و ڤیتامینE ێ فتی جارەکێ ژبن بستی ب برِی 4 ملگم فیتامین E + 80 مایکروگرام سودیوم سیلینەیت/ کگم کێشا لەشی, دوەختەکیدا گروپا معامەلا دووێ (T3) ە معامەلە کرن ب دەرزی دانێ ب سلینیوم و ڤیتامینE ێ ،فتی جارەکێ ژبن پیستی ب برِی 2 ملگم فیتامین E + 40 مایکروگرام سودیوم سیلینەیت/ کگم کێشا لەشی, بو ماوێ 18 هەفتەیان.

ت گیانەوەرا د هاتنە کێشان هەفتیی جارەکێ, ر وەسا دیارکرنا هاتنە نێریێ ب رێکا نێریت دیارکەر هاتە ئەنجامدان رۆژێ دوو جاران. ل دەما ئاشکرا بوونا هاتنە نێریێ نێن خوینێ هاتنە وەرگرتن بمەرەما پیڤانا پروجیستیرون .

لەشی ل دەمێ گەهشتن ب ھ ارییا رەگەزی و رێژا زێدەبوونا کێشا رۆژانە گەهشتە 24.39±0.46 کگم و 0.116 ±0.033 کگم ل دیڤ ئیك. ا دەرزیێ ب سلینیوم و ڤیتامینE ێ هیچ تێکرنەکا بەرچاف نەبوو لسەر وان هەردوو سالوخەتان. ەژیێ تنێ یە, رکێن گروپا دووێ T2 هاتنە نێریێ ب وەختەکێ تر دیارکرن بەراورد دگەل هەردوو گروپێن دی T1 و T3.

دراسة تأثير السيلينيوم و فيتامين E على: 1- البلوغ الجنسي في اناث ماعز المرعز

الخلاصة

اجريت هذه الدراسة في مشروع قسم الانتاج الحيواني في فاكولتي الزراعة / جامعة دهوك خلال المدة من 23 ايار لغاية 3 تشرين الاول 2013 حيث تم توزيع ثلاثون (30) من اناث جداء ماعز المرعز المفطومة (90-105 يوم) و بمعدل وزن ابتدائي 9,31 ± 0.18 كغم عشوائيا الى ثلاثة مجاميع متساوية (10 مرعز/ مجموعة). تم حقن المجموعة الاولى بمحلول الملح الفسلجي تحت الجلد اسبوعيا واعتبرت كمجموعة السيطرة (T1) اما المجموعة الثانية (T2) تم حقنها اسبوعيا تحت الجلد بجرعة 4 ملغم فيتامين E + 80 مايكروغرام سيلينايت الصوديوم/كغم وزن الجسم, اما المجموعة الثالثة (T3) حقنت ب 2 ملغم فيتامين E + 40 مايكروغرام سيلينايت الصوديوم/كغم وزن الجسم و لمدة 18اسبوعا.

تم وزن الحيوانات اسبوعيا و تم الكشف عن الشياع باستخدام الكباش الكشافة مرتين في اليوم, كما تم اخذ عينات من الدم لدى ظهور علامات الشياع لتقدير هورمون البروجيستيرون.

بلغ وزن الجسم عند البلوغ الجنسي ومعدل الزيادة الوزنية اليومية لاناث المرعز 0.46 ±24.39 , ± 0.116 0.003كغم على التوالي. ولم يكن للمعاملة بالسيلينيوم و فيتامين E تأثير معنوي على كلتا الصفتين. علما بان اناث المعاملة الثانية اظهرت الشياع مبكرا مقارنة بالمعاملتين T1 و T3 .

EFFECT OF SPACING ON DEGREE OF TAPER AND PREPARING TAPER TABLE FOR EVEN AGED STAND OF *Populus nigra* L.

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ABSTRACT

A taper equation was developed for poplar trees growing at four initial spacing (0.5 × 0.5, 1 × 1, 1 × 2, and 2 × 2 m) at age 4 years. In this study, Data came from 160 trees of *Populus nigra L.* plantations collected from two sites Semel and Zakho districts. Total tree height, diameter at breast height, height limit and diameter limit at one meter interval were recorded for each tree. From five candidate equations, equation (1) gives the best performance for estimating tree taper depending on the values of test statistics. This equation can be used to construct taper table to show diminution of diameter along the stem. Total tree volume is obtained by integrating the area from equation (1) at each infinitesimal stem diameter along the entire height of the tree. Under all spacing, the results of statistical analysis showed that increasing in spacing from (0.5×0.5 to 2×2 m) significantly (P < 0.01) increased the average diameter at breast height from (4.5275 to 7.4560 cm), but spacing regime had no significant effect (P >0.35) on tree height.

***KEYWORDS*:** Poplar, spacing, Stand density, Taper equation, Tree form.

INTRODUCTION

Poplars are rapid increasing growth, precocious ripening species in moderate regions. They represent a large amount of timber production. All species of polar are propagated easily (Spanos et al. 2001). The disability of wood production in confronting the demand is increasing in many countries. In general, establishment of plantations with fast growing like poplar is one of the most effective way to meet the growing demand for wood. Poplar and fast growing plantations will decrease the demand pressure on natural forests. It can be a very profitable way of cultivation and provide an alternative source of income for farmers. Therefore, management, research and development studies concerning poplar and fast growing plantations must be encouraged.

Stem taper and stem volume are the two most important tree characteristics used in forest mensuration, to determining the value of a tree and model users (Weiskittel et al. 2011). It is possible to estimate the total volume contained in that portion of stem by integrating the stem profile model between two given heights (Calama and Montero 2006). However, it is difficult to describe the main stem of tree completely by using simple models, because the form of a main stem is dividing into three geometric shapes. The lower, middle, and upper portion of the main stem is assumed to be neiloid, paraboloid, and cone respectively (Hush et al. 1972). The form of a tree is affected by Spacing (Sharma and Zhang 2004). Taper equation provides an estimate of the merchantable volume at any given height by using taper Integration. Stem form and the variation of taper have been widely studied by (Kozak 1988, Newnham 1992, Daquitaine et al. 1999, and Bi et al. 2010). To develop a taper function, pairs of data of diameter and height along the stem are required. In most cases, stem taper functions are referenced to dbh and predict the diameter over bark (Barrio-Anta et al. 2007, Sevillano- Marco et al. 2009, Rodríguez et al. 2010). In most mathematical models, taper is modeled in terms of diameter at 1.3m above the ground and total height.

As reported by Kozak (2004), the benefit of using taper equations to predict (*i*) diameter at any height, (*ii*) total volume, (*iii*) merchantable volume at any portion of a tree, and (*iv*) individual log volume at any height from the ground.

In Iraq, numerous studies have been execute to test taper models and estimate stem volume of different tree species (Salih, 1978; Younis, 1995;

Obeyed, 2006).The objectives of this study were to assay the effect of Spacing on taper of *Populus nigra* L. plantations and to develop and evaluate taper equations that can be used to predict single-tree volume and stem diameter at any given height of tree.

MATERIALS AND METHODS

Area Characterization

Poplar plantations have been selected from Semel and Zakho districts in Dohuk province, northern Kurdistan region of Iraq (figure: 1). The regional climate is characterized by Continental climate, dry hot in the summer, cold rainy in the winter. Coordinates of two locations are presented in (table 1). The mean annual rainfall was about 514.00 mm for the period (2001 to 2012), while the average annual temperature for the same period was about 20.44°C. (Mustafa et al., 2012)

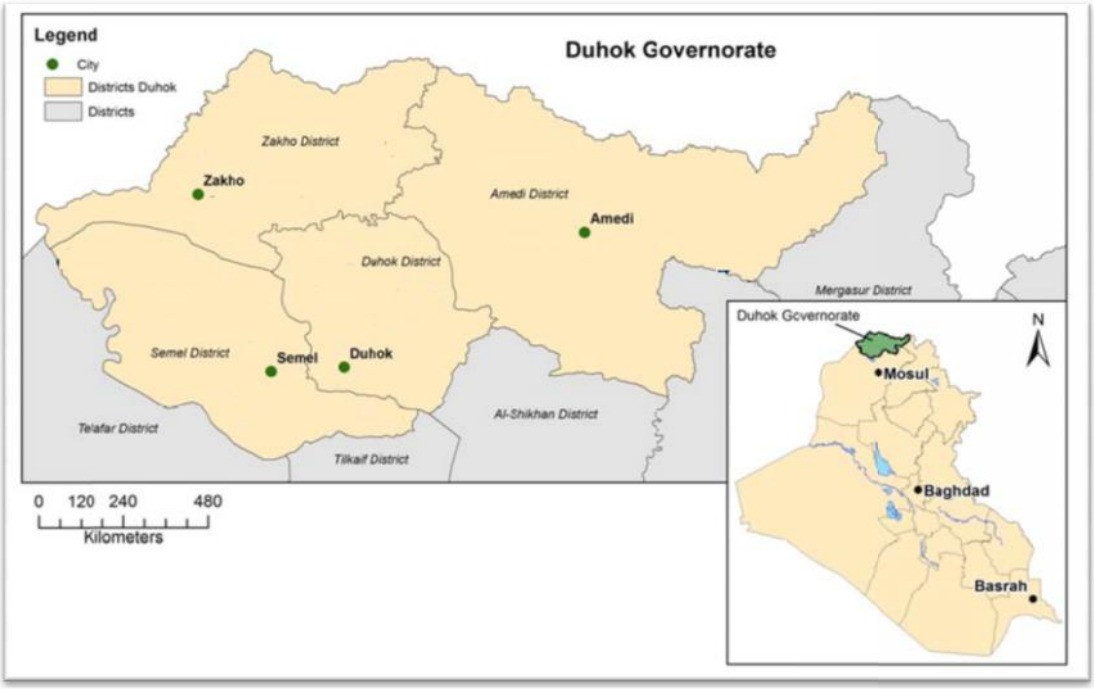

Fig. (1) Map showing the location of study sites

Experimental design

The seedlings were planted in the field using a randomized complete block design with three blocks. Each block had 150 seedlings distributed into three experimental plots, where seedlings were planted in 5 rows in each plot, in each row contain 10 trees with spacing (1 × 1, 1 × 2, and 2 × 2 m) (between rows and trees within row). Out of total 450 trees, 120 dominant and co-dominant trees were selected (40 trees from each block).The seedlings were irrigated twice a week in summer and once in the winter. After that, in Zakho district, we take 40 dominant and co-dominant trees from 150 trees with one spacing (0.5 X 0.5m) at the same age of experimental design (4 years) to make compare between them, in order to find the least degree of taper from each of these four spacing (Table 1).

Table (1): study Area of planted poplar in different spacing.

Location	Geoposition	Spacing	Trees Plot^{-1}	Tree selected	Area (m^2)	Trees ha^{-1}	V Plot^{-1} m^3
Zakho	Altitude: 427 Latitude: 37° 08' 54" N Longitude: 42° 40' 15" E	0.5 X 0.5	150	40	37.5	40000	0.76120
Semel	Altitude: 472 Latitude: 36° 51' 29" N Longitude: 42° 51' 52" E	1 X 1	150	40	150	10000	0.88312
		1 X 2	150	40	300	5000	1.26489
		2 X 2	150	40	600	2500	2.04133
			600	160	1087.5	57500	4.95054

Data

Sample tree was marked with a painting spray at 1.30 cm above ground for indication of subsequent measurements. The tree was cut at 10 cm above ground. After felling 160 dominant and co-dominant trees, Total tree height (H) was measured and recorded nearest 0.1 m using diameter tape. Diameters over-bark at 1-m intervals from stump height (30 cm) to the diameter at (6.30 m) above the ground were measured and recorded to nearest 0.1 cm using diameter tape. Volumes (m^3) were measured with Smalian's formula for all logs, except the last log of the main stem was derived using the conic formula (Avery and Burkhart 2002). The top section volume was added to the cumulative volume to obtain a total stem volume. Tree size characteristics are summarized in (Table 1 & 2).

Table (2): Summary statistics of the data set

Location	Spacing	D (cm)			H (m)		
		Min.	**Mean**	**Max.**	**Min.**	**Mean**	**Max.**
Zakho	0.5 X 0.5	2.60	4.53	6.00	3.80	6.12	7.40
Semel	1 X 1	3.00	5.01	7.00	3.90	6.17	7.40
	1 X 2	4.12	5.96	8.68	4.20	6.15	7.60
	2 X 2	4.91	7.46	9.70	4.10	6.33	7.70

Stem taper equations are very useful in forest mensuration for they describe mathematically the decrease of stem diameter along the tree. Five of candidate equations (Table 3) were used to estimate tree taper and select the best performance taper equations depending on the values of the test statistics. These equations are used to estimate diameters along the bole at any given height. Individual tree volume can then be calculated based on these diameters and corresponding heights.

Table (3): A list of candidate taper equations for *Populus nigra L* plantations.

No.	Taper equation
1	$di = D\,(B_0+B_1\,(hi/H)+B_2\,(hi/H)^2)$
2	$di = D\,(B_1((hi/H)-1)+B_2\,(hi/H)^2-1)$
3	$di = B_0\,D\,(H-hi)^{B1}$
4	$di = D\,(B_0((H-hi)/H)+B_1((H-hi)/H)^2+B_2\,((H-hi)/H)^3+B_3\,((H-hi)/H)^4)$
5	$di = B_0\,(H-hi)^{B1}$

Where *di*: diameter outside bark at a given height *h*, *D:* diameter outside bark at 1.3 m.

H: total tree height, b_1 -b_4: parameters estimated from the data.

USES

The species has a significant economic value due to its wide geographic adaptation and fast growth. A poplar is multi-purpose species, most of the poplar wood is used for construction and making boxes. Peeled unprocessed poles are commonly used for rafters, posts and beams. Poplar is the main source of construction wood for local markets. They provide timber, fiber, fuel wood and other wood and non-wood forest products. These many attributes make poplar ideally suited for supporting rural livelihoods. In planted forest stands the reported average growth performance is up to 21 m^3 per hectare per year (FAO 2006). In Argentina every year 1,200 m^3 of these wooden slabs are exported to Brazil for pencil production (Calderón *et al.* 2004). In Islamic Republic of Iran, total area of poplar plantations was 150,000 ha, of which 35% were young stands. The average standing volume of these stands was estimated at 155 m^3/ha (Rouchiche and Mirsadeghi 2003).

In Duhok province, especially in Zakho district, fast-growing plantations of *Populus nigra L.*have been established. Growth rates of up to 45 m^3/ha/yr have been reported in a five-year rotation cycle. The internal rates of return (IRR) achieved under different management regimes range between 12 and 34 % (Hassan and Salim 2004).

Evaluating models

The comparison of the models was based on four statistical indices: adjusted coefficient of determination (R^2), the standard error of estimate (SEE), the mean absolute error (MAE) and the standard deviation of the residuals (SDR). Residual analysis was necessary for evaluating taper models in this study. Three of statistical criteria obtained from residuals were examined to compare the performance of tested models Kozak and Smith (1993). A t-test was used to determine if there is a significant or non-significant effect of spacing for both diameter and height. The data were processed on using the programs Statigraphics plus: 5.1, Minitab and Microsoft Excel 2007 all test statistics are defined as:

$$R^2 = 1 - \frac{\sum(y_i-\hat{y}_i)^2/df}{\sum(y_i-\bar{y}_i)^2/df} \qquad SEE = \sqrt{\frac{\sum(y_i-\hat{y}_i)^2}{df}} \qquad MAE = \frac{1}{n}\sum|y_i - \hat{y}_i|$$

$$t = \frac{\bar{y}_1-\bar{y}_2}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}} \qquad SDR = \sqrt{\frac{\sum(y_i-\hat{y}_i)^2-(\sum(yi-\hat{y}))^2}{n-1}}$$

Where:

y_i: *is observed value.*

$\hat{y}_i$: *is predicted value.*

$\bar{y}_1$: average of sample 1

$\bar{y}_2$: average of sample 2

S_1^2: *variance of sample* $1 = \frac{\sum(X_i-\bar{X}_1)^2}{n_1-1}$

S_2^2: *variance of sample* $2 = \frac{\sum(X_2-\bar{X}_2)^2}{n_2-1}$

n: *is number of observation.*

n_1: *number of observations in sample* 1

n_2: *number of observations in sample* 2

X_1: mean stem diameter (Control) at 1.30 m with spacing (0.5 x 0.5m).

X_2: mean stem diameter at 1.30 m with spacing (1 x 1, 1 x 2, and 2 x 2 m).

RESULTS AND DISCUSSION

Tree taper equations are precious implements in forestry. The relationship between taper and three main variables of tree includes diameter at 1.3m, height limit, and total height were involved in this study. With the help of a computer, regression analysis which was used to prepare five taper equations for *Populus nigra* L. plantations in Semel and Zakho districts. The main stem taper was represented by simple and polynomial functions. For instance of such simple and polynomial taper functions are presented by Reed and Byrne (1985), Sharma and Oderwald (2001), and Sharma et al. (2002). As recommended by Kozak and Smith (1993), for each of this taper equation overall statistics of fit (R^2, SEE, MAE and SDR). Parameter estimates and fit of statistics for taper equations are presented in (Table 4).

Table (4): Parameter estimates and fit statistics for taper equations.

No.	B_0	B_1	B_2	B_3	R^2	SEE	MAE	SDR
1	1.26418	-1.36631	0.16251		96.0234	0.4545	0.3439	0.4523
2	-2.42863	1.24984			91.7320	0.6553	0.5333	0.6502
3	0.23682	0.85394			87.7748	0.7969	0.6055	0.7903
4	1.73843	-2.36604	3.55641	-1.68634	95.9576	0.4582	0.3469	0.4552
5	1.30732	0.92464			79.6834	1.0273	0.7769	1.0265

According to the table 4 for estimating the parameters of five candidate taper equations for *Populus nigra* L. These equations were compared between them to select the best equation depending on four measures of precision, which are: the adj. R^2, SEE. MAE and SDR. The fit-test statistics obtained from residuals were tested to compare the performance of models (Kozak and Smith, 1993). Models (3 and 5) was eliminated from the competition list, because have relatively lowest values of adj. R^2 than other models (87.7748, 79.6834) respectively and also have highest values of residuals as compared with other candidates (Table 4). The remaining equations (1, 2 and 4) very close to one another of fit test statistics. Nevertheless, equation (1) gave the best performance for estimating tree taper according to the values of the statistics. The true diameters were compared with predicted diameters (Fig: 2) by calculating bias in predicting diameters along the stem, it gives the smallest values of the mean bias.

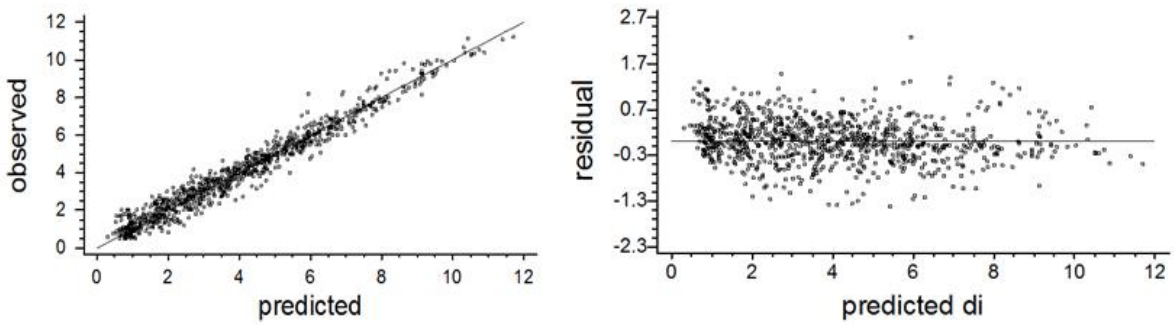

Fig. (2): plots of Residuals against predicted values for equation (1).

For that reason, equation (1) Single polynomial function can be used to construct taper table of *Populus nigra* L. plantations located in Semel and Zakho districts, presented in (Table 5).

Table (5): Taper table constructed from equation (1) for Populus nigra L. plantations.

H (m)	h_i (m)	D (cm)			
		2	4	6	8
5	**0.3**	2.3656	4.7311	7.0967	9.4623
	1.3	1.8399	3.6797	5.5196	7.3594
	2.3	1.3401	2.6803	4.0204	5.3605
	3.3	0.8664	1.7328	2.5992	3.4656
	4.3	0.4187	0.8374	1.2561	1.6748
6	**0.3**	2.3925	4.7851	7.1776	9.5702
	1.3	1.9516	3.9031	5.8547	7.8062
	2.3	1.5286	3.0572	4.5858	6.1145
	3.3	1.1237	2.2475	3.3712	4.4950

	4.3	0.7369	1.4738	2.2108	2.9477
	5.3	0.3682	0.7363	1.1045	1.4726
	0.3	2.4118	4.8237	7.2355	9.6474
	1.3	2.0321	4.0642	6.0963	8.1283
	2.3	1.6656	3.3312	4.9968	6.6624
7	**3.3**	1.3124	2.6247	3.9371	5.2494
	4.3	0.9724	1.9448	2.9172	3.8896
	5.3	0.6457	1.2914	1.9371	2.5828
	6.3	0.3323	0.6645	0.9968	1.3291

di = D [1.26418-1.36631 (hi/H) +0.162512 (hi/H) ^{2}]

Equation (1) was then used to calculate the volume of a log between any two heights, by taking the following integration (Calama and Montero 2006):

$$V = 0.00007854 \int_{h1}^{h2} d^2 dh - - - - - (6)$$

After estimating parameters for equation [1] as given in Table 4:

$$V = 0.00007854 \int_{h1}^{h2} D^2 \left(1.26418 - 1.36631\left(\frac{hi}{H}\right) + 0.162512\left(\frac{hi^2}{H^2}\right)\right)^2 dh - - - - - (7)$$

Equation (7) can then be simplified to get the following combined variable equation:

$$V = 0.0000247165\, D^2 H - - - - - - - - - (8)$$

Test statistics (t-test) for all spacing, was examined by way of the difference between the two means (for both variable D and H). Since the calculate P-value is less than 0.01, we can reject the null hypothesis and we conclude that the sample did not provide evidence that the two means are equals α = 0.05. Therefore for all spacing, diameter (D) had increased significantly from (4.5275, 5.0150, 5.96075 and to 7.4560 cm) respectively with increasing the distance between trees from (0.5 × 0.5, 1 × 1, 1 × 2, and to 2 × 2 m.) respectively (Table 6). In several studies, diameter has been found to vary with stand density (Varmola, 1980; Valinger, 1992; Sharma and Zhang 2004).

Table (6): comparison between means to show effect of spacing on diameter and height by using T-test and P-value statistics.

Variable	Spacing	Mean	T- test	P-value
D	0.5 X 0.5	4.52750	-2.79581	0.00652
	1 X 1	5.01500		
	1 X 2	5.96075	-7.13992	0.00000
	2 X 2	7.45600	-14.1137	0.00000
H	0.5 X 0.5	6.11750	-0.23646	0.8137
	1 X 1	6.17000		
	1 X 2	6.15000	-0.15503	0.8772
	2 X 2	6.32675	-0.93487	0.35274

On the other hand, for all spacing, increasing distance between trees had no significant effect (P >0.35) on the mean of tree height (Table 6) , which increased slightly from 6.11750 in spacing (0.5 X 0.5) to 6.32675 in spacing (2 X 2)

CONCLUSIONS

To gratify the increasing requirements for wood products, fast-growing trees such as poplar plantations are being regard as for future provide demands. From five candidate equations, equation (1) gave the best performance for estimating tree taper depending on the values of the statistics represent R^2 adj, SEE, MAE and SDR. For that reason, this equation can be used to construct taper table presented in Table 5. This table shows the diminution of diameter along the stem, also by integrating equation (1), it is possible to estimate the total volume contained in that portion of stem (Calama and Montero 2006).The spacing indicated that there were significant effects (P < 0.01) on the mean diameter of *Populus nigra* L. plantations. In other words, lower stand density produced trees with smaller stem taper. On the other hand, there was no significant difference (P >0.35) in height under all the spacing of the study.

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کارتێکرنا مەودا لسەر پلەیا تاپەر وبەرهەقکرنا خشتەیێ تاپەری بو ارێن سپینداری Populus nigra L. ین هەڤژی.

پوختە

ه یا تاپەری بو دارێن سپینداری ئین شین بووی ل چار مەودا دا هاتە پەرەساندن (0.5 × 0.5, 1 × 1, 1 × 2، و2 × 2 م) ،مێ ں وان 4 سال. ین هاتینە بکارئینان دقێ ەکولینێ دا ژ (160) رێن سپینداری Populus nigra L. تە کومکرن ژ دەقەرێن سێمیل و زاخو. ەرجەمێ بلنداهیا دارێ ئیرە لسەر ئاستێ سینکی، ه ل ئاستێ وجور وماوێن ئیك میتر هاتە تومارکرن بو هەر نمونەیەکی. ەر بێنج هاوکیشێن پالێوراو، هاوکێشەی ژمارە (1) باشترین کارتیکرن بو هەلسنگاندنا تابەری داری بشتبەستن لسەر هندیك بەهای ئامارێ. ، هاوکیشە دی هیتە بکار ئینان بو چیکرنا خشتێ تابەری ژ بو نیشاندانا کیمبونا تیرەی داری لسەر ەیا قەدی، هەر وەسا برێکا یەکخستنا هاوکیشا (1) دێ شین سەرجەمی قەبارەی ل بجوکترین تیرە ەریخێن. ئەنجامێن شروفەکر ری خویادکەن کو زێدەبوون ل ئاستێ مەودا لە (0.5 × 0.5,بو 2 × 2 م) یا بەرچاڤ بوو (P <0.01) رای تیرە زێدەبوو ل ئاستێ سینگی دا ژ (4.5275 بو 7.4560 سم) ەلێ کارتیکرنا ودا لسەر تێکرایێ بلنداهیا داران نەیا بەرچاڤ بوو (P > 0.35) .

تأثير المسافات على درجة الاستدقاق واعداد جدول الاستدقاق لمشاجر الحور الاسود *Populus nigra* L. المتساوية العمر

الخلاصة

تم تطوير معادلة الاستدقاق لأشجار الحور النامية في أربعة المسافات زراعة بين الاشجار. (0.5 × 0.5, 1 × 1, 1 × 2، و2 × 2 م) عند عمر 4 سنوات. البيانات المستخدمة في هذه الدراسة، جاءت من 160 شجرة من أشجار الحور الاسود *Populus nigra L* تم جمعها من منطقتي سميل و زاخو . أرتفاع الشجرة الكليّ، القطر عند مستوى الصدر، والقطر عند مستويات مختلفة على فترات متر واحد تم تسجيلها لكل عينة .من خمسة معادلات مرشحة، المعادلة رقم (1) أعطت أداء أفضل لتقدير الاستدقاق شجرة اعتمادا على بعض الاختبارات الإحصائية .هذه المعادلة يمكن استخدامها لبناء جدول الاستدقاق لإظهار تناقص القطر على طول الساق. حجم الشجرة الكليّ يمكن الحصول عليه باخذ تكامل المساحة للمعادلة رقم (1) عند أصغر قطر موجود على طول الجذع من أرتفاع الشجرة. وأظهرت نتائج التحليل الإحصائي أن زيادة في مستوى المسافات من (0.5 ×0.5 إلى 2 ×2م) كان معنويا (P <0.01) حيث ازداد متوسط القطر عند مستوى الص

در من (4.5275 الى 7.4560 سم)، ولكن تأثير المسافة على متوسط ارتفاع الاشجار كان غير معنوي (P > 0.35).

CORRELATED RESPONSE TO SELECTION FOR RESIDUAL FEED INTAKE IN JAPANESE QUAIL (*Coturnixcoturnix japonica*)

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ABSTRACT

The present study aimed to investigate the impact of direct selection for feed conversion ratio (FCR) on the residual feed intake (RFI) as a correlated response to selection character (CR_{RFI}). Layer performance, expected feed intake (EFI) and genetic parameters for the associatedcharacters in base generation (F0), selected parent (SP) and offspring generation (F1), were studied by using batteries as pens and individual cages in Japanese quail. A total of 240 and 180 birds aged 6 weeks old were utilized for both F0 and F1, respectively. EFI was estimated by simulation during the period from 12-16 weeks of age.The findings showed a significant difference between both generationsin body weight (BW), egg mass (EM) and feed intake (FI). Estimation of heritability for WG, EM, FCR and RFI were 0.27, 0.57, 0.62 and 0.54, respectively. Equations for EFI were derived for F0, SP and F1; Residual curves with both observed feed intake (OFI) and EFI were drawn. The CR_{RFI} was computed and determined as 10.57g.

KEY WORDS: Japanese quail, laying performance, genetic parameters, correlated response to selection, residual feed intake.

INTRODUCTION

It is known that feed intake (FI)in layers as depends on the metabolic body weight (MBW), weight gain (WG), egg mass (EM), plumage density, body temperature, body conformation and the bird's activity(Luiting, 1999; and Hussen *et. al*., 2000). Some birds consumed more than their requirements of feed or energy, and considered as a waste and usually calledresidual feed intake (RFI) or residual feed consumption (Hussen, 2000).Residual feed intake is the difference between observed feed intake quantity and the predicted feed requirements, which computed from multiple regression equations via MBW ($BW^{0.75}$), WG and EM (Luiting and Urff, 1991; Fathi, *et. al*., 1995; El-Sayed, 1995; and Hussen *et. al*., 2000). The exact reasons forthis residual is not known, but it is believed that RFIwas related to bird's genome, nutritional factors and organs physiology, because it is differ from the bird to another (El-Sayed, and El-Hakim, 1994; Luiting, 1999; and Hussen, 2000).Selecting birds for feed conversion ratio may result in unpredictable variations in its component traits, so, RFI criterion has been derived, which is a measure of feed consumption that deals the bird's maintenance costs and production (Varkoohi *et. al*., 2010).

In an experiment, to study the residual feed intake in Japanese quail, duck and chickens, El-Sayed and El-Hakim (1994), found that the RFI was less affected in duck because of the body weight was almost constant, but in J. quail resulted in a negative residual, and concluded that it may select birds on the basis of less residual feed intake.Moreover, means of residual feed intake for two lines (selected for feed conversion and control) were -24.5 and 10.2 g, respectively (Varkoohi *et. al*., 2010),and the correlated response for RFI was improved from -34.7 to -11.6 g during 4 generations.

Studies on heritability estimation and correlated response to selection for RFI in J. quail are very rare(Gill & Washburn, 1974; Pym & Nicholls, 1979; and Varkoohi *et. al*., 2011).Estimation of heritability in quail for feed conversion ratio ranged between 0.2 – 0.8 (Wilson, 1969; Chambers *et. al*., 1984; Leenstra *et. al*., 1986). Predicting the impact of direct selection for FCR on its components is needed to estimate the genetic parameters (Gunsett, 1984).The genetic correlation between FCR and RFI in J. quail, during the period from 7-28 d, was

estimated as 0.26 (Varkoohi *et. al*., 2011).Also theyestimated the heritability for both BW at 28 d. and WGas (0.22 and 0.28, respectively).Varkoohi *et. al*. (2010) concluded that the selection for decreasingfeed conversion ratio also decreasedresidual feed intake.Silva *et. al*., (2013), found that the heritability estimate for egg number in two strains of J. quail was very low (0.04 and 0.05), wherease the estimation for egg weight was (0.39 and 0.41). Therefore, the present investigation aimed to study the direct response to selection for feed conversion ratio of egg production and to estimate the heritability of residual feed intake and other laying traits.

MATERIALS AND METHODS

This investigation was carried out at poultry farm, Dept. animal production, Faculty of Agriculture, Duhok University, Kurdistan region, Iraq.

Rearing and Selection:

The fertile eggs of base population were brought from Mosul province (on April, 2013), Iraq. A total of 240chicksas base population (*F0*), were hatched from one lot. The unsexed birds with equal numbers were reared in 8 pens (replicates) on the floor up to sexual maturity. Then the female birds were distributed on single floor batteries (each battery considered as one pen or replicate), and housed individually in cages(30 × 50 × 30 cm) within each battery.The laying performance include(BW, WG, EM, FI, FCR and RFI), wasrecorded for *F0*during the period from 12-16 weeks of age. The birds on the basis of the best FCR were selected (≤ the average FCR value), the intensity of selectionwas 0.8 (the culled birds represent 50% of the total quails). The males were selected on the basis of high live body weightduring the period from 6 – 12 weeks of age,anddistributed randomly on cages of selected females for mating, and they were rotated twiceweeklyamong female cages.The fertile eggs from selected parent were collected daily for a week, and incubated forhatchingthe first generation(*F1*) chicks.The new generation comprised180 one day old chicks, andreared up to the sexual maturity in 6 pens on the floor (equally numbers for each pen or replicate),then thebirds randomly distributed on individual cages within the batteries, which considered as pens (replicates). The same previous traits were measured on the progeny, in order to estimate the genetic parameters. Residual feed intake experiment was conducted on the offspring flockduring the period from 12-16 weeks of age.

During the growing period, feed and water was offered *ad-libitum*. Rations offered to the both stocks contained 2904 K. cal. ME/kg with 26 % CP; 2937 K. cal. ME/kg with 21 % CP and 2793 K.cal.ME/kg with 18.3% CP for starter (1-21 d), grower (22-42) d and layer(43 – end of trial), respectively, according to Lesson and Summers (2005).Light was provided 23 hours a day, ventilation included ear from water coolers for both generations

The studied traits:

Live body weight, weight gain, feed intake and egg mass (g) of each female were individually recorded weekly for two successive generations during the period from 12 – 16 weeks of age.Body weight gain (g) was calculated as the difference between the two successive body weights; Feed conversion ratio was computed as the ratio of feed intake to the egg massduring each week. Residual feed intake (RFI) was computedas the difference between the observed (actual) feed intake (OFI) and expected (predicted) feed intake (EFI) according to Hussen *et. al.* (2000) *RFI = OFI – EFI.* The expected feed intake was determined as the following equation:

$$EFI = b1\ MBW + b2\ \Delta WG + b3\ EM + a$$

Where: *MBW* = metabolic initial body weight ($BW^{0.75}$); ΔWG = change in body weight (gaincalculated from the difference between final and initial body weights); *EM* = Egg mass during the experimental period; *b*1, *b*2 and *b3* = partial regression coefficients; and *a* = intercept.The mentioned traits were computed for each week separately, and across the whole four weeksexperiment within each generation.

Genetic estimation:

Direct selection for the FCR was applied, so the response to selection (*R*) was calculated for FCR and other related traits (including RFI) as the difference between records of progeny (*F1*) and the parent (base population), while the selection differential (*S*) was determined as the difference between the selected parent and the base population (*F0*). Realized heritability for the same traits was estimated as the ratio of (*R*) to (*S*), the genetic correlation between FCR and RFI was estimated by the geometric method as follows:

$$r_g = \sqrt{(\text{cov Z2X1 } \mathbf{X} \text{cov Z1X2})} / \sqrt{(\text{cov Z1X1 } \mathbf{X} \text{cov Z2X2})}$$

Where: 1 and 2 both studied traits; Z and X both generations (Z observations of parents and X observations of offspring). Correlated response to selection for the RFI was calculated according to Falconer and Mackay (1996):

$$Cr_{RFI} = iXh_{FCR}Xh_{RFI}X\, r_{A(FCR,\, RFI)}X\sigma_{pRFI}$$

Where: Cr_{RFI}= Correlated response to selection for the residual feed intake,i = Intensity of selection, h_{FCR} = Square root of heritability for feed conversion ratio, h_{RFI} =Square root of heritability for residual feed intake, $r_{A(FCR,\ RFI)}$ = Genetic correlation between FCR and RFI, σ_{pRFI} = Standard deviation of residual feed intake.

Statistical Analysis

The data of laying traits werestatistically analyzed using SAS software (SAS, 2010), by GLM proc., via the following multivariate model:

$$Y_{ij} = \mu + G_i + e_{ij}$$

Where: Y_{ij}= records of the first trait (BW); μ = overall mean; G_i = the effect of generation; and e_{ij} = the experimental error.Duncan's multiple range test, was used to compare means of generations (Duncan, 1955).

The expected feed intake (EFI) has been analyzed usingthe previous software by linear regression and via the following model:

$$EFI_{ijkl} = \mu + MBW_i + \Delta WG_j + EM_k + a_{ijkl}$$

Where: variables in this model are the same as the expected feed intake equation, which mentioned previously.

RESULTS AND DISCUSSION

Laying Performance:

A comparison between both studied generations was performed for some important traits in laying stage in order to illustrate the effectiveness of selection (Table 1). It could be noticed from the table that theinitial body weight (IBW), final body weight (FBW), EM and FIof *F1* surpassed significantly (P≤0.01) *F0*, and the difference was amounted to 7.8, 10.2, 12.6and 10.6 %, respectively. However, WG, FCR and RFI were not differed significantly between the two generations. Such result may be due to the variation exist in replicates as evident from the standard error of the traits.

Table (1): The effect of selection on laying performance of J.quail femalesduring the period from 12-16 weeks of age, for both generations (means ± SE)

Trait	*F0*	*F1*	(*P*≤)
IBW	240.28 ±4.7[b]	260.67±3.99[a]	0.003
FBW	238.33±4.54[b]	265.33±3.83[a]	0.0001
WG	-1.94*± 3.62[a]	4.67 ± 5.01[a]	NS
EM	262.5 ± 8.64 [b]	300.32 ± 4.9 [a]	0.001
FI	886.28 ± 30.76 [b]	991.68 ± 25.96 [a]	0.01
FCR	3.38± 0.18[a]	3.31 ± 0.07[a]	NS
RFI	22.77 ± 21.55 [a]	10.35 ± 21.35[a]	NS

Means with different letters within each raw differ significantly. NS: Non-significant.

*- In layer some birds loss from their body weight because of egg production.

IBW = Initial body weight g. (at 12 weeks old); FBW = Final body weight g. (at 16 weeks old); WG = Weight gain g. (12-16 weeks of age); FI = Feed intake g. (12-16 weeks of age) and FCR = feed conversion ratio (12-16 weeks of age).

In a similar study on the quail meat yields, Varkoohi et. al. (2010), found that the selected line for FCR surpassed unselected line by about 16.4, 17.2, 4.9 and -34.7 % in BW, WG, FI and RFI, respectively for 4 successive generations. Moreover, Muir and Craig (1998); Muir and Cheng (2004); Muir (2005); and Muir *et. al.*, (2013), stated that the best way forincreasing egg production in poultry species is selection.

Genetic Parameters:

Selection differential, heritability and response to selection for some traits are given in Table 2. It seems an appreciable difference exist in the

selection differential between the *F0* and *F1*, and such difference is acceptable from selection for one generation only, which is due to selection intensity of 50 % of the stock.However, response to selection decreased FCR by about 0.07 fromits mean value before selection, and RFI mean value was decreased by about 12.4 g. These results indicate that the genetic potential of quail in FI and related traits may develop a special strain or line for egg yield. The heritability estimate for the studied traits indicates that the FCR and RFI have high h^2 values, which insure the genetic potential of the quail. However, all heritability estimates for most traits wererelatively high except that of WG, (0.27).The genetic correlation between FCR and RFI was (0.29), which indicate a close linkage between them.

Table (2): Response to selection and heritabilityfor some traits of J. quail females during the period from 12-16 weeks of age.

Trait	*SP*	*SD*	*R*	h^2
IBW	272.78	32.5	20.79	0.64
FBW	297.78	59.44	28.09	0.47
WG	25.00	26.94	7.30	0.27
EM	326.97	64.47	37.82	0.57
FI	1070.17	183.89	105.4	0.67
FCR	3.27	-0.11	-0.07	0.62
RFI	-0.3	-23.1	-12.42	0.54

RFI = Residual feed intake; SP = Selected parent; SD = Selection differential; R = Response to selection; h^2*= Heritability;* (*Selection intensity i = 0.80 for remaining 50 %);* $r_{A(FCR, RFI)}$ ***= 0.29***.

Several investigators noted a lower value of heritability for such traits (Schuler *et. al*., 1998; N'Dri *et. a*l., 2006; and Varkoohi *et. al*., 2010). The genetic correlation between FCR and RFI was estimated by Varrkoohi *et. al*. (2011) at different ages in quail, and ranged from 0.11 to 0.28. Also, they added that the selection for FCR was genetically resulted inan increase ofWG and reducing FI, they added that RFI is expected to be low to moderate correlated to FCR.

Expected Feed Intake:

EFI (g) for both generations and selected parent are built according to the partial regression coefficients (Tables 3, 4 and 5), in order to calculate the RFIs, later.

For base population, the EFI model had relatively low R^2 (0.41) and high intercept (1114.3), which might be attributed to the high variations among the individualsin *F0*generation (Table 3). However, in general the EFI equation resulted from the analysis was acceptable, since the values of MBW and WG are negatives.

Table (3): The model and partial regression coefficients for the parent stock's (***F0***) prediction equation.

Model	Partial Regression Coefficients (R^2 = 0.41)	
	b	Std. Error
(Constant)	1114.295	58.005
MBW	-6.317	10.764
WG	-2.830	2.623
EM	.444	1.071

The expected feed intake for (*F0*) females during the period from 12-16 weeks of agewas calculated according to the following equation:

$$\mathbf{EFI_{F0} = 0.44\ EM - 2.83\ WG - 6.32\ MBW + 1114.3}$$

For selected parent, the EFI model has an acceptable R^2 (0.63) with negative intercept (-1422.5) and higher coefficient of EM. Contrary to the previous model, this equation gives an indication about bird's homogeneity (Table 4).

Table (4): The model and partial regression coefficients for the selected parent's (***SP***) prediction equation.

Model	Partial Regression Coefficients (R^2 = 0.63)	
	b	Std. Error
(Constant)	-1422.49	193.16
MBW	22.24	23.5
WG	.487	4.7
EM	3.037	2.21

However, the EFI ofthe selected femalesbased on theFCR during the same periodcould be calculated according to the following equation:

$$\mathbf{EFI_{SP} = 3.04\ EM + 0.49\ WG + 22.2\ MBW - 1422.5}$$

For offspring generation, the EFI model has the best R^2 (0.70) with negative low intercept (-190.4) and the highestEM coefficient. This model is an indicative of increasing homogeneity of the birds (Table 5).

Table (5): The model and partial regression coefficients for the offspring flock's (***F1***) prediction equation.

Model	Partial Regression Coefficients (R^2 = 0.70)	
	b	Std. Error
(Constant)	-190.443	82.334
MBW	.574	12.027
WG	1.492	1.762
EM	3.800	1.527

The EFI forthe femalesof progeny for the FCRtrait during the same period could be computed according to the following equation:

$$\mathbf{EFI_{F1} = 3.8\ EM + 1.49\ WG + 0.57\ MBW - 190.4}$$

The females of quail in the second generation (*F2*) utilized feed more efficiently (Mignon and Minvielle, 2003). Some workers reported that in somepoultry species, there were a small negative correlation between BW and RFI, which permit to increase EFI for growth and laying periods (Bordas and Me´rat, 1981; Katle *et. al*., 1984; Luiting and Urff, 1991; Tixier- Boichard *et.al*., 1995; Gabarrou *et. al*., 1998 and Aggrey *et. al*., 2010)

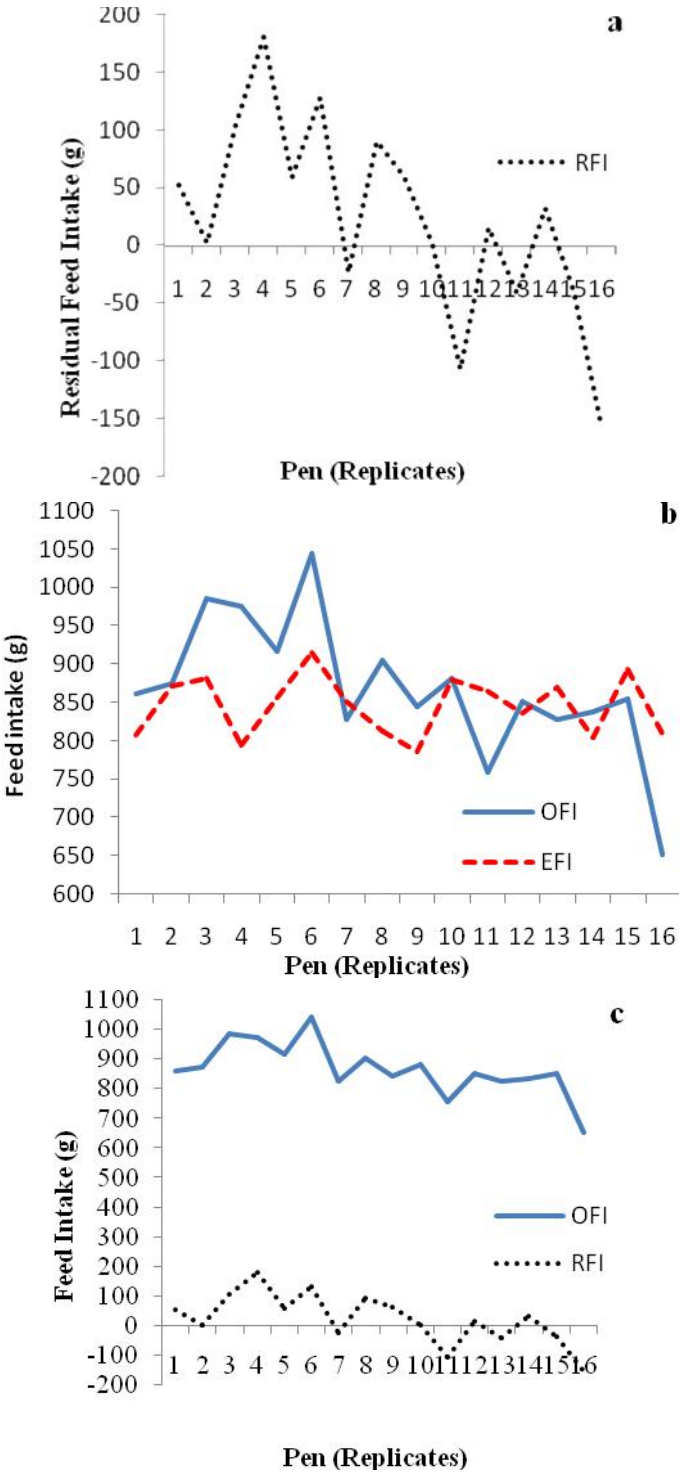
Residual Feed Intake:

Residual feed intake for both generations during the period from 12 – 16 weeks of age has been presented as curvesas alone, withOFI, with EFI, with bothOFIand EFI, and also OFI was representedwith EFI (Figures 1 and 2). These curves give an idea about the RFI manipulation for individuals within replicates (batteries).

For base population (*F0*), it could be noticed that RFI curve fluctuate from -157.7 up to +181 g (Figure 1-a). In general this result indicate, that the unselected birds tend to consume more feed than their requirements, and if some birds loss energy from their bodies, which is consideredlower than the expected, because the negative residual values are lower than the positive values (above the axes). With regard to OFI vs. EFI (Figure 1-b), the curves values are within normal range. RFI vs. OFI curves (Figure 1-c) tend to be similar to their counterparts (RFI vs. EFI) in (Figure 1-d), except the extreme values in OFI, and the final curves (Figure 1 –e), illustrate such extreme values in OFI. These curves indicate that the feed intake for the base

population needs to be restricted, in order to minimize the feed lost by birds.

For *F1* birds, it could be observed that RFI curves fluctuate from -173.9 up to +119.6 g (Figure 2 –a), this finding indicate that the selection for FCR, improved feed utilization by the offspring, in order to reduced RFI in positive side and also to increase RFI in negative side compared to *F0*.



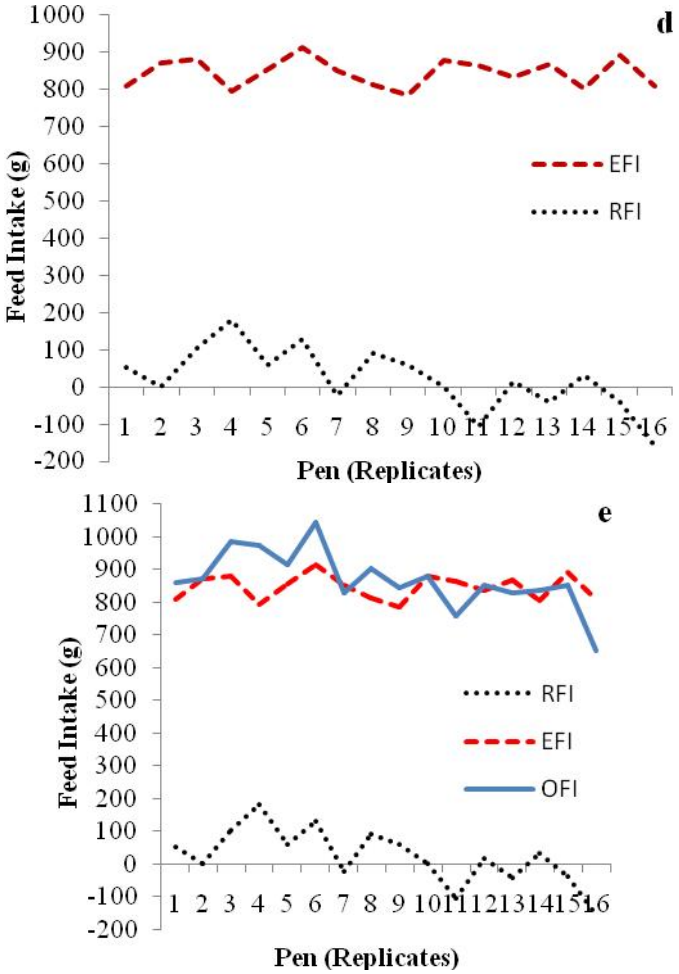
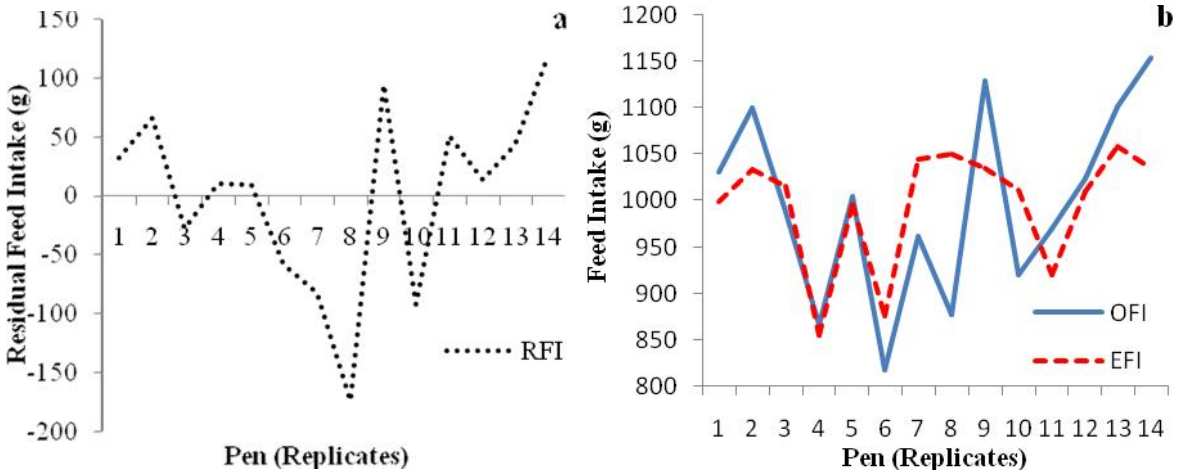


Fig. (1): Residual Feed Intake in parent stock (***F0***) during the period from 12 – 16 weeks of age. a- Residual; b- Observedvs.Expected;c- Observed vs. Residual; d- expected vs. Residual; and e- Observed vs. Expected vs. Residual.



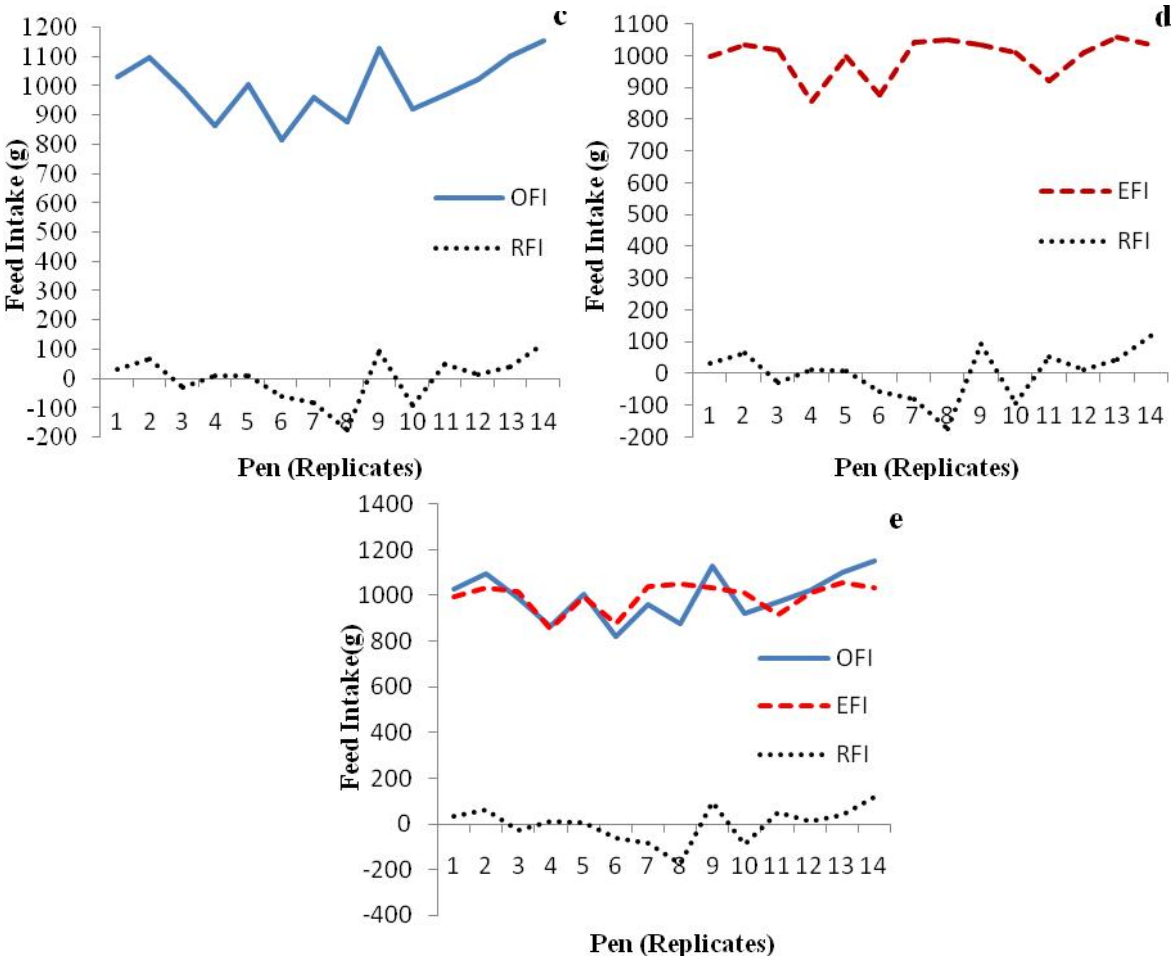


Fig. (2): Residual Feed Intake in offspring flock (***F1***) during the period from 12 – 16 weeks of age. a- Residual; b- Observed vs. Expected; c- Observed vs. Residual; d- expected vs. Residual; and e- Observed vs. Expected vs. Residual.

From the Figure (2 –b), it could be noted that OFI vs. EFI, are more fluctuated than that of *F0*, which may due to the high variation in RFI within pen's individuals. With respect to RFI vs. OFI, the Figure (2 –c), shows that the OFI curve tend to recordlower extreme values in spite of more fluctuate values. While both curves (Figured2 –d; and 2 –e), show that RFI vs. EFI; and RFI vs. both OFI and EFI, illustrate a minimum extreme values compared to *F0* replicates (Figure 1-e).Mignon and Minvielle (2003*)*, reported an association between RFI and EM, andconclude that *F2* quail birds utilized feed more efficiently. In chickens, some investigators found that there is a negative correlation between RFI and BW, which affect also the egg size (Bordas and Me´rat, 1981; Tixier- Boichard *et al*., 1995).

Correlated Response to selection:

Correlated response to selection for RFI as affected by the direct selection for FCRis an indicator of the genetic potential of the quail birds.Variables which included in the calculation of the correlated response to selection for RFI trait are given in Table (6).

Table (6): Components and value of correlated response to selection for residual feed intake during the period from 12-16 weeks of age in J. quail.

Selection Intensity	Square root of Heritability for FCR	Square root of Heritability for RFI	Genetic correlation between FCR and RFI	Standard deviation for RFI	CR_{RFI}
0.80	0.79	0.73	0.29	± 79.02	**10.57**

As it is shown from Table (6), the standard deviation of the RFI is relatively negatively and positively ishigh (79.02g).As mentioned previouslya direct selectionimproves the FCR in the next generation by about (0.07), and decreased the computed quantity of the RFI by about 12.42g (Table 2). Moreover, the genetic ability of the birds for improvement the RFI could be predicted from the equation of correlated response to selection (especially when the RFI didn't computed directly). The improvement of RFI means a reductionits value in the next generation, so thevalues of CR_{RFI} (10.57) from Table (6) indicate the reduction in overall mean of RFI. The RFIaverages in the base population and progeny were 22.77 and 10.35 g, respectively (Table 1), and the difference between them (12.42 g) refer to the actual (direct) response to selection for RFI, so it could be say that actual response to selection is very close to the theoretical correlated response to selection (12.42 vs. 10.57), that is mean a reduction occurs in RFI trait when selectionapplied to improve FCR trait.

Actually $\mathbf{CR_{RFI}}$ decreased the standard deviation of RFI trait depending on the different genetic parameters affecting it including selection intensity, heritability and genetic correlation, so, the correlated response to selection for RFI decreased the standard deviation of RFI from 79.02 to 10.57 (about 86.6 %).Similar result was obtained by Varkoohi *et.al*. (2010), who concluded that the direct selection improve FCR and decreased RFI in the next generations. However, Mignon and Minvielle (2003) reported that RFI quantity ranged between -96.4 to 183.3 g.

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EFFECT OF SOIL COMPACTION IN ROOT PENETRATION RESISTANCE AND SOME GROWTH PARAMETERS OF MAIZE GENOTYPES

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ABSTRACT

The experiment was conducted in Lath house at college of agriculture, University of Duhok. The design of experiment was factorial and the treatment arrangement in RCBD with three replications. Soil compactions made to reach these levels of bulk density (1.35, 1.54, 1.74, and 1.94) g.cm^{-3} using four genotypes of corn crop (*Zea mays L.*) (Polina, Synthetic 5012, Synthetic one, Synthetic 5018) which were planted in 48 pots at depth 4-5 cm from soil surface. The results were showed a significant differences in plant height, leaf area, root depth and soil strength. The Synthetic 5018 gave highest value in plant height, leaf area and soil strength. Root growth of genotypes were decreased with increasing soil compaction levels.

KEY WORDS: Maize genotype, Soil compaction, Root depth, leaf area

INTRODUCTION

Soil compaction has negative effects on seed emergence and yield and yield component of crops (Hadas *et. al.*,1986; Alakukku and Elonen 1995;Radford *et al.*, 2001). Ramazan *et. al.*, (2012) reported that Compaction caused using heavy machinery in the field which compact soil, pressure from wheels, tillage equipment, trampling by animals, using low of organic matter, in fertilization frequent use of chemical fertilizer and plowing at the same depth for many years. Slow plant emergence, thin stand, uneven early growth, small seed heads, abnormal rooting patterns, shallow or horizontal root growth and reduced nutrient concentration can be a reflection of compaction. Excessive soil compaction impedes root growth and there for limits the amount of soil explored by root. Hakansson and Lipiec, (2000) stated to Harmful effects of soil compaction on soil structure include reduction of air filled void spaces, reduction of the volume of macro pores, changes in soil matrix gaseous composition and increases in resistance to root growth and configuration. Root growth of crops depends on plant and ecological factors but an understanding the mechanism by which these factors affect root growth simultaneously and quantitatively in the field during the vegetation period is still limited (Baeumer, 1981). Maize considered one of the most important cereal crops, which cultivated widely in Iraq and the world. Grains are valuable source of protein, vitamins, minerals etc. and it is used also as feed, raw material in industries for produce oil, glucose.

The issue of soil and crops damage due to compaction problem is of major concern worldwide and research work will be conducted on various aspects of soil compaction. The objective of this which study was to know the best genotypes of Maize gives better root growth under different levels of soil compactions.

MATERIALS AND METHODS

The experiment was conducted in Lath house in College of Agriculture, University of Duhok. The soil was collected from field of the Faculty at surface 20 cm and then sieved through a 4 mm mesh. The soil analysis showed (pH=6), (EC= 0.3dsmm^{-1}), (O.M. = 4.6 g kg^{-1}), and percent of clay, silt and sand were (40%, 30% and 30%) respectively. Soil compactions made

to reach these levels of bulk density (1.35, 1.54, 1.74, and 1.94) g.cm^{-3}. A thin layer of gravel placed in bottom of pots and then the soil wetted was prepare by mixing soil with spray water continuously which on the base of field capacity, the first part of the moist soil placed pots then flattened stroked the by limited number of strikes and then added the second part of the wet soil as well as added the third part of the wet soil to reach the desired height determine the bulk density that we measured in advance after taking the penetration resistances, the soils were discarded and fresh samples were compacted with the same number of hammer blows in pots have (6kg) capacity. Each of the soils in the pots was subjected to 0, 5, 10 and 15 blows of a standard Proctor hammer following the standard proctor compaction procedure (Lambe, 1951). Following the bulk density determination, the penetration resistances of the soils in the pots were determined using a hand pushed cone penetrometer according to the American Society of Agricultural Engineers (1982) standard procedure. Seven seeds of four genotypes of corn crop (*Zea mays L.*) (Polina, Synthetic 5012, Synthetic one, Synthetic 5018) were planted in 48 pots in depth 4-5 cm from soil surface after germination four seeds were inserted into each pot with minimum soil disturbance. In order to enhance seedling and to avoid water stress, 200 ml of water was added to each pot for two to three times in week. Record of seedlings emergence daily in each pot which began 4 days after planting and final emergence was counted made on the 12th day. The fertilizer applied depending on the recommendations, after 40 days data recorded the for characters (plant height, leaf area, root depth and soil strength). The design of experiment was factorial with RCBD and used three replicatedion.

RESULTS AND DISCUSSION

Table (1) showed the significant differences effect of genotypes in plant height and leaf area and non significant for root depth and soil strength, but the levels compaction exhibited significant differences effect in all studied characters. Effect of interaction between genotype and levels of compaction showed significant differences effect for all traits with exception of soil strength.

Table (1): Analysis of variance (mean squares values) for all characters.

S. O.V.	df	Plant height	Leaf area	Root depth	Soil strength
Block	2	6.89	10.19	55.01	35.55
Genotypes	3	556.35*	43.97*	9.23	2.32
Level compaction	3	721.16*	17.68*	41.09*	21.24*
Interaction (genotypes x levels)	9	147.40*	10.51*	36.65*	5.07*
Error	30	278.20	11.40	40.63	14.71

***** Significant at level (P ≤ 5%)

Table (2) indicated that an interaction between genotypes and soil compaction level, gave maximum plant height (cm) which recorded by synthetic 5018 (69.33) and followed by synthetic 5012 (68.42). While, the minimum plant height recorded by polina which was (61.17). Regarding of the soil compaction levels effect the results showed non significant between the different levels of soil compaction in plant height exception the level 1.54 g.cm^{-3} which was (58.25) , while depending on an interaction effect between genotypes and soil compaction levels in plant height, synthetic 5018produced the maximum value with (85.67) at level 1.74 g.cm^{-3} , while polina gave the minimum value with (53.67) at level 1.57 g.cm^{-3} . the results were non agreement with Ramazan *et. al.,* (2012).

Table (2): interaction effect, maize genotypes and soil compaction levels on plant height (cm).

Soil compaction / Varieties	compaction levels (bulk density) g.cm^{-3}				Varieties Means
	1.35	1.54	1.74	1.94	
Polina	61.00ef	53.67g	64.33de	65.67de	61.17b
Synthetic 5012	66.33de	76.67bc	62.67ef	68.00de	68.42a
Synthetic one	62.00ef	56.00fg	64.33de	70.67cd	63.25b
Synthetic 5018	79.67ab	46.67h	85.67a	65.33de	69.33a
Compaction Means	67.25a	58.25b	69.25a	67.42a	

Values for each column having the same letters are not significantly difference according to Duncan Multiple Range Test (DMRT).

The table (3) showed the interaction between genotypes and soil compaction levels, synthetic 5018 was superiority in leaf area (cm^2), obtained highest value (74.39), while the polina gave the lowest value (56.64). concerning the soil compaction levels, the levels1.35 g.cm^{-3} gave the highest value for leaf area which was (73.40) and the lowest value for leaf area obtained by level 1.54 g.cm^{-3} (57.45). Depending the interaction between genotypes and soil compaction levels, synthetic 2018 recorded the high value for leaf area (97.05) at level 1.35g.cm^{-3} the same genotypes gave the lowest value (40.12) at level 1.54 g.cm^{-3} . The same results have been reported by research Kobaissi *et. al.,* (2013).

Table (3): interaction effect between genotypes and soil compaction levels on leaf area (cm^2).

Varieties	compaction levels (bulk density) g.cm^{-3}				Varieties Means
	1.35	1.54	1.74	1.94	
Polina	61.33def	49.25g	65.90d	50.08g	56.64c
Synthetic 5012	78.83bc	81.99bc	47.98g	84.09b	73.22a
Synthetic one	56.73f	58.44ef	64.24de	76.12c	63.88b
Synthetic 5018	97.05a	40.12h	93.37a	67.00d	74.39a
Compaction Means	73.49a	57.45c	67.87b	69.32b	

Values for each column having the same letters are not significantly difference according to Duncan Multiple Range Test (DMRT)

Table (4) exhibtied significant difference between genotype maize, the maximum value was (52.84) for [Polina], while the lowest value was (41.79) in [Synthetic 5018]. In the other hand, the root depth exhibited maximum compaction levels found at [1.35] g.cm^{-3} was (50.41), whereas the minimize value detected at [1.94] g.cm^{-3} was (43.51). The interaction between soil compaction levels and maize genotypes the highest value were recorded by genotype Polina at level 1.74 g.cm^{-3} was (55.66). Whereas, lowest the value were recorded by genotype Synthetic 5018 at level 1.94 g.cm^{-3} was (35.11) .Because less space available for proliferation and growth and consequently roots ability to penetrate in deep soil layers was hampered due to high bulk density and low porosity. These results are in agreement with those reported by, Beulter and Centurion,(2004),Ramazan *et. al.,* (2012).

Table (4): interaction effect between genotypes and soil compaction levels on root depth (cm).

Varieties	compaction levels (bulk density) g.cm^{-3}				Varieties means
	1.35	1.54	1.74	1.94	
Polina	52.94ab	55.58a	55.66a	47.16abcd	52.84a
Synthetic 5012	51.50ab	42.33cdef	44.38bcde	49.28abcd	46.87b
Synthetic one	44.78bcde	36.41ef	51.00abc	42.50cdef	43.67bc
Synthetic 5018	52.44ab	41.89def	37.72ef	35.11f	41.79c
Compaction Means	50.41a	44.05b	47.19ab	43.51b	

Values for each column having the same letters are not significantly difference according to Duncan Multiple Range Test (DMRT).

The table (5), the exhibited results were significant difference between maize genotypes the highest value was recorded by Synthetic 5018 was (3.06), whereas lowest value was (2.58) for genotype polina. However there are no significant differences among soil compaction levels. An interaction between two genotypes and soil compaction levels found the largest value by genotype Synthetic 5018 at level 1.74 g.cm^{-3} was (3.26), while minimize value was recorded in genotype Polina at level 1.35 g.cm^{-3} was (2.47). These results indicated when increase soil bulk density (soil compaction) reached to maximum point the soil strength begin decrease due to soil moisture. These results are in accordance with pervious findings of, (Merotto and Mundstock, 1999).

Table (5): interaction effect between genotypes and soil compaction levels on soil strength.

Varieties	compaction levels (bulk density) g.cm^{-3}				Varieties means
	1.35	1.54	1.74	1.94	
Polina	2.47c	2.67bc	2.60bc	2.58bc	2.58b
Synthetic 5012	2.48c	2.72bc	2.73bc	2.60bc	2.63b
Synthetic one	2.98ab	2.77bc	2.83abc	2.95abc	2.88a
Synthetic 5018	2.90abc	3.07ab	3.26a	3.03ab	3.06a
Compaction Means	2.71a	2.80a	2.86a	2.79a	

Values for each column having the same letters are not significantly difference according to Duncan Multiple Range Test (DMRT).

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كورتى

ئولين هاته ئەنجامدان دخانیێ ی ل كولیژا چاندنێ،زانكویا دهوك. زانیا قەكولیێ فاكتوریال ب
یێ وبارەكرنا لدویف دیزاینا بلوكێن هەرەمییین تەواو هاتەكرن. شتن و دەوساندنێن ئاخێ هاتنە
مدان ژ بو گەهاندنا چڕی یا كەاەكە بوونێ ؛ ئاستێن (1.35, 1.54, 1.74, 1.94 غم.سم^3). بار توخمێن
ی یێن گەنم شامی) Polina, Synthetic 5012, Synthetic one, Synthetic 5018) هاتنە جاندن د 48
قافكادا بكویراتیا (4-5) م ژ سەرڕویێ خێ. جام ددنەخویاكرن كو جیاوازیێن بەر جاف هەبوون د
بلنداهیا رووەكی، روبەرێ بەلگی،كویر ا رەهیا و بەرهنگاریا ئاخێ. جورێ (Synthetic 5018) بەرزترین بها
امەلێن بلنداهیا رووەكی، روبەرێ بەلكی و هێزا ئاخێ تومارکر.گەشەكرنا رەهین توخمێن جینی یێن گەنم
ی كێمبو ب زێدەبوونا ئاستێن دەوساندنا ئاخێ

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الخلاصة

اجريت تجربة في ظلة الخشبية لكلية الزراعة، جامعة دهوك. باستخدام (RCBD) في تجربة عاملية و بتصميم قطاعات العشوائية الكاملة و بثلاثة مكررات. رصت التربة لحين الحصول على كثافة ظاهرية (1.35, 1.54, 1.74, 1.94 / غم.سم^3) و تم زراعة اربعة تراكيب وراثية من الذرة الصفراء (*Zea mays L.*) (Polina, Synthetic 5012, Synthetic one, Synthetic 5018) في 48 سندانه بعمق (4-5)سم. اظهرت النتائج وجود فروق معنوية لصفات طول النبات و المساحة الورقية و عمق الجذور و مقاومة التربة. اعطى التركيب الوراثي (Synthetic 5018) أعلى قيم بالنسبة لطول النبات و مساحة الورقة و مقاومة التربة. و قلة نمو الجذورالتراكيب الوراثية المزروعة بزيادة الكثافة الظاهرية للتربة.

EFFECT OF BREAD YEAST AND MAMMOTH ON GROWTH AND YIELD OF CABBAGE (*Brassica oleraceae* L.)

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ABSTRACT

This study was carried out at the vegetative research farm of the Faculty of Agriculture, University of Duhok, on cabbage plants during 2014-2015 season, to study the effect of three concentrations of bread yeast (0, 4,8 g.l^{-1}), three concentrations of mammoth (0, 1, 2 ml.l^{-1}) and their interaction on cabbage (Gunma F1). The results showed that spraying with bread yeast significantly increased in leaves number, leaf area, stem length, dray weight, fiber, carbohydrate and total yield. Mammoth led to positive significant differences in leaves number, leaf length with petiole, leaf area, stem length, root length, protein, vitamin C, total sugar, carbohydrate and total yield as compared to untreated plants. The interaction between bread yeast and mammoth significantly enhanced all detected traits, since cabbage plants received 4g.l^{-1}bread yeast and sprayed with 2 ml.l^{-1} of mammoth were characterized by the highest values of leaves number, leaf breadth, leaf area, stem length, vitamin C, TSS and total yield.

KEYWORDS: cabbage, bread yeast, mammoth, sucrose

INTRUDUCTION

Cabbage (*Brassica oleraceae* L.) is one of the crusiferae family plant and a useful vegetable, belongs to the genus brassica. It is one of the important field vegetable crops in Iraq as well as in many other countries of the world. Cabbages have a high nutritional values and contain organosulphur phytochemicals that increase their antioxidant capacity, which may have anticarcino-genic effects (Kurilich *et al.*, 1999, Kim *et al*., 2004). Bread yeast as a kind of bio-fertilizer is usually used as foliar application to the vegetative growth of vegetable crops or may be added to soil (El-Ghamriny *et al*, 1990). It contains many nutrient elements as well as it has a role in producing substances like growth regulators such as gibberellins, auxins and cytokinins (Glick, 1995). It's known that bread yeast is considered as a natural source of cytokinin that improve plant cell divisions and enlargement as well as the synthesis of chlorophyll, proteins and nucleic acids (Fathy and Farid, 1996). Previous researches declared that the foliar application of bread yeast increased growth, yield and quality of many vegetable crops (Hussain and Khalaf, 2007, Fawzy *et al*., 2010, Ghoname *et al.* 2010). Mammoth seen sugar express unique innovative micronutrient formulation technology from napnotriscience. This high Performance liquid formulation provides rapid absorption of micronutrients and enhances waxy-shine leaves. It has been suggested to cause an increase in leaves number. It may probably affect various aspects of development in plants (Jang *et al*., 1997, Dijkwel *et al.*, 1997). It has been found that sugars are involved in responses of many biotic and abiotic stresses, cross taking with hormone (Gibson, 2004), and modulating the expression of many gene application of photosynthesis, respiration, nitrogen metabolisms and defense process (Jang *et al.*, 1997).

The aim of this study was to investigate the efficiency of foliar application of bread yeast and mammoth on improving growth, yield and quality of cabbage plant.

MATERIALS AND METHODS

This experiment was conducted at the vegetable research farm, Faculty of Agriculture, University of Duhok during the growing season of 2014-2015 to study the effect of bread yeast and mammoth on growth and yield of cabbage (Gunma F1).

The experiment included two factors, the first was spraying bread yeast in three concentrations (0, 4, 8 g.l^{-1}) the second factors was mammoth

with three concentration (0, 1, 2 m.l^{-1}). Bread yeast and mammoth spraying were applied two times within ten days intervals, starting 20 days after seedling. The land was plowed and it was well soften, then it was divided into ridges 0.80 m x4 m and seedlings were planted at a distance 50cm on October, 1st 2014, the previous treatments were arranged in three replicates using complete randomized block design (RCBD). Data were analyzed by using SAS program (SAS, 2001).

Experimental measurements were as follows: vegetative characteristics including: leaves number, leaf length with petiole (cm), leaf breath (cm), leaf area (cm^2) stem length (cm) at harvest, root length (cm) at harvest, dry weight (g) and total chlorophyll content%. Yield quality and yield characteristic including: fiber%, protein%, vitamin C%, total sugar%, carbohydrate % and TSS%, yield kg/ plant and yield ton/hectare.

RESULTS AND DISCUSSION

Table (1) shows that spraying bread yeast with concentration 4 g.l^{-1} caused significant increase in leaves number/plant and leaf area (cm^2) as compared with the control treatment. Spraying cabbage plants with mammoth at 1 ml.l^{-1} caused positive significant differences in leaf length with petiole (cm), leaf area (cm^2) and spraying 2 ml.l^{-1} caused positive significant in leaf number/plant as compared with control while the increase in the leaf breadth (cm) wasn't reached to the significant level.

The interaction between bread yeast and mammoth caused significant increases in all vegetative characters, the plants which were treated by 4 g.l^{-1} bread yeast and mammoth at 2 ml.l^{-1} were characterized by the highest values of leaves number/plant 27, leaf breadth 25.33 cm, leaf area 475 cm^2 as compared with the least of the above parameters recorded with control treatment (20.00, 19.00 cm and 318.54 cm^2) respectively.

Table (1): Effect of bread yeast and mammoth on leaves number/plant, leaf length with petiole (cm), leaf breadth (cm) and leaf area (cm^2) of cabbage plants.

Treatment		Leaves number (plant)	Leaf length with petiole (cm)	eaf breadth (cm)	Leaf area (cm^2)
Bread Yeast (g. l^{-1})	**0**	23.11 b	30.28 a	21.44 a	365.69 b
	4	25.78 a	30.98 a	23.59 a	446.09 a
	8	25.67a	32.22 a	23.22 a	422.03 a
Mammoth (ml.l^{-1})	**0**	22.67 b	29.03 b	21.53 a	386.14 b
	1	25.67 a	32.56 a	23.61 a	438.71 a
	2	26.22 a	31.89 ab	23.11 a	408.96 ab
0	**0**	20.00 c	26.50 b	19.00 b	318.54 d
	4	24.00 ab	28.60 ab	22.10 ab	390.97 b-d
	8	24.00 ab	32.00 ab	23.50 ab	448.92 ab
1	**0**	23.67 b	31.00 ab	22.83 ab	415.71 a-c
	4	26.33 ab	34.00 a	23.33 ab	472.17 a
	8	27 a	32.67 ab	24.67 a	428.25 a-c
2	**0**	25.67 ab	33.33 a	22.50 ab	362.83 cd
	4	27 a	30.33 ab	25.33 a	475.14 a
	8	26 ab	32.00 ab	21.50 ab	388.92 b-d

Means within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

Data in Table (2) shows that bread yeast at 8 $g.l^{-1}$ caused significant increase in stem length (cm) and dry weight (g) as compared with control treatment. Also spraying mammoth at 2 $ml.l^{-1}$ caused significant increases in stem length and spraying 1 $ml.l^{-1}$ caused positive significant in root length (cm) while the increases in the dray weight (g) and chlorophyll content wasn't reached to the significant level. For the interaction between bread yeast and mammoth was a significant increase in its effect.///This enhancement in the characteristics of the vegetative growth in table (1and 2) may attribute to the ability of bread yeast to increase the production of stimulants for plant growth, especially auxins, gibberellins and cytokinins which work to improve the plant cell division and its growth (Glick, 1995 and Sarhan, 2008). Or might be due to bread yeast induces minerals nutrient absorption through the improvement of soil pH to acidity (Leonard, 2008).The positive effect of the mammoth as an essential factor for plant growth and metabolism may be attributed to that sugar plays a role as a signaling molecule that regulates a variety of genes (Koch, 1996)

Table (2): Effect of bread yeast and mammoth on stem length (cm), root length (cm), dry weight(gm) and chlorophyll% of cabbage plants.

Treatment		Stem length (cm)	Root length (cm)	Dry weight (gm)	Chlorophyll%
Bread Yeast (g. l^{-1})	**0**	4.36 b	14.06 ab	10.20 b	58.46 a
	4	4.89 a	13.71 b	11.51 a	60.80 a
	8	5.00 a	14.83 a	12.07 a	59.81 a
Mammoth (ml. l^{-1})	**0**	4.19 b	13.81 b	11.36 a	59.09 a
	1	4.94 b	14.86 a	11.03 a	59.24 a
	2	5.11 a	13.94 ab	11.39 a	60.73 a
0	**0**	3.50 c	13.25 b	9.68 c	53.73 b
	4	4.33b c	13.67 b	11.87 ab	62.53 a
	8	4.75 ab	14.50 b	12.55 a	61.00 a
1	**0**	4.75 ab	14.60 b	10.21cb	60.70 a
	4	4.83 ab	13.47 b	11.85 ab	59.83 ab
	8	5.25 ab	16.50 a	11.02 a-c	57.20 ab
2	**0**	4.83 ab	14.33 b	10.72 cb	60.93 a
	4	5.50 a	14.00 b	10.81 cb	60.03 a
	8	5.00 ab	13.50 b	12.63 a	61.23 a

Means within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

Table (3) shows that bread yeast caused significant effects on the fiber while the increase in the protein%, vitamin C% and total sugar% wasn't reached the significant level. They also show that cabbage plants sprayed with mammoth caused significant increases in characters of protein 2.34%, vitamin C 23.19%, and total sugar 1.97%, as compared with the least values of these traits which give (1.77%, 19.20% and 1.62%)respectively.The interaction between bread yeast and mammoth was significant in its effect on all characters as compared to untreated plants.

Table (3): Effect of bread yeast and mammoth on fiber%, protein%, vitamin C% and total sugar% of cabbage plants.

Treatment		Fiber%	Protein%	Vitamin C%	Total sugar%
Bread Yeast (g. l^{-1})	**0**	2.17 b	2.04 a	20.16 a	1.74 a
	4	2.83 a	2.10 a	21.32 a	1.78 a
	8	2.46 ab	1.99 a	20.96 a	1.99 a
Mammoth (ml.l^{-1})	**0**	2.41 a	1.77 b	20.04 b	1.62 b
	1	2.69 a	2.34 a	19.20 a	1.97 a
	2	2.36 a	2.02a b	23.19 a	1.92 a
0	**0**	1.77 b	1.43 b	19.00 d	1.40 c
	4	2.93 a	2.07 ab	21.27 bc	1.73 bc
	8	2.53 ab	1.80 ab	19.87 cd	1.73 bc
1	**0**	2.43 ab	2.47 a	18.77 d	1.93 ab
	4	3.07 a	2.20 ab	19.03 d	1.73 bc
	8	2.57 ab	2.37 a	19.80 cd	2.23 a
2	**0**	2.30 ab	2.23 a	22.70 ab	1.90 ab
	4	2.50 ab	2.03 ab	23.67 a	1.87 a-c
	8	2.27 ab	1.80 ab	23.20 ab	2.00 ab

Means within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

Data presented in Table (4) clearly shown that bread yeast at 4 g.l^{-1}caused significant increases in carbohydrate%, yield kg/plant and yield ton/hectare as compared to the untreated plants. Shows that cabbage plants sprayed with mammoth caused significant increases in characters of carbohydrate 4.66%, yield 1.191 kg/plant and yield 25.76 ton/hectare as compared with the lowest values (4.04%, 0.802 kg/plant and 17.62 ton/hectare) respectively. The interaction treatment between bread yeast and mammoth was significant in its effect, since the plants sprayed with 4g.l^{-1} bread yeast and 2 ml.l^{-1} mammoth gives highest values of vitamin C%, TSS% and total yield.

These improvements of yield characters in table (3 and 4) may be due to bread yeast's cytokinins content, and the high content of vitamin and minerals. Also it might play a role in the synthesis of protein and nucleic acid (Natio *et al.*, 1981).Bread yeast enhanced growth and yield were reported by many investigators on different vegetable (Fathy *et al*., 2000, Omer, 2003 and Sarhan, 2008). The spraying mammoth gives a positive increases these may be attributed to that sugar plays a role as a signaling molecule that regulates a variety of gene (Kock, 1996), or may be due to the mammoth lead to an increase in the vegetative growth so this enhanced increase total yield.

Table (4): Effect of bread yeast and mammoth on carbohydrate%, TSS%, yield kg/plant and yield ton/hectare of cabbage plants.

Treatment		Carbohydrate%	TSS%	Yield kg/plant	yield ton/hectare
Bread Yeast (g. l^{-1})	0	3.91 b	10.11 a	0.882 b	19.40 b
	4	4.62 a	11.33 a	1.050 a	23.10 a
	8	4.44 ab	11.28 a	1.050 a	23.10 a
Mammoth (ml. l^{-1})	0	4.04 b	10.89 a	0.802 c	17.64 c
	1	4.66 a	10.39 a	0.988 b	22.37 b
	2	4.28 ab	11.44 a	1.191 a	25.76 a
0	0	3.17 b	9.17 b	0.673 d	14.81 d
	4	4.70 a	11.50 ab	0.833 cd	18.33 cd
	8	4.27a	12.00 a	0.900 b-d	19.80 b-d
1	0	4.37 a	10.00 ab	0.883 b-d	19.43 b-d
	4	4.80 a	10.50 ab	0.950 bc	20.90 bc
	8	4.80 a	10.67 ab	1.133 ab	24.93 ab
2	0	4.20 a	11.17 ab	1.090 bc	23.98 bc
	4	4.37 a	12.00 a	1.366 a	30.06 a
	8	4.27 a	11.17 ab	1.116 ab	24.56 ab

Means within a column, row and their interaction following with the same latter are not significantly different according to Duncan multiple range test at the probability of 0.05 level

According to the results of this study we can concluded that application of both bread yeast and mammoth is beneficial in increasing nearly all the traits undertaken in this study. Mammoth appeared to be more effective in improving quality of cabbage yield. Bread yeast alone or in combination with mammoth significantly enhanced vegetative growth of cabbage plants and substantially improves the yield and quality.

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كارتێكرنا هەڤیر ترشی و ماموپی ل سالوخەتێن كەسكاتیێ وبەرهەمی كەلەمی (Brassica oleraceae L.)

پوختە

ئەف ڤەكولینە هاتە بجهئینان ل زەڤێن چاندنێ ل فاكولتیا چاندنێ/زانكویا دهوك ل سالا 2014-2015 ژبو تاقیكرنا كارتێكرنا سێ راتیێن جودا ژ هەڤیر ترشی (0, 4, 8 گم/لتر) سێ راتیێن جودا ژماموپ (0, 1, 2 مل/لتر) ێكهەلاوان ل سەر كەلەمی یا (Gunma). ،نجاما دیاركر كو هەڤیر ترشی زێدەكرنەكا پێش چاڤ ل ژمارا بەلگا وروبەرێ ژاهیا قەدی وكێشەیا هشك وچەنداتیاریشالا وچەنداتیا كاربوهیدراتیو بەرهەمی روەك. ماموپ كرنەكا ئەرینی ل ژمارا بەلگا و درێژاهیا بەلگا دگەل بستیكێ و روبەرێ بەلگا و هیا قەدی و درێژاهیا رەهێ وچەنداتیا بروتینی وچەنداتیا فیتامینC وچەنداتیا سەرجەمی شەكرێ ەنداتیا كاربوهیدراتی و بەرهەمێ روەكی. ەسا لێكدانێن دوو قولی دناقبەرا هەڤیر ترشی وماموپ كارتێكرنێن پێش چاڤ هەبوون ل سەر زوربەی سالوخەتان, ەمێ بكارئینانا 4گم/لتر هەڤیر ترشی و2 مل/لتر ماموپبووئەگەرێ ێدەبونێن پیش چاڤ ل ژمارا بەلگا و فرەهیا بەلگا و درێژاهیا قەدی, چەنداتیا فیتامینC, كەرستێن حەلیای و بەرهەمێ روەكی.

تأثير خميرة الخبز و الماموث في نمو وحاصل نبات اللهانة (*Brassica oleraceae* L.)

الخلاصة

اجريت هذه الدراسة في حقل الخضراوات التابع لفاكولتي الزراعة/جامعة دهوك على نبات اللهانة خلال موسم النمو 2014 - 2015 لدراسة تأثير ثلاث مستويات من خميرة الخبز (0, 4, 8 غم/لتر) مع ثلاث مستويات من الماموث (0, 1, 2 مل/لتر) وتداخلاتهما على هجين اللهانة (Gunma) . أظهرت النتائج بان الرش بخميرة الخبز أدى الى زيادة معنوية في عدد الاوراق والمساحة الورقية وطول الساق والوزن الجاف والألياف والكاربوهايدرات والحاصل الكلي. والماموث أدى الى زيادة معنوية موجبة في عدد الاوراق وطول الورقة مع العنق والمساحة الورقية وطول الساق وطول الجذر والبروتين وفيتامين C والسكريات الكلية والكاربوهايدرات والحاصل الكلي مقارنة مع معاملة المقارنة. التداخل بين خميرة الخبز والماموث شجع معنويا" جميع الصفات المدروسة وتميزت نباتات اللهانة التي استلمت 4غم/لتر من خميرة الخبز ورشت ب 2 مل/لتر من الماموث باعطائها اعلى القيم في عدد الاوراق واتساع الورقة وطول الساق و فيتامين Cوالمواد الصلبة الذائبة والحاصل الكلي.

OCCURRENCE OF ANTI-*Toxoplasma Gondii* ANTIBODIES IN BOVINE AND OVINE MEAT JUICE SLAUGHTERED IN DUHOK ABATTOIR, KURDISTAN REGION-IRAQ

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ABSTRACT

Toxoplasmosis is a zoonotic infection caused by the protozoan parasite Toxoplasma gondii. It has the capacity to infect all warm-blooded animals, in some it causes acute life-threatening disease and in others, it may manifest itself as a disease of pregnancy. This is a preliminary study was performed to the investigation of anti-*T.gondii* antibodies in meat juice samples collected in Duhok abattoir, Kurdistan region-Iraq. A total of 92 meat juices samples (ovine 37 and bovine 55) each of 92 sample were examined by LAT and ELISA test, from April, 2012 to March 2013. 40/92 (43.4%) of meat juice found to be positive by LAT(38.18% of cattle and 51.35% of ovine) and 18/92 (19.5%) by ELISA test (16.36% samples of cattle and 24.32% of ovine) were positive with higher prevalence in sheep than in cattle. The high prevalence rate of anti-*T. gondii* antibodies was observed in this study, which is usually represent the actual picture of the prevalence of *T. gondii* in bovine and ovine meat consumed in Duhok city and need good strategies of food hygienic standard.

KEY WORDS :- Toxoplasma , Meat juice, Kurdistan Region

INTRODUCTION

Toxoplasmosis caused by *Toxoplasma gondii* is considered as common zoonotic diseases all over the world (Dubey, 1996). This is regarded as an obligate intracellular protozoan parasite that commonly affect humans, mammals and bird (Smith and Reduck, 2000). There are two basic forms of toxoplasma organism: the "oocyst," which is shed in the cat feces, and the toxoplasma tissue stages, which found in various tissue of cattle, sheep and other worm blooded intermediate hosts(Tenter *et al*., 2000 and Khadi *et al.*, 2009).

Humans can gains infection by consuming undercooked meat containing cysts, contaminated food or drinking water or by the ingestion of oocysts from the surrounding environments (Dubey, 2009). It is known that eating undercooked meat of animal origin infected with cyst or oocyst (Tenter, 2009). The most important clinical manifestations in human are abortion, fetal abnormalities or prenatal death (Cook *et al*., 2000).

In Duhok province no previous work has been done for investigation of the presence of this parasite in ovine or bovine meat used for human consumption therefore this study is aimed to estimate the risk level of human infection in associated with the consumption of ovine and bovine meat by determining the level of anti-*T.gondii* antibodies using Latex Agglutination Test (LAT) and Enzyme Linked Immunosorbent Assay (ELISA) test in meat juices of ovine and bovine slaughtered in Duhok abattoir, Kurdistan Region of Iraq.

MATERIALS AND METHODS

2.1: Sample collection

A total of 92 meat samples (ovine 37 and bovine 55) from diaphragmatic and skeletal muscles of animals (≥12 months of age) slaughtered in Duhok abattoir that receive animals from all regions of Iraq and neighboring countries

from each animal about 50 gm of meat, were taken by sterile disposable blades in sterile containers, on April, 2012 to March 2013. All meat samples were immediately transported to the research laboratory at the Faculty of veterinary Medicine, University of Duhok. About 3-4 ml of meat juice preparation was obtained by freezing–thawing of each meat sample and stored at -20Cº until tested by LAT and ELISA tests.

2.2: Serological tests

2.2.1: Latex agglutination test

Commercial latex agglutination test (LAT) kit from Toxocheck-MT, Eiken, Japan), was used to identify antibodies against *T. gondii* according to the manufacturer's instructions. The samples of meat juices were diluted 1/2 - 1/8 in physiological saline (0.9% NaCl), then one drop of diluted sample was placed onto the slide black area, a one drop of latex reagent was added to each diluted meat juices sample and the slide was tilted to observe the presence or absence of a clear agglutination within a period no longer than 3 minutes.

2.2.2: ELISA test

The Indirect IgM ELISA with P30 antigen of *T. gondii* (ID VET innovative diagnosis- France) was used with meat juice samples using the complete kit in which meat juice samples were diluted in 1/2 instead of 1/10 used for serum samples. The test was used according to the manufacture's instruction. Briefly samples to be tested and controls were added to the wells. Anti-toxoplasma antibodies, if present, will form an antigen-antibody complex. After washing, a multi-species peroxidase (Po) conjugate was added to the wells. It fixes to the antibodies forming an antigen-antibody-conjugate-Po complex. After elimination of the excess conjugate by washing, the substrate solution (TMB) was added.

The resulting coloration depended on the quantity of specific antibodies present in the specimen to be tested: In the presence of antibodies, a blue solution appears which becomes yellow after the addition of the stop solution while in the absence of antibodies, no coloration appears, and finally the OD (optical density) was read immediately at 450 nm.

RESULTS AND DISCUSSION

Out of 92 meat juice samples from both animal species examined for the presence of anti-*Toxoplasma gondii* antibodies, 40/92 (43.4%) for both animal species were found to be positive, in which sheep showed a higher rate 19/37 (51.3%) than cattle(38.1%) using latex agglutination test (Table.1).

Table (1): Presence of anti *T. gondii antibodies* in cattle and sheep in meat juice using LAT test.

animal Species	Total samples examined	Positive LAT		Negative LAT	
		No.	%	No.	%
Cattle	55	21	38.18%	34	61.82
Sheep	37	19	51.35%	18	48.45%
Total	92	40	43.48%	52	56.52%

While by ELISA test, showed a lower positivity, since 18/92 (19.5%) of the samples were positive, 9/37 (24.3%) from sheep and 9/55 (16.3%) from cattle, (Table 2).

Table (2): Presence of anti *T. gondii* antibodies in cattle and sheep in meat juice using ELISA test.

Species of animal	Total samples tested	Positive ELISA		Negative ELISA	
		No.	%	No.	%
Cattle	55	9	16.36%	46	83.64%
Sheep	37	9	24.32%	28	75.68%
Total	92	18	19.57%	74	80.43%

This study was performed on meat juice samples because they are usually as alternative to serum samples when testing carcasses to identify the antibodies against *T. gondii* as recommended by many authors (Villena *et al*., 2012; Glor *et al*., 2013). So far no attempts have been made in this direction, therefore, this study represent first report for the estimation the level of *Toxoplasma gondii* antibodies in juice samples of ovine and bovine meat used for human consumption in Duhok abattoir.

In this study the prevalence of anti-*Toxoplasma gondii* antibodies by using LAT in sheep wa higher (51.3%) than the rate (37%) reported by Zakaria, 2011 in Mosul city, Iraq. Also some other studies in Saudi Arabia and Brazil by Amin and Morsy (1997) and Silva and Langoni (2001) reported lower rate (39% and 7.7% reapectivley) than the rate of this study. However this finding was lower than (63%) reported by Boughattas *et al*. (2014) in Tunisia. In cattle also the prevalence of anti-*Toxoplasma gondii* antibodies was higher (38.1%) than that was reported by Zakaria (2011), in Mosul, who found a prevalence rate of 17%.

The prevalence of anti-*Toxoplasma gondii* antibodies using ELISA test in sheep was 24.3% which was lower than that reported by Berger-Schoch *et al*. (2011) in Switzerland as he recorded a rate of 61.6% and to the rates of 27% and 89% in adult sheep reported by Villena *et al*.(2012) and Halos *et al*. (2010) respectively in France. On the other hand, this finding was higher than 10.8% reported by Gharbi *et al*. (2013) in Tunisia. Regarding the prevalence of antibodies using ELISA test in cattle in this study which was 16.3%, was lower than the rates recorded in other studies, such as Roqueplo *et al*. (2011) reported a much lower rate (3.3%).

In this study the rate of anti-*Toxoplasma gondii* antibodies in sheep (51.3%) was higher than that of cattle (38.1%) using both tests (ELISA and LAT). This may be due to the out-door feeding production system of sheep in contrast to cattle which reared in close areas, therefore, sheep are subjected to a higher risk of infection with toxoplasma (Schulzig and Fehlhaber, 2006; Giessen *et al*., 2007).

The high prevalence rate of anti-*Toxoplasma gondii* antibodies reported in this study, reflect that this pathogen is circulating abundantly in sheep and cattle and it represent the actual picture of the prevalence of *T. gondii* in bovine and ovine meat consumed in Duhok city. Also these results shows the direct link between meat consumption and human infection, because meat is commonly consumed by people living in Duhok. Finally this study recommend the application of good strategies of food hygienic standard including hand washing after handling meat and insuring good cooking of consumed meat.

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ەركەفتنا دژەتەنێن ژمەخور Toxoplasma اف نمونێن گوشتێ پەز و جێلا یێت هاتینە قەکوشتن ل سەربرخانا دهوك یا هەڤچەرخ/ ی پارێزگەها دهوك-هەرێما کوردستانا عیراقێ

پوختە

ئەقە قەکولینەکا دەستپێکیە لسەر دیقچوونا دژەتەنێن (ژمەخور) مشەخور توکسوپلازما لناڤ ئاڤاگوشتی ژ سامپلێت هاتینە خرڤەکرن ل سەربرخانا دهوك یا هەڤچەرخ ل پارێزگەها دهوك ل هەرێما کوردستانێ. قێ ،کولینێ نزیك 92 ڤکێن گوشتی ژوان 37 گوشتێ بێلا و 55 گوشتێ پەزی. ژهەر سامپلەکی 50گرام هاتنە ەرگرتن و هەر دوو پشکنینێن (LATو ELISA) هاتنە ئەنجام دان. نجامێ وێژینا LAT و ELISAلسەر شتێ پەزی بڤی رەنگیە 51.35% و 24.32% لایەکی دیڤە ئەنجامێت پشکنینا لسەر گوشتێ بێلا ب ەردوو رێکا 38.18% و 16.3% بLAT وELISA دیڤ ئێك. ستێ دژەتەنا ل ئاڤا گوشتی پەزی بلندتربو ژ ەتەنا لناڤ ئاڤاگوشتێ بێلا. ێ ،کولینێ اردبیت کو ئەو ئاستێ د یێ ەتەنا لناڤ گوشتێ پەزی وچێلا دبیتە ئەگەرا وەرگرتنا برەك مەزن ژ دژەتەنا ژلایێ مروڤی ڤە. ورا بو دیقچون و لێ گەرهان و بنبرکرنا ن دیاردێ قی ستراتیجیەك مکم هەیە لسەر ئاستێ اخلەمیا خوارنێ.

ظهور أضداد طفيلي Toxoplasma في عينات اللحوم الأغنام والأبقار المذبوحة في مجزرة دهوك العصرية/محافظة دهوك–أقليم كوردستان العراق

خلاصة

تعتبر هذه اول دراسة للكشف عن اضداد المقوسات الكوندية *Toxoplasma gondii* في العصارة المستخلصة من لحوم الأغنام و الأبقار المذبوحة في مجزرة دهوك / إقليم كردستان العراق . تم جمع 92 عينة لحوم (37 اغنام و55 ابقار) و لفترة من نيسان 2012 حتى اذار 2013 حيث اخذت 50 غرام من كل عينة و استخلصت العصارة و فحصت بواسطة فحصي التلازن LAT و الاليزا ELISA.حيث أظهرت نتائج فحص التلازن المباشر اصابة 40 عينة من مجموع 92 (43.4%) بينما كانت نسبة الإصابة 38.18% في الأبقار و51.35% في الأغنام , اما اختبار الاليزا فاظهرت اصابه 18 عينة من مجموع 92 عينة و بنسبة 16.36% في الابقار و 24.32% في الاغنام على التوالى, و هذا يشير الى ارتفاع نسبة الاصابة في الاغنام . كذلك تشير الدراسة الى ارتفاع نسب اضداد المقوسات الكوندية في لحوم الابقار و الاغنام المستهلكة في مدينة دهوك و تستدعي اتخاذ هذه الحالة اجراءات جذرية في مجال سلامة و صحة اللحوم المستهلكة.

EFFECT OF ALGAMIX AND IRON ON GROWTH, NUTRITIONAL STATUS OF OLIVE TREE CV. ARBEGONIA.

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ABSTRACT

The present study was conducted at the Farm of Faculty of Agriculture of Dohuk University on olive young trees (*Olea europaea* L) 4 years old, the trees were sprayed two times during the growing season 2014 first, 2 week after growth beginning and second, month after one with three concentrations of Algamix (0, 5 and 10 ml.L^{-1}) and three concentrations of iron $Fe_2(SO_4)_3.H_2O$ (0, 150 and 300 ml.L^{-1}) in order to study their effect on growth, nutritional status of olive tree cv. Arbegonia. Results indicate that foliar spray of Algamix at 10 ml.L^{-1} and Fe at 300 ml.L^{-1} significantly increased all vegetative growth characteristics (leaf area, Total leaf chlorophyll, leaf dry matter and protein in leaves) and leave nutritional status (N, P and K) . The interaction between 10 ml.L^{-1} Algamix and 300 ml.L^{-1} Fe tended to be more effective from other interactions in increasing all traits undertaken in this study.

***KEYWORLDS*:** Algamix, Iron, Olive Tree

INTRODUCTION

Olive belongs to the family Oleaceae*;* this family includes 30 genus including *Olea* and has 600 species (Bartolucci and Dhakal, 1999). Only *Olea europaea* L. produces edible fruit. The Mediterranean region is the native habitat (Sibbett *et al.*, 2005). Mediterranean countries account for more than 98% of world olive production, Spain is the world's leading olive producer, accounting for more than 30 % of this amount, followed by Italy , Greece, Syria, Turkey and Tunisia (Tubeileh *et al*., 2004). The root system of olive tree develops and extends quickly during the first few years. Fertilizers play an important role in improving the growth of young trees during the 1- 4 years of plantation (García et al., 1999).

Seaweed extracts act as plant growth stimulants. Overall crop performance is improved due to their effect on plant growth, protein, carbohydrate production and prolonged chlorophyll production and photosynthesis, the influence of these extracts on cell metabolism via the induction of the synthesis of antioxidant molecules which could improve plant growth and plant resistance to stress (Cardozo *et al*., 2007; Zhang and Schmidt, 2000). Jensen (2004) found that spraying Seaweed extract contain micro elements (Co, B, Mo, Zn, Cu) as well as macro element, Auxins, Gibberellins and Cytokines led to increase root ability for growth and nutrient absorption and then increasing stem thickness and strong vegetative and root growth. Mohammad (2010) studied the effect of seaweed (Kelpak) on improving vegetative growth of olive transplants cv. Sorani, he found that using of (Kelpak) at (1:150, 1:200 and 1:250) give better outcome in most characteristics of transplants as compared with control (stem, branches, internodes number, stem length, new growth part of branches, leave number at stem and branches). The micro-elements are considered necessary to increase and improve the plant production, and it is favored to use the foliar fertilization for the micro-elements especially under the Iraqi limy soils conditions which are characterized by a high number of (pH) which is exceeded above (7), where the availability of these elements become difficult, so the foliar application become more effective and more efficient (Winkler *etal.* 1974; Al-Niemi 1984).

In plant, micronutrients play an important role in the production and productivity. Among micronutrients, iron plays vital role in synthesis of chlorophyll, carbohydrate production, cell respiration, chemical reduction of nitrate and sulphate and in nitrogen assimilation (Yogeesha 2005).

Al-Hamadany (2004) studied the effect of iron in combination with GA_3 on vegetative growth, root growth and mineral composition of three

olive cultivars and stated that transplants height, stem diameter, leaves number, number and length of shoot, leaf area, the length of main root, dry weight of root, stem diameter, leaves number and total chlorophyll were significantly increased with the increases of iron and GA_3 levels. Al-A'areji and Al-Hamadany (2005) discovered that cv. Dermalali olive transplant gave the highest interaction effect of cultivar with Fe spray, the highest mean of shoots number in the cv. Sorani olive transplant and the highest mean of shoots elongation were observed in the cv. Dermalali transplant. The cv. Khoderi affected significantly in the stem and shoots dry matter, while the cv. Sorani increased significantly in root dry matter, compared with the two cultivars Dermalali and Khoderi, and in the interaction of cultivars with Fe spray, cv. Sorani was increased in dry matter of leaves, stem and shoots significantly on the cvs. Dermalali and Khoderi. The main purposes of this experiment are to study the effects of seaweed Algamix and iron on the vegetative growth, nutritional status of olive tree cv. Arbegonia.

MATERIAL AND METHODS

This study was carried out during 2014 on four years olive trees cv. Arbegonia planted in the farm of faculty of Agriculture/Duhok University. The young olive trees under taken in this study were planted at distance between trees was 2 X 4 m; the trees were choosing uniform in vigor as possible. The experiment included 9 treatments, three concentration of seaweed Algamix (0, 5 and 10ml.$L^{-1)}$ and three concentration of iron $Fe_2(SO_4)_3.H_2O$ (0, 150 and 300 ml.L^{-1}), with three replication for each treatment. The spraying of Algamix and iron was carried out twice per season (first, 2 week after growth beginning and Second, month later). The trees were sprayed in the morning till runoff and the Tween-20 was added at 0.1 ml/L to reduce the surface tension of water molecules while the control was sprayed only by the distilled water with Tween 20. The experimental was arranged as RCBD and The results were analyzed statistically and the comparisons were made using Duncan's multiple range test at 5% probability (Al-Rawi and Khalaf-Allah 2000). All the data were tabulated and statistically Analyzed with computer using (SAS system 2000).

The following parameters will be measured:

1- Leaf area by using leaf area meter (AM300, 2003).

2- Total leaf chlorophyll by using chlorophyll meter (SPAD- 502, Konica Minolta).

3- Leaves dry Matter (%)

4- Protein % in Leaves

5- Leaf nutrient Content (N, P and K).

Table (1):- The main components of seaweed extract Algamix according Spain lida Quimica Company

The Main Components	%
Nitrogen	0.42-0.54
Phosphor	0.009-0.021
Sulfur	0.3-0.6
Calcium	0.30-0.35
Magnesium	0.09-0.18
Sodium	0.04-0.06
Protein	1.8-2.4
Carbohydrate	10.5-15.0
Organic Mater	15.0-16.5
	Ppm
Boron	24-30
Cobalt	0.3-0.6
Cupper	9-13
Iron	46-78
Zink	3-6
Manganese	7.5-12.0
Cytokinin	300
Indol Acetic Acid	200
Gibberelin	*Trace amount*

RESULT AND DISCUSSION

1- Leaf area (cm^2):

The data in table (2) displays, that spraying olive trees with 10 $ml.L^{-1}$ Algamix significantly increased leaf area and give the highest value (9.321) as compared to the control treatment. The obtained results of table (2) revealed that spraying olive tree with iron had no significant effect on leaf area. For the interactions the results indicated that the combination between Algamix and iron displayed that 10$ml.L^{-1}$ and 300 $mg.L^{-1}$ iron appeared to be the most potent treatment as it give the highest leaf area (9.844 cm^2).

2- Total leaf chlorophyll (SPAD):

Table (2) showed that foliar spray of Algamix (seaweed extract) had a significant effect on leaf chlorophyll content particularly at concentration 10 $ml.L^{-1}$ which gave the maximum value (76.09). Data reported that iron sulfate spray at 300 $ml.L^{-1}$ recorded the highest value (75.61) of total leaf chlorophyll as compared with other treatments. Results indicated that the combination between Algamix and iron displayed that 10 $ml.L^{-1}$ Algamix and 300 $ml.L^{-1}$ iron are appeared to be the most potent treatment as it gave appeared to be the most potent treatment as it gave the highest chlorophyll content value (77.50).

3- Leaf dry matter (%):

Results in table (2) shows that foliar spray of Algamix at 10 $ml.L^{-1}$ significantly superior leaf dry matter % and gave the highest value (57.56 %) as compared with other treatment. Foliar application of iron at 300 $ml.L^{-1}$ significantly increased leaf dry matter (55.53) when compared with control. The interaction between Algamix and iron note that the highest leaf dry matter (59.06%) was observed in trees received 10 $ml.L^{-1}$ Algamix and 300 $ml.L^{-1}$ iron, and the lowest leaf dry matter (48.8%) recorded in control.

4- Protein in leaves (%):

The obtained results in table (2) revealed that foliar spray of Algamix at 10 $ml.L^{-1}$ was the most significant effective treatment which gave the maximum leaf protein % (9.85%). Tabulated data demonstrate that protein % in leaves affected significantly by foliar application of iron (300 $ml.L^{-1}$) which gave the highest value (8.68%). The interaction between Algamix and iron had significant effect on leaf protein %, the highest leaf protein % (11.35%) was obtained as a result of the interaction between (10 $ml.L^{-1}$ Algamix and 300 $ml.L^{-1}$ iron).

Table (2):- Effect of foliar application with Algamix and iron on vegetative growth characteristics of olive (*Olea europaea* L.) cv. Arbegonia

Treatment		Parameters			
Algamix $ml.l^{-1}$		Leaf area (cm^2)	chlorophyll Content	Leaf dry Matter %	Protein in leaves
		6.91 b	71.69 b	50.97 c	6.52 c
5		7.67 b	74.87 a	53.44 b	7.49 b
10		9.32 a	76.09 a	57.56 a	9.85 a
Iron $ml.l^{-1}$					
0		7.67 a	72.93 b	52.15 b	7.35 b
150		7.79 a	74.10 ab	54.29 a	7.82 b
300		8.44 a	75.61 a	55.53 a	8.68 a
			Algamix x iron		
G0	F 0	6.35 c	69.50 c	48.89 e	6.10 e
	F 150	6.84 c	71.57 bc	51.75 de	6.35 de
	F 300	7.55 bc	74.00 ab	52.26 d	7.10 de
G 5	F 0	7.76 bc	74.80 ab	51.67 de	7.35 c-e
	F 150	7.31 bc	74.47 ab	53.37 cd	7.52 cd
	F 300	7.93 bc	75.33 ab	55.27 bc	7.60 cd
G 10	F 0	8.90 ab	74.50 ab	55.88 bc	8.60 bc
	F 150	9.22 ab	76.27 a	57.74 ab	9.60 b
	F 300	9.84 a	77.50 a	59.06 a	11.35 a

Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level.

5- Leaf nitrogen concentration (%):

The results in table (3) indicated that spraying olive trees with 10 ml.L^{-1} Algamix was the most influential treatment which gave the maximum value (1.58%) nitrogen in leaves. Table (3) shows that the foliar applications of iron at 300 ml.L^{-1} significantly increased leaf nitrogen concentration and gave the highest value (1.39%). Results in the same table indicated that the combination between Algamix and iron displayed that 10 ml.L^{-1} Algamix and 300 ml.L^{-1} iron appeared to be the most potent treatment, as it give the highest value (1.06).

6- Leaf phosphor concentration (%):

Results in table (3) indicated that foliar spray of Algamix significantly surpass in leaf phosphor concentration and gave the highest value (0.201) in comparison with other treatment. The recorded data shows that olive trees sprayed with different concentrations of iron particularly at 300 ml.L^{-1} produced a higher significant leaf phosphor concentration (0.193). Results indicated that the interaction between Algamix and iron significantly affected leaf phosphor concentration, the highest value (0.214) was obtained as a result of the interaction between 10 ml.L^{-1} Algamix and 300 ml.L^{-1} iron.

7- Leaf potassium concentration (%):

The data in table (3) revealed that spraying olive trees with 10 ml.L^{-1} Algamix significantly increased leaf potassium concentration and gave the maximum value (1.00%) as compared to control treatment. The same table displayed that there were no significant differences in leaf potassium concentration when sprayed with different concentration of iron. The interaction between Algamix and iron significantly affected leaf potassium concentration, the result indicated that combination between 10 ml.L^{-1} Algamix and 300 ml.L^{-1}iron was the most influential treatment which gave the highest value (1.06).

Table (3):- Effect of foliar application with algamix and iron on leaves nutrient characteristics of olive (*Olea europaea* L.) cv. arbegonia

Treatment		Parameters		
Al-gamix (ml.L^{-1})		N% in leaf	P% in leaf	K% in leaf
0		1.04 c	0.163 c	0.88 b
5		1.20 b	0.186 b	0.95 ab
10		1.58 a	0.201 a	1.00 a
Iron (ml.L^{-1})				
0		1.18 b	0.172 b	0.90 a
150		1.26 b	0.185 ab	0.95 a
300		1.39 a	0.193 a	0.97 a
Algamix x iron				
G0	F 0	0.98 e	0.151 d	0.84 c
	F 150	1.02 de	0.159 cd	0.93 a-c
	F 300	1.14 de	0.179 c	0.87 bc
G5	F 0	1.18 c-e	0.185 bc	0.95 a-c
	F 150	1.21 cd	0.186 bc	0.92 a-c
	F 300	1.22 cd	0.187 bc	0.98 a-c
G10	F 0	1.38 bc	0.180 c	0.92 a-c
	F 150	1.54 b	0.209 ab	1.01 ab
	F 300	1.82 a	0.214 a	1.06 a

Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level.

DISCUSSION

The foliar spray of Algamix, had a positive effect on all vegetative growth parameters, since spraying olive trees with 10 ml.L^{-1} 1 Algamix significantly increased leaf area, total leaf chlorophyll, leaf dry matter and protein in leaves this effect may be due to the role of macro and micronutrient (the main content of seaweed table 1) in stimulating growth characters (Kulk, 1995) and their role in an improving the nutrient uptake by root (Crouch, *et al.*, 1990), and increasing vegetative growth parameters due to increasing N, P and K % in the leaves (Mancuso *et al*., 2006) and their role in activating the cell division and increasing biosynthesis of organic products that lead to accumulation of carbohydrates and protein in leaves.

Increasing N, P and K in leaves by using Algamix may be due to increasing membrane permeability of root, leaves and stomata cells and activity cell respiration, photosynthesis and various enzymes reaction (Turan and Kose 2004) and which leads to improving the plant mineral uptake by the roots (Vernieri *et al.,* 2005) and increasing it in the leaves and petiole (Mancuso *et al.,* 2006).

The reason of improving vegetative growth due to iron spraying may be attributed to the role of iron in increasing chlorophyll amount in leaves which lead to increase quickness and products of photosynthesis that used in different growth processes (Hurley *et al.,* 1986), in addition of that iron is involved as an active factor in the structure of some enzymes such as catalase, peroxidase and cytochrome oxidase that act to activation of many physiological processes in plant (Marschner, 1986 and Singh, 2003), this may lead to increase in the roots growth and distribution in the soil, more absorption of elements and more use of these elements in the metabolic process (Al-Aa'reji, 2001 and 2003). The increase of N, P and K in leaves with increasing iron levels may be attributable to the role of iron in improving of leaf area and leaves chlorophyll content (Table 2) which may be caused in an enhancing of photosynthesis and its protects, trees may be using a part of this protects in an improving root growth, consequently it is important to improve absorption of some nutrients from soil and increasing its concentration in leaves (Al-Aa'reji , 2001; El-Seginy *et al.,* 2003; Tsipouridis, *et al.,* 2006; El-Sheikh *et al.,* (2007).

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كارتێكرنا الگاميكس و ئاسن ل سەر ساخلەتێن شينكاتی و بارێ خارنی يا دارێن زەيتونا ژ جورێ اربيكونيا

پوختە

ئەڤ ڤەكولينە هاتە ئەنجامدان د ناڤ كێلگەيێن فاكولتيا چاندنێ - زانكويا دهوكێ ل سەر دارێن زەيتونێن بچيك (Olea europaea) تەمەن چوار سال، دار هاتنە رەشاندن دو جاران دوەرزێ چاندنێ 2014 (يا ئێكێ دو هەفتەيان پشتی دەست پێكرنا شينكاتيێ وە يا دوێ پشتی بورينا هەيڤەكێ ژ دەمێ ئێكێ) ب سەرڤەچونا ژ بو ڤەكولينا الگاميكس (0 , 5 و10 مل.لتر$^{-1}$) وە سەرڤەچونا ژ ئاسنی Fe2(SO4)3.H2O (0, 300,150 مل.لتر$^{-1}$) ژ بو ڤەكولينا كارتێكرنا وان ل سەر ساخلەتێن شينكاتيێ وە بارێ خارنی يا دارێن زەيتونا ژ جورێ اربيكونيا. ئەنجامان بەرچێ شيوەی بوون كو رەشاندنا بەلگان ب الگاميكس ب رێژەيا 10 مل . لتر$^{-1}$ وە ئاسن ب رێژەيا 300 مل . لتر$^{-1}$ بوويە ئەگەرێ زێدەبوونەكا بەرچاڤ دهەمی ساخلەتێن شينكاتی دا (رووبەرێ بەلگان ور ژا كلوروفيلی ور ژا پێكهاتێن هشك دناڤ بەلگاندا ور ژا پروتينی دناڤ بەلگاندا) و بارێ خارنی يا دارا زەيتونێ (N,P,K). تێكەل كرنا كارتێكەرا دناڤبەرا الگاميكس ب رێژەيا 10 مل . لتر-1 وە ئاسن ب رێژەيا300 مل . لتر$^{-1}$ كارتێكرنەكا پتر هەبو ژ تێكەلكرنێن دی د زێدەبونا هەمی ساخلەتێن هاتينە ڤەكولينێ .

تاثير الجاميكس والحديد في النمو الخضري والحالة الغذائية لاشجار الزيتون صنف اربيكونيا

الخلاصة :

اجريت هذه الدراسة في حقل كلية الزراعة- جامعة دهوك على اشجار زيتون فتية (*Olea europaea*) بعمر اربع سنوات، رشت الاشجار مرتين خلال موسم النمو *2014* (الاول: اسبوعين من بدء النمو والثاني بعد شهر من الموعد الاول) بثلاث تراكيز من الجاميكس (*0* و*5* و*10* مل.لتر$^{-1}$) وثلاث تراكيز من الحديد *Fe2(SO4)3.H2O* (*0* و*150* و*300*مل.لتر$^{-1}$)لدراسة تأثيرهما على النمو والحالة الغذائية لاشجار الزيتون صنف اربيكونيا. تشير النتائيج الى ان الرش الورقي للجاميكس بتركيز *10*مل.لتر$^{-1}$ والحديد بتركيز و*300*مل.لتر$^{-1}$ زادت معنويا كل صفات النمو الخضري (المساحة الورقية ومحتوى الكلوروفيل ونسبة المادة الجافة في الاوراق ونسبة البروتين في الاوراق) والحالة الغذائية للشجرة (*N* و *P* و*K*). التداخل بين الجاميكس بتركيز *10* مل.لتر$^{-1}$والحديد بتركيز و*300*مل.لتر$^{-1}$ كان اكثر تأثيرا من التداخلات الاخرى في زيادة كل الصفات المدروسة.

PREDICTIVE EQUATIONS OF SOME STAND CHARACTERISTICS FOR *Pinus brutia* Ten. IN ZAWITA AND ATRUSH DISTRICTS

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ABSTRACT

This study was done on 200 trees of natural pine stands (*Pinus brutia* Ten.) located in Zawita and Atrush district in Duhok province in northern Kurdistan region of Iraq. The paper presents the analysis of some characteristics of tree, following elements were analyzed: diameter at breast height (D), tree height (H), crown diameter (CD) and age of tree at breast height (A). We discuss the approaches of equations in order to establish the relationships between tree height with diameter at breast height (H-D), crown diameter with diameter at breast height (CD-D), age of tree at breast height with diameter at breast height (A-D), and age of tree at breast height with crown diameter (A-CD). Regression analysis were applied, one linear and seven non-linear functions were selected for each of these relationships, and then were compared between these equations in order to choose the best fit equation by examining the adjusted coefficient of determination (R^2 adj.), Standard error of estimated (SE. of Est.) and the mean square error (MSE). The results of the study indicated that the (H-D), (CD-D), (A-D) can be described by cubic function, except the relationship between (A-CD) can be described by quadratic function.

KEY WORDS: Age of tree, Crown diameter, Dimensional relationship, Stem diameter, Tree measurements.

INTRODUCTION

The tree (D) is one of the most common and important characteristics used in forest inventory. This variable has numerous beneficial attributes: - It is easy to measure (Zhang *et al*., 2004), volume of tree can be estimated and have strong correlations with other tree characteristics such as (H, CD and A). Measurements of these variables are more difficult and time consuming than that of (D) variable. Therefore, regression analysis is one of the tools usually employed to predict relationship between two or more variables. The distribution of trees by diameter class allows foresters to understand volume tables, stand structure, stand dynamics, and future forest yield.

The (H) is a fundamental geometrical variable for trees. Unfortunately, most measures are based on visual inspection, and they are almost always considerably biased. Generally most of methods for measuring (H) are more difficult, cumbersome and time-consuming than measuring (D) especially in dense stands. On the other hand, Tree (D) can easily be measured at low cost, but tree (H) data are relatively more difficult and costly to collect. Therefore, (H-D) equations can be used to predict (H) where actual measurements of (H) are not available for equation purposes. Missing (H) may be predicted using a suitable (H-D) equation. (Temesgen and Gadow, 2004).

The (CD) of tree is the center of physiological activity, particularly gas exchange, which drives growth and development. The ability to predict (CD) from (D) provides an efficient method of obtaining an estimate of (CD). Estimates of (CD) can also be used to calculate stand canopy closure, which is important for assessing wildlife habitat suitability, fire risk, and competition for regeneration (Crookston and Stage, 1999). Tree (CD) is well correlated with tree (D) (Lockhart *et al*., 2005). Conifers have smaller (CD) than deciduous trees, but the location of the tree is also important, such that trees in southern Duhok have greater (CD) than those in the north. Meanwhile, trees on poor sites or in open growth stands have larger (CD) than those on nutrient-rich sites or in denser stands.

Total (H), and (CD) could be estimated by means of stem (D), which is easy to measure for the studies in ground-based forest inventory and stand structure determination (Turan, 2009). Foresters determine (A) by counting the growth rings of a severed tree stump or by taking a core sample using an increment borer. In this study, the

process of measuring (D, H, CD and A) variables of *Pinus brutia* Ten. grown naturally in Zawita and Atrush are applied for the first time in these two regions, to see the strength of relationship between these variables with each other.

The aim of the present research: 1- develops regression equations between (H-D, CD-D, A-D and A-CD) for natural pure Calabrian pine in Zawita and Atrush districts in Duhok province. 2- Select the best fit equation for each one of these relationships without incurring unaffordable costs and time.

MATERIALS & METHODS

Study Area

Pinus brutia Ten. covers extensive areas in the Eastern Mediterranean region: mainly Turkey, Greece, Cyprus, West Syria, Lebanon and Italy; scantly North Iraq, West Caucasus and Crimea (Gezer, 1986; Fady *et al*., 2003). This species is occurring naturally only in two districts in northern Iraq, in Zawita and Atrush districts situated in Duhok province. It lies at the very northern tip of Iraq, bordered by Turkey As shown in Figure 1 .The study area for these two districts are summarized in table (1).

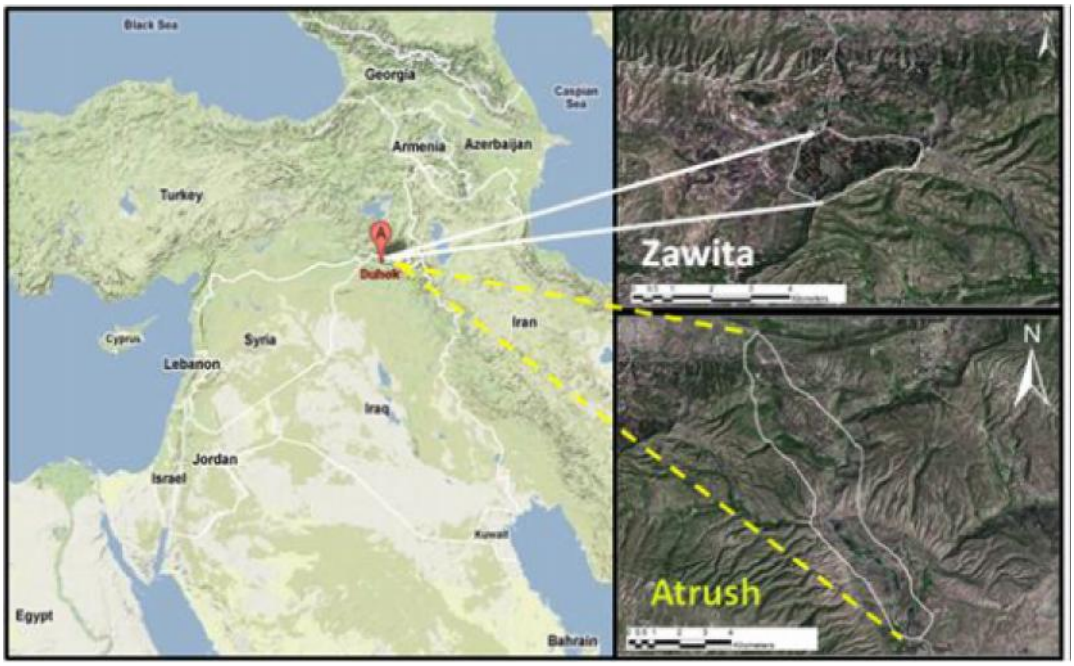

Fig. (1):- Location of the study Area.

TABLE (1):- Characteristics of location in Zawita and Atrush districts.

Characteristics	Zawita	Atrush
Coordinates	Latitude: 36° 89' 97" N Longitude: 43° 14' 66" E	Latitude: 36°83'74" N Longitude: 43°34'04" E
Altitude	883 - 1175 m above sea level.	741-875 m above sea level.
Area	287 ha.	317 ha.
Ecoregion	Zagros Mountains Forest Steppe.	Zagros Mountains Forest.
Located	about 13 km northeast of Duhok province	about 65 km east of Duhok province

Measurements and Data Collection

The data used in the research were obtained from the natural pure Calabrian pine in Zawita and Atrush districts. The (A) of trees ranged from (16) years to (66) years. A total of 200 Calabrian pine individuals were measured (one hundred tree for each district) from July to November 2012. Summary statistics, including mean, minimum, maximum, and standard deviation of each of the individual tree data sets are shown in Table (2).

The trees were in good health, and without visible evidence of major injury, normal trees of the stand void with disease or insect attack and free from natural injuries, such as broken tops due to wind, storm, and fire. The tree is open grown and relatively free from competition of other trees generally at least 12 m from neighboring trees (Forked or top damaged trees were excluded). The following variables of the selected trees were measured: diameter at breast height (D), tree height (H), crown diameter (CD), and age at breast height (A).

Table (2): -A Summary Statistics of Field Data *of Pinus brutia* Ten. In Duhok province.

Variable	Minimum	Mean	Maximum	Range	Standard deviation
D	11.40	30.35	59.70	48.30	11.47
H	4.50	13.69	23.60	19.10	4.27
CD	3.40	8.34	18.40	15.00	3.48
A	16.00	31.64	66.00	50.00	10.73

The tree (D, cm) over bark of all of the trees were found by taking the mean of the two measurements that were made in the direction perpendicular to each other by a caliper, to the nearest 0.01 centimeter, All trees selected had (D) larger than 11.4 cm. Total tree (H, m) were measured, using a Haga altimeter, to the nearest 0.01 meter. Two (CD, m) were measured per tree; one being the horizontal diameter of the axis of the crown which passes through the centre of the plot and the second being perpendicular to the first. The arithmetic mean crown diameter calculated from these two field measurements to the nearest 0.01 meter. The (A, year) were determined using increment borers. The tool consists of a hilt, a borer bit, and core extractor. Since trees were cored at the (D), it refers to the age at this level. The distance from solid wood to the estimated tree centre was predicted based on the annual ring widths closest to the pith. Extract a tree core by boring into the center of a tree with the appropriate sized increment borer. Slip the extractor fully through the core tube, break the core by turning the increment borer counterclockwise one-half turn and remove extractor with core. You will then be able to see a core from the bark to the pith. Count the age of the tree by counting each annual ring increment as one year. Note that one year includes both summer wood and spring wood.

Statistical Analysis

In order to estimate the parameters of all equations and validate the equations, Minitab ver. 16 and Statigraphics plus: 5.0 programs were used. The data of a total of N = 200 trees were included in the analysis; thus, the relationships between (H-D, CD-D, A-D and A-CD) were determined. For each relationship between any two variables, eight equations were used represents (linear, Quadratic, Cubic, power, Compound, Growth, Reciprocal and Logarithmic) are summarized in Table 3. One of these equations is linear and others are non-linear. All parameters were found to be significant at the 5% level. To select the best fit equation, among the eight candidate equations were evaluated on the basis of the adjusted coefficient of determination (R^2 adj.), standard errors of estimate (SE. of est.) and mean square error (MSE). Equation resulting in the largest R2 adj, least S.E. of Est. and MSE which fits our data. The F statistic and the significance F were then computed and the results tabulated for the best equation in each of the relationships mentioned above. Another important step in evaluating the equations was to perform a graphical analysis for the best fit equation to assess the appearance of the fitted curves overlaid on the data set.

Table (3):- List of equations examined in this study.

No.	Function form	Designation
1	$Y = B^0 + B^1 X$	Linear
2	$Y = B^0 + B^1 X + B^2 X^2$	Quadratic (Polynomial)
3	$Y = B^0 + B^1 X + B^2 X^2 + B^3 X^3$	Cubic
4	$Y = B^0 X^{B^1}$	Power
5	$Y = B^0 B^1 X$	Compound
6	$Y = EXP(B^0 + B^1 X)$	Growth
7	$Y = B0 + B1 \frac{1}{X} + B2 \frac{1}{X^2}$	Reciprocal
8	$Y = B^0 + B^1 \log(X)$	Logarithmic

RESULTS & DISCUSSION

This research presents relationships between (H-D), (CD -D), (A-D), and (A-CD) for natural pure Calabrian pine in Zawita and Atrush districts in Duhok province. For all relationships, the (D) was taken as the independent variable except relationship between (A-CD) where CD of tree as independent variable, while the (H, CD, and A) are taken as the dependent variable. Several equations for fitting data were performed well and produced very similar results. To select the best fit equation for each of the relationships above, the following procedure were used:

Tree Height with Diameter at Breast Height Relationship (H-D)

The (H) is an important variable which is used for preparing standard volume table (Obeyed, 2009) and form class volume table (Younis and Obeyed, 2007), also used for estimating site index and for describing stand structure. As a tree increases in height, it's metabolic and growth requirements would increase too, competition for light is important, especially in groups of trees. Measuring (H) is costly however, and foresters usually welcome an opportunity to estimate this variable with an acceptable accuracy. Missing (H) may be estimated using a (H-D) function. The trend in this study was also in concert with equations formulation proposed by several findings on its relationship (Canadas, 2000; Calama and Montero, 2004; Sharma and Parton, 2007). Table 4 shows the eight regression equations developed to estimate the (H) depending on (D), as well as many measuring of precision such as The R^2 adj., SE. of Est. and MSE. Equations (5, 6, 7, 8) were dropped from the competition list, because have comparatively lower values of The R^2 adj. and higher values of S.E of est. and MSE than that of other equations in the set. The remaining equations (1, 2, 3 and 4) nearly have the same precision for estimating height (very close to one another. The R^2 adj. ranging from (0.8639) in equation (4) to (0.8708) in equation (3). SE. of Est. ranging from (1.5760) in equations (1 and 4) to (1.5358) in equation (3). MSE for equation (3) have the value (2.35853) lower than other equations.

Table (4):- Statistical Equations and parameter estimates from tree height prediction for *Pinus brutia*Ten.

No.	B_0	B_1	B_2	B_3	R^2 adj	S.E. of Est.	MSE
1	3.18388	0.346345			0.8646	1.5760	2.48367
2	2.21999	0.411195	0.000955		0.8644	1.5734	2.47558
3	8.72572	-0.261084	0.019908	-0.0001972	0.8708	1.5358	2.35853
4	1.00146	0.769932			0.8639	1.5760	2.48383
5	6.83411	1.02217			0.8330	1.7461	3.04871
6	1.91292	0.0221591			0.8331	1.7455	3.04671
7	31.9403	-709.738	5262.16		0.8406	1.7062	2.91119
8	-20.5335	10.2428			0.8333	1.7445	3.04339

Equation (3) gave the best performance for estimating (H) according to the values of the statistics. Consequently, cubic equation was selected. There was a strong positive non-linear relationship between H and D (Figure 2.a). The observed height versus the predicted heights is also drawn for testing data (Figure 2.b), it show that the equation (3) fits the data well. The cubic equation established between these two variables was statistically significant (F = 448.189; P < 0.001) as shown in table (5).

Table (5):- The result of Analysis of Variance for cubic equation to estimate (H) for *Pinus brutia* Ten.

Source	DF	SS	MS	F-Test	P-value
Regression	3	3171.20	1057.07	448.189	0.001
Error	196	462.27	2.36		
Total	199	3633.48			

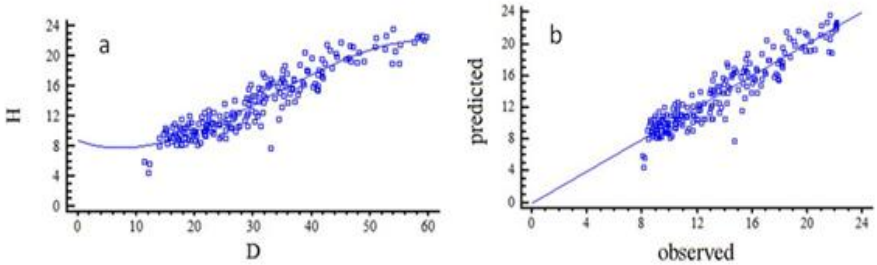

Fig. (2):- a- The relationship between H and D b- Observed vs. predicted H for selected equation

Crown Diameter with Diameter at Breast Height Relationship (CD-D)

Generally, the CD-D regressions were highly significant and showed a strong relationship between the two variables. This corroborates results reported by earlier researchers (Bragg, 2001; Foli *et al*., 2003; Pommerening and Stoyan, 2006) Measurement of crown width is not common in forest inventories, yet this value has wide applicability in forestry. Consequently, quantification of crown width attributes is an important component of many forest growth and yield equations. According to the table 6 for prediction (CD) depending on (D) for *Pinus brutia* Ten., eight candidate equations was tested to select the best fit equation depending on The R^2 adj., SE. of Est. and MSE. Equations (7, 8) were dropped from analysis, because have comparatively lower values of The R^2 adj. and higher values of S.E of est. and MSE than that of other equations in the set. The remaining equations (1, 2, 3, 4, 5, and 6) slightly have the same precision for estimating (CD). The R^2 adj. ranging from (0.8408) in equation (6) to (0.8542) in equation (3). SE. of Est. ranging from (1.3886) in equation (6) to (1.3288) in equation 3. MSE for equation (3) have the value (1.7656) lower than other equations.

TABLE (6): -Statistical Equations and parameter estimates from crown diameter prediction for *Pinus brutia* Ten.

No.	B_0	B_1	B_2	B_3	R^2 adj	S.E. of Est.	MSE
1	-0.114067	0.278711			0.8440	1.3781	1.89919
2	2.043120	0.133578	0.002136		0.8511	1.3432	1.80410
3	5.984910	-0.273752	0.014777	-0.000119	0.8542	1.3288	1.76560
4	0.239257	1.03901			0.8442	1.3739	1.88771
5	3.280460	1.02938			0.8408	1.3889	1.92894
6	1.179990	0.029163			0.8408	1.3886	1.92833
7	24.3777	-652.466	5282.92		0.8061	1.5324	2.34823
8	-18.46800	8.02355			0.7704	1.6677	2.78134

Equation (3) was finally selected because it was slightly superior according to the measures of precisions. Consequently, cubic equation was selected. There was a strong positive non-linear relationship between CD and D (Figure 3.a). The observed CD versus the predicted CD is also drawn for testing data (Figure 3.b), it show that the equation (3) fits the data well. The cubic equation established between these two variables was statistically significant (F = 389.729; P < 0.001) as shown in table (7).

Table (7): - The result of Analysis of Variance for cubic equation to estimate (CD) for *Pinus brutia*Ten.

Source	DF	SS	MS	F-Test	P-value
Regression	3	2064.43	688.144	389.729	0.001
Error	196	346.08	1.766		
Total	199	2410.51			

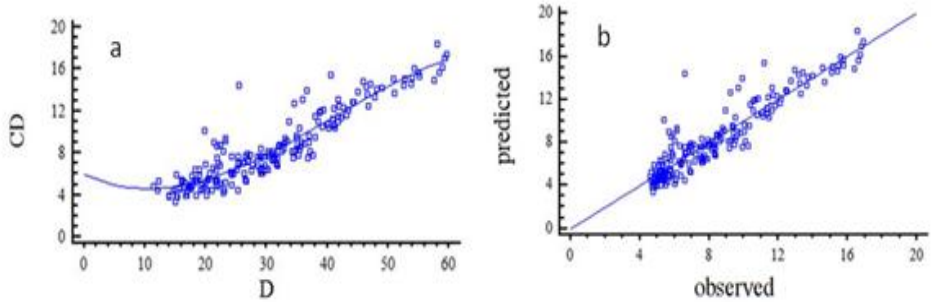

Fig. (3):- a- The relationship between CD and D b- Observed vs. predicted CD for selected equation

Age of Tree at Breast Height with Diameter at Breast Height Relationship (A-D)

Method of measuring the (A) of the tree at (D) is very difficult when compared with the measurement of the diameter, height, and Crown width. It also can be very expensive and takes large time as well as it needs muscular effort to extract a sample from the tree and then calculate (A). The relationship between tree age and tree diameter has been examined and reported by earlier researchers (Faunt, 1992; Burrows *et al*., 1995; Stoneman *et al*., 1997; Whitford, 2002).

According to the table 8 for prediction (A) depending on (D) for *Pinus brutia* Ten., eight candidate equations was tested to select the best fit equation depending on The R2 adj, SE. of Est. and MSE. Equations (5, 6, 7, 8) was dropped from analysis, because have comparatively lower values of The R2 adj. and higher values of S.E of est. and MSE than that of other equations in the set. The remaining equations (1, 2, 3 and 4) slightly have the same precision for estimating height. The R^2 adj. ranging from (0.9201) in equation (4) to (0.9340) in equation (3). SE. of Est. ranging from (3.0222) in equation (4) to (2.7564) in equation (3). MSE for equation (3) have the value (7.59777) lower than other equations.

TABLE (8):- Statistical Equations and parameter estimates from age at D prediction for *Pinus brutia* Ten. in Duhok province.

No.	B_0	B_1	B_2	B_3	R^2 adj	S.E. of Est.	MSE
1	4.345200	0.899273			0.92528	2.9391	8.63839
2	8.893240	0.593285	0.004504		0.92857	2.8665	8.21672
3	23.579200	-0.924306	0.051599	-0.000445	0.9340	2.7564	7.59777
4	1.592840	0.877403			0.9201	3.0222	9.13366
5	14.205400	1.02535			0.9160	3.1084	9.66201
6	2.648260	0.025177			0.9160	3.1077	9.65776
7	81.962500	-2022.27	15993.8		0.8844	3.6471	13.3016
8	-55.491800	26.073			0.8572	4.0524	16.4219

Equation (3) gave the best performance according to the values of the statistics. Consequently, cubic equation was selected. There was a strong positive non-linear relationship between A and D (Figure 4.a). The observed (A) versus the predicted (A) is also drawn for testing data (Figure 4.b), it show that the equation (3) fits the data well. The cubic equation established between these two variables was statistically significant (F = 938.925; P < 0.001) as shown in table (9).

TABLE (9): -The result of Analysis of Variance for cubic equation to estimate (CD) for *Pinus brutia*Ten.

Source	DF	SS	MS	F-Test	P-value
Regression	3	21401.2	7133.73	938.925	0.001
Error	196	1489.2	7.60		
Total	199	22890.4			

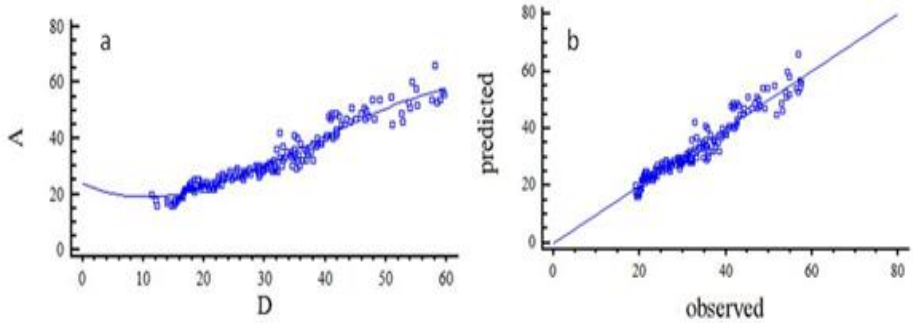

Fig. (4):- a- The relationship between A and D b- Observed vs. predicted A for selected equation.

Age of Tree at Breast Height with Crown Diameter Relationship (A-CD)

The process of extracting the sample from the tree has an effect on its growth as it leads to be a hole in the trunk of the tree, which is considered one of the disadvantages of logs during the sales process which affects the price and worth less. Based on this, it is preferable to use regression equations to measure the (A) of the trees by using linear or non-linear equations between (A) as independent variable and (CD) as the dependent variable. There are many studies investigating the relationship between them (Lindholm, *et al*., 1999; Peng, 2000; Vanclay, 2002; Macke and Mathew, 2006; Bueno, 2009). According to the table 10 for prediction (A) depending on (CD) for *Pinus brutia*Ten., eight candidate equations was tested to select the best fit equation depending on The R^2 adj., SE. of Est. and MSE. Equations (7, 8) were dropped from completion list, because have comparatively lower values of The R^2 adj. and higher values of S.E of est. and MSE than that of other equations in the set. The remaining equations (1, 2, 3, 4, 5, and 6) slightly have the same precision (very close to one another) for estimating (A). The R^2 adj. ranging from (0.8392) in equations (5 and 6) to (0.8457) in equation (2). SE. of Est. ranging from (4.3006) in equation (5) to (4.2136) in equation (2). MSE for equation (2) have the value (17.7547) lower than other equations.

TABLE (10): -Equation statistics and parameter estimates from age at D prediction for *Pinus brutia* Ten.

No.	B_0	B_1	B_2	B_3	R^2 adj	S.E. of Est.	MSE
1	8.0015	2.83245			0.8448	4.2352	17.9367
2	11.3828	2.01898	0.041706		0.8457	4.2136	17.7547
3	11.456	1.99224	0.044629	-0.000097	0.8449	4.2244	17.8453
4	6.37695	0.761287			0.8379	4.3185	18.6493
5	15.7616	1.08203			0.8392	4.3006	18.4947
6	2.75652	0.078941			0.8392	4.3005	18.4945
7	78.9049	-530.344	1201.81		0.8131	4.6360	21.4929
8	-16.6593	23.6805			0.7934	4.8747	23.7627

Equation (2) gave the best performance according to the values of the statistics. Consequently, polynomial equation was selected. There was a strong positive non-linear relationship between A and CD (Figure 5.a). The observed (A) versus the predicted (A) is also drawn for testing data (Figure 5.b); it shows that the equation (2) fits the data well. The polynomial equation established between these two variables was statistically significant ($F = 546.128$; $P < 0.001$) as shown in table (11).

TABLE (11): -The result of Analysis of Variance for polynomial equation to estimate (A) for *Pinus brutia*Ten.

Source	DF	SS	MS	F-Test	P-value
Regression	2	19392.7	9696.34	546.128	0.001
Error	197	3497.7	17.75		
Total	199	22890.4			

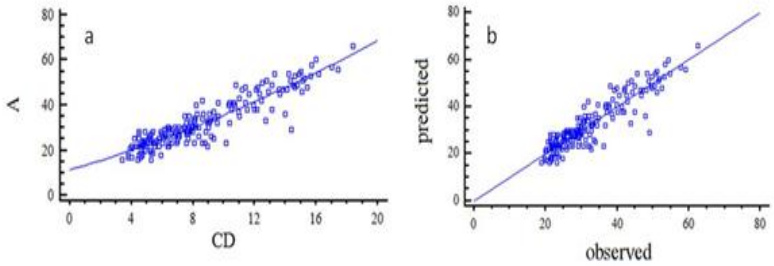

Fig. (5):- a- The relationship between A and CD b- Observed vs. predicted A for selected equation.

CONCLUSION

At the end of the regression analysis, there was a strong positive non-linear relationship between (H-D, CD-D, A-D and A-CD).It was determined that there were statistically significant ($P < 0.001$) and strong (R^2 adj. > 0.77) relationships between (H-D, CD-D, A-D and A-CD) which are significant. The corresponding F-values from analyses of variance are also significant ($P < 0.001$) in Calabrian pines. The strongest relationship determined was the A-D relationship (R^2 adj. = 0.9340) very close relationship, followed by the H-D (R^2 adj. = 0.8708) then CD-D (R^2 adj. = 0.8542) and A-CD (R^2 adj. = 0.8457) respectively. The results of the study indicated that the relationships between (H-D, CD-D and A-D) can be described by the cubic equation, while (A-CD) relationships can be described by the second-degree polynomial equation. Finally the important characteristics variables of tree such as heights, crown diameters and age of tree can be estimated by means of diameter at breast height, of which measurement is easy, in Calabrian pines of the research area.

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ەڤین پێشبینی کری دناقبەرا تیرەی، بلنداهێ بڕەی تاج، وژیێی دارێت Pinus brutia Ten ل دەڤەرا زاویتە ئتروشێ.

پوختە:

ئەڤ ڤەکولینە هاتەکرن لسەر (200) بن سروشتی یا کاژا زاویتە ل دەڤەرا زاویتە واتروشێ ل ڕیزکەها دهوکێ ل باکورێ ڕدستانا عیراقێ. کو هندەك گورینکارێ دارێدا هاتنە پیڤان وشلوڤەکرن وەکو رە لسەر ئاستێ سینگی (D)، باندا‌هیا داری (H)، تیرەی تاج (CD) وژیێی دارێ ەر ئاستێ سینگی(A) . هەر وەسا هاتیە دیارکرن پەیوەندیا دناڤبەرا بلنداهیا دارێ دگەل تیرەێ ەر ئاستێ سینگی (H-D)، تیرەی تاج دگەل تیرەێ ەر ئاستێ سینگی (CD-D)، وژیێی دارێ ەر ئاستێ سینگی دگەل تیرەێ ەر ئاستێ سینگی(A- D) ژیێی دارێ ەر ئاستێ سینگی دگەل تیرەی تاج(A-CD). ە نمونا راستەهێلی دکەل ،فت نمونەیێن نەراستەهیلێ هاتە بکارئینان هەر پەیوەندیەکێ ژڤان بەیوەندیا. تی ڤێ چەندێ جیاوازیا دناڤبەرا ڤان نمونەیا هاتە ئەنجام دان بو هەلبژارتنا باشترین نمونە بریکا معامل دەستنیشانکری یادروست (R2 adj.) وئینحرافا ئەندازەی (SE. of Est) وهەلەی ناوەندی .(MSE) یارکر ئەنجاما ڤەکولینێ کو (H-D), (CD-D), (A-D) ژ هاوکێشا پلا سێی، ژبلێ بەیوندیا دناڤبەرا (A-CD) بارکر کو ژ هاوکێشا پلا دووێ.

النماذج التنبؤية بين القطر، الارتفاع،قطر وتاج والعمر لاشجار *Pinus brutia* Ten. في منطقتي زاويتة و أتروش

الخلاصة:

أجريت هذه الدراسةعلى *(200)* شجرة من أشجار الصنوبر البروتي الطبيعية الواقعة في منطقتي زاويتة وأتروش في محافظة دهوك اقليم كردستان العراق. حيث تم قياس وتحليل بعض متغيرات الشجرة والتي تتمثل ب قياس القطر عند مستوى الصدر *(D)*، ارتفاع الأشجار*(H)*، قطر التاج *(CD)* وعمر الشجرة عند مستوى الصدر*(A)*.كما تم تحديد العلاقة بين ارتفاع الأشجار مع القطر عند مستوى الصدر*(H-D)* ، قطر التاج مع القطر عند مستوى الصدر*(CD-D)* ، وعمر الشجرة عند مستوى الصدر مع القطر عند مستوى الصدر*(A-D)*، وعمر الشجرة عند مستوى الصدر مع قطر التاج *(A-CD)*. تم استخدم نموذج خطي واحد مع سبعة نماذج غير خطية لكل علاقة من هذه العلاقات، ثم أجريت مقارنة بين تلك نماذج وذلك لاختيار أفضل نموذج من خلال دراسة معامل تحديد المعدل *(R2 adj.)*، الخطأ القياسي المقدر *(SE. of Est.)* ومتوسط مربع الخطأ *(MSE)* وأشارت نتائج الدراسة إلى أن *(H-D)* ، *(CD-D)*، *(A-D)* يمكن وصفها كدالة تكعيبية، فيما عدا العلاقة بين *(A-CD)*يمكن وصفها كدالة تربيعية.

BIOASSAY AND CHEMICAL CONTROL OF WHEAT SEED GALL NEMATODE *Anguina tritici**

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ABSTRACT

Bioassay results indicated that the fungicides Vitavax, Dividentand Dithane and herbicide Granstar caused mortality to second stage juveniles (J_2) of *A.tritici*. Higher mortality (89.12%) appeared after a week of immersion of J2 in Dithane at concentration 8 ppm while less mortality (16.63%) was with Vitavax at concentration 2ppm.Regression analysis and correlation coefficient showed positive relation between concentrations of pesticides and J_2 mortality. From toxicity lines, LC50 and relative toxicity Dithane was more toxic to nematode juveniles while Vitavax was less. Chemical control of *A.tritici* by mixing of wheat seeds (Sham 6 cv.) with fungicides revealed that less infection percentage (35.68%) and number of galls (3) were recorded with Dithane in the third planting date (15 Jan.2011) compared to the control treatment. In general fungicides slightly improved the growth and yield criteria of wheat plants and an obvious improvement in leaf area (19.92 cm^2), harvest index (27.43) in the first (15 Nov.2010) and second planting dates (15 Dec.2010) respectively with Vitavax, weight of seeds (0.44gm) in the first planting date with Dithane and number of seed/spike (18.75) in third planting date with Dividant. Depending on the number of galls, the third planting date may be the most suitable planting date. Herbicide Granstar® caused a non-significant reduction in the infection criteria compared with non sprayed treatment while it caused significant increasing some growth and yield criteria including harvest index, weight of seed/spike, spike length, straw weight and number of seeds/spike.

KEYWORDS: *Bioassay, chemical control, Anguina tritici.*

INTRODUCTION

Ear-cockle disease was the oldest reported disease of wheat (*triticum* spp.) (Bhatti, *et al.*,1978) which was caused by Wheat seed gall nematode *A. tritici*. It is one of the major aerial diseases and causes sustainable losses in wheat crop of tropical and sub-tropical countries (Kort, 1972).It is still common in Eastern Europe and in part of Asia and Africa (Agrios, 2005).Symptoms of nematode attack can be discerned at seedling stage but farmers generally fail to recognize the disease before harvesting and threshing of the plant (Khan and Athar, 1996). From the first record of *Anguina tritici* in Iraq by Rao,1921 it is still an important nematode pest in Iraq occurred in the most areas of wheat growing with disease incidence 22.9 to 45% on mexipac cv. (Al-Beldaw; *et.al*.1974) increased to 75% on the same cultivar in Duhok Province in 1989 (Stephan and Antoon,1990). Ami,*et.al*.,(2004) reported that the percentage of infestation by galls reached 50% on bread wheat in Bashika - northern of Iraq. However, Ear-cockle disease reduces human consumption and market price of wheat (Paruthi and Bhatti, 1988), with significant reduction in the protein and gluten contents of the flour product of infested wheat seeds (Mustafa, 2009). Due to the use of non-chemical control against *A.tritici*, the current study aimed to examine the effect of some common pesticides for controlling pathogenic fungi and herbicide of Granstar for controlling this nematode.

MATERIAL AND METHODES

1. Preparation of *A. tritici* J_2 suspension:

suspension of second stage juveniles of *A.tritici* was prepared by immersing wheat galls in distill water in a Petri dish for 2 hours after which they were opened with the aid of 2 needles under stereomicroscope for releasing of nematode juveniles. Nematode population was counted under stereomicroscope. J_2 suspension was diluted to obtain 50±5 J_2/ml.

* Part of M.Sc.thesis of the second author

2. Bioassay of pesticides on vitality of nematode juveniles:

One ml of nematode juvenile suspension contained 50 ± 5 J2 was Placed in petri dishes with 5 cm,one ml of each pesticides (Vitavax, Divident, Diathin and Granster) at concentrations of 0.0 ppm (D.W.) control), 2.0, 4.0, 6.0 and 8.0 ppm was added to Petri dishes separately and replicated three times before incubation at 25±5 C°. J_2 mortality percentage was counted daily for a week and dead larvae were discriminated according to Al-Abdi (1985).Then mortality percentage was corrected using the following equation mentioned by Ami (1998). Corrected mortality percentage = 100 – 100 (Number of living juveniles in treatment / number of living juveniles in control). LC50 and relative toxicity were evaluated according to (Finney, 1977). Relative toxicity = Lc50 of less effected pesticide / Lc50 of more effected pesticide. This experiment consisted of 20 treatments (4 pesticides × 5 concentration) Complete Randomized Design(C R D). Data were analyzed using SAS program and means were compared according to Duncan's Multiple Range test,P=0.05 (SAS, 1999).

3-Effect of fungicides and planting dates:

Wheat seeds of Cham- 6 cv. were mixed manually with fungicides included Divident®, Vitavax® and Dithane®at recommended concentrations (Table, 1) before sowing seeds separately at three planting dates (15 / Nov., 15 / Dec. 2010 and 15 / Jan.2011) in pots at the rate of five seeds / pot followed by soil infestation with eight galls / pot which were treated also with fungicides individually and added to the soil. Control treatment contained a non-treated seeds. This experiment included 48 experimental units **{3** sowing date × (3 fungicides+1 control) × 4 replication**}** and conducted as Factorial experiment in Randomized Complete Block Design (RCBD).

4- Application of selective herbicide "Granstar":

Granstar®75D.F (Table, 1) an herbicide of broad leaf weeds in wheat fields. Hand atomizer was used for spraying at the time of weeds emergence (in late April) within wheat plants planted in 15 / Dec / 2010.Control treatment consists of infested soil sprayed with water. Seeds sown and infested directly. Each treatment replicated four times and conducted as factorial experiment in RCBD. Pots were plunged in the fields of college of Agriculture, University of Duhok. The following criteria were calculated:

1-Growth and yield criteria: a-Plant height (cm/plant): as described by Osmar*et al.*, (2007).

B-Straw (hay) weight (gm/plant).

C-Spike weight (gm/plant).

D-Spike length (cm/spike)

E-Number of seeds /spike.

f- Seed weight/spike. (gm/spike).

G-Biological yield = hay weight + seed weight.(gm/plant).

H-Harvesting index according to the following equation: H.i = (seed yield / biological yield) × 100 (Sharma and smith, 1986).

I-Increment percentage in criteria = (Criteria value in treated treatment – criteria value in control) ÷ criteria value in control (soil infested with galls) × 100. j- Flag leaf area(L.E)(cm²)at the end of the spikes stages in which leaf area reached its maximum size L.E =leaf length ×leaf width in the middle ×0.95(Kemp,1960).k=Chlorophyll %.Measured by Chlorophyll meter (SPAD-502 / Konica Minolta Sensing, INC. made in JAPAN).

2-Infection criterion:

A-infection percentage% = (Number of infected plants / total number of plants) ×100.

B-Number of galls / spike.

C-Weight of galls.(mg/gall).

D-J2 population density. (J_2/ dry gall).

RESULT AND DISCUSSION

1-Bioassay of 2nd stage juveniles of *A.tritici* against selected fungicides (Vitavax,Divident,Dithane), and herbicide (Granstar):

Results indicated that pesticides caused mortality of nematode juveniles by average 42.01% with Vitavax and exceeded to 80.77% with Dithane. Less mortality (49.29%) appeared at low concentrations (2ppm) and increased with increasing of pesticide concentration where reached 79.545% at 8ppm.The interaction between pesticides and their concentrations was significant. less mortality (16.63%) recorded after a week of nematode immersion inVitavax at 2ppm while the highest (89.12%) with Dithane at 8ppm (Table.1).

Table (1): Effect of pesticides on mortality percentage of 2nd stage juveniles of *A.tritici*

Pesticides / Concentrations (ppm)	Vitavax	Divident	Dithane	Granester	* Mean of concentrations
2	16.63 f	55.91 cd	62.99 c	61.55 c	
4	38.61 e	69.20 bc	83.45 a	68.90 bc	**65.04 c**
6	50.50 d	81.86 ab	87.54 a	77.32 b	**74.30 ab**
8	62.30 c	85.07 a	89.12 a	81.68 ab	**79.54 a**
** Mean of pesticides	**42.01 c**	**73.01 b**	**80.77 a**	**72.36 b**	

*Means followed by different letters are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each number is mean of 3 replications & **means (concentrations& pesticides) are means of 4 number.

Regression analysis and correlation coefficient (Fig.1) showed positive relation between concentrations of pesticides and J_2 mortality. It seems clearly from the regression equation for each pesticide that the increase in one unit (ppm), of user concentration resulted in increasing in nematode mortality by 7.445, 4.124, 5.007 and 3.440 unit for each of Vitavax, Dithane, Divident and Granstar, respectively, Thus it can be depended on 97.29, 77.51, 94.48, and 98.52% on the regression equation for each pesticide respectively, to determine the expected percentage of nematode mortality. From toxicity lines(Fig. 2), LC50 and relative toxicity (Table, 2) Diathane was more toxic to nematode juveniles compared to the other pesticides, while Vitavax was less toxic. Effect of Effect of these pesticides on nematode may attribute to their interfering in nematode metabolism.

Table (2) LC50 and relative toxicity of tested pesticides in bioassay of J2 of *A.tritici*.

Pesticides	Vitavax	Divident	Granstar	Dithane
LC50 (ppm)	6	2.5	2	1.8
Relative toxicity	1	2.5	3	3.3

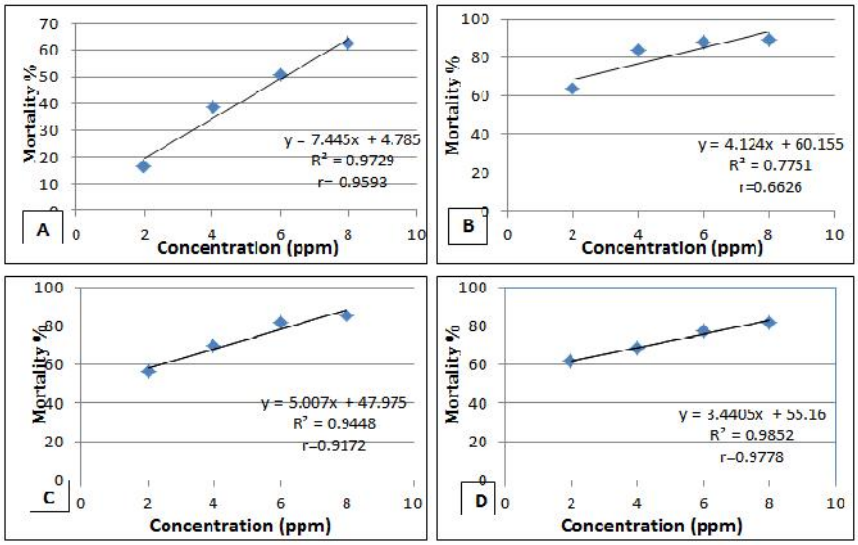

Fig.(1) Linear relation, regression equation and correlation coefficient between concentration of Vitavax(A), Dithane (B), Divident (C), Granstar (D) and mortality % of 2nd stage juveniles of *A.tritici*.

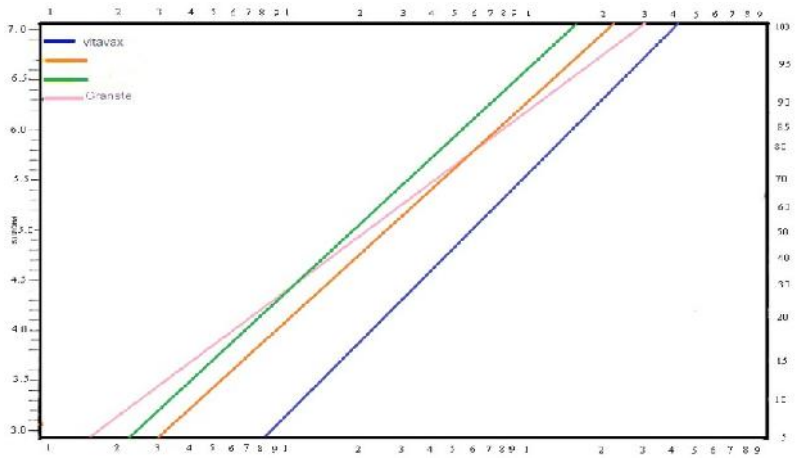

Fig. (2) Toxicity lines of pesticides as a result of their effect on mortality of J_2 of *A.tritici.* LC50 = lethal concentration for killing 50% of 2nd stage juveniles of *A.tritici*

2Application of fungicides in different planting dates for controlling *A.tritici* :

Highest infection criteria observed in control treatments at different planting dates though some of them were not significant. Lowest infection (35.68%) and number of galls (3) were recorded when Dithane applied in the third planting date and more infection observed also in control treatment in the same planting date (Table, 3).

2.1. Interaction effect between fungicides and planting dates on infection criteria:

Means shown that fungicides and planting dates had no significant effect as independent factors on infection criteria compared with control. Number of galls/plant were (34.46) with weight of galls reached 2.15mg/gall in plants treated with Dithane, whereas lowest number of J_2 recorded in galls of plants applied with dividend.

Significant decrease in number of galls (28.3galls/plants) appeared in plants of third planting dates (Table 4).

Table (3): Interaction effect between fungicides with planting dates on infection criteria in wheat plants(sham6 cv.)

Planting date	15 / November/2010				15 / December / 2010				15 / January / 2011			
Fungicide / Criteria	Dithane	Vitavax	Divident	Control	Dithane	Vitavax	Divident	Control	Dithane	Vitavax	Divident	Control
Infection percentage	40.73 b	42.17 b	42.17 b	44.32 b	35.84 b	46.49 b	38.42 b	40.35 b	35.68 b	49.66 b	37.28 b	68.6 a
gall/plant	43 d	118 ab	118 ab	107 ab	57.38 c	149.2 a	40.75 d	150 a	3 e	56.75 c	56.75 c	60 c
weight of gall mg.	3.02 ab	2.55 ab	1.35 b	2.62 ab	2.93 ab	4.67 a	3.82 ab	4.7 a	1.5 b	3.82 ab	2.57 ab	4.07 a
Number of J_2/gall	9609 a	8112 a	9593 a	10858 a	8150 a	10848 a	8581 a	9723 a	10030 a	9268 a	8171 a	9080 a

*Means followed by different letters among each criterion are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each value is mean of 4 replications.

Table (4): Effect of planting dates and fungicides as independent factors on infection criteria in wheat plants (Sham6

Means	** Fungicide				*** Planting date		
Criteria	Dithane	Vitavax	Divident	Control	15 November 2010	15 December 2010	15 January 2011
Infection percentage	37.42 a	46.11 a	39.29 a	51.09 a	29.41 b	30.64 b	31.11 B
Number of gall/plant	34.46 c	108 a	60.17 b	103.33 a	79 a	64.5 b	28.3 C
weight of gall (mg/gall)	2.15 b	4.01 a	2.58 b	3.8 ab	2.38 b	3.6 ab	2.74 A
Number of J2/gall	9263 a	9410 a	8781 b	9887 a	9543 a	9325 a	9137 A

*Means followed by different letters among each criterion are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each value is mean of 4 replications.

2. 2.Effect on Growth and yield criteria of wheat (sham6 cv.):

The growth and yield criteria slightly improved as a result of fungicides applications where an obvious improvement in leaf area (19.92 cm²) and harvest index (27.43%) in the first and second planting dates with Vitavax seed dressing, weight of seeds (0.44gm) in the first planting date with Dithane and number of seed/spike (18.75) in the third planting date with Dividant.(Table,5) Means illustrated that the highest value of each of leaf area, chlorophyll %, spike length, straw weight and plant length was recorded in the first planting date, while the lowest value for each of leaf area and chlorophyll recorded in the third planting date while the lowest value of the other characters recorded in the second planting date (Table, 6).

Table (5): Interaction effect of fungicides with planting dates on growth and yieldCriteria of wheat 9 sham6 cv.).

Planting date	15 / November / 2010				15 / December / 2010				15 / January / 2010			
Fu Fngicide / Criteria	Dithane	Vitavax	Divident	Control	Dithane	Vitavax	Divident	Control	Dithane	Vitavax	Divident	Control
leaf area (cm²)	13.17 b	19.92 a	14.21 b	13.17 b	11.77 b c	12.76 b	9.310 b c	10.06 b c	8.408 b c	6.353 c	10.90 b c	13.42 b
Chlorophyll (%)	39.07 ab	39.90 ab	41.50 ab	42.85 a	40.80 ab	42.65 a	34.27 b	40.80 ab	37.30 ab	33.57 b	35.67 ab	40.17 ab
Harvest Index (%)	8.07 b	12.74 d	9.47 d	10.79 d	16.56 b	27.43 a	15.63 b c	20.92 ab	16.92 b	11.87 d	21.76 ab	16.78 b
Weight of seed/spike (gm)	0.44 a	0.33 c	0.33 c	0.31 c	0.35 c	0.31 c	0.44 a	0.30 c	0.36 b c	0.33 c	0.43 a	0.32 c
Straw weight (gm/plant)	7.12 a	8.89 b	8.32 a b c	6.39 b-e	3.87 d e f	4.59 c-f	2.83 e f	6.21 b-e	1.74 f	7.79 a-d	3.99 d e f	4.85 b-f
Number of seed/spike	17 a b c	5.50 d	5.50 d	4.87 d	5.62 d	4.50 d	18.75 a b	4.3 a b c	7.75 b c d	6.75 c d	17.3 a	4.6 a-d
spike length (Cm/spike)	7.06 a	6.75 a	6.62 a	6.06 a	5.5 a	6.67 a	6.18 a	6.5 a	5.43 a	5.81 a	7.25 a	7.12 a
plant length (Cm/plant)	45.66 a	34.66 b	32.16 b	29.41 b	28.58 b	29.54 b	29.45 b	34.83 b	28.70 b	28.24 b	31.69 b	34.74 b

*Means followed by different letters among each criterion are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each value is mean of 4 replications.

Table (6) Effect of planting dates and fungicides on growth and yield criteria of Wheat (Cham6 c.v.).

Means	** Fungicides				*** Planting dates		
Criteria	Dithane	Vitavax	Divident	Control	15 November 2010	15 December 2010	15 January 2011
leaf area (cm²)	11.11 a	13.01 a	11.47 a	12.22 a	15.12 a	10.97 b	9.77 b
Chlorophyll %	39.05 a	38.70 a	37.15 a	41.27 a	40.83 a	39.63 ab	36.68 b
Harvest index %	17.18 a	17.35 a	15.62 ab	16.16 ab	12.77 b	20.13 a	16.83 ab
Weight of seed/spike (gm)	0.37 a	0.32 a	0.4 a	0.31 a	0.35 a	0.35 a	0.36 a
Straw weight (gm/plant)	5.38 a	7.09 a	5.05 a	5.82 a	8.54 a	4.38 b	4.59 b
Number of seed/spike	10.12 ab	5.58 b	14.66 a	12.04 a	8.21 a	11.46 a	12.12 a
spike length (cm/spike)	6 a	6.41 a	6.68 a	6.56 a	6.62 a	6.21 a	6.40 a
plant-length (cm/plant)	34.31 a	30.81 a	31.10 a	32.99 a	35.47 a	30.60 b	30.84 b

*Means followed by different letters among each criterion are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each value is mean of 4 replications.

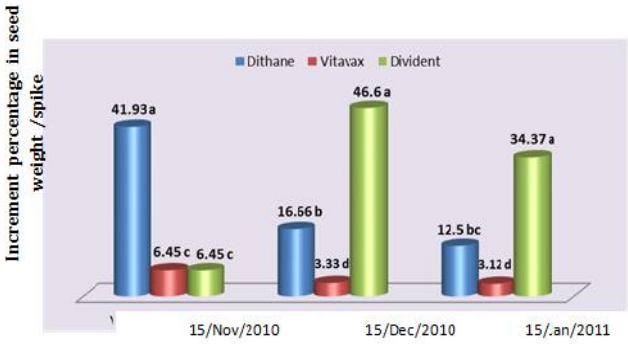

Fig. (3) Interaction effect of fungicides with planting dates on increment percentage of seed weight/spike.
*means followed by different letters significantly differ based on Duncan's Multiple Range test (P=0.05).

Figure (3) demonstrates that the maximum increment percentage of seed weight/spike was 46.6% in plants treated with Divident in second planting date followed by application of Dithane in first planting date (41.93%). Due to absence of significant differences within most of infection criteria and depending of number of galls, the third plan

ting date may be most suitable planting date and the absence of significant differences may be attributed to process of soil infestation which was done directly after planting in the three dates and nematode juveniles acquire the same opportunity.
However decreasing in the number of galls in the third planting date may be attributed to climbing of little number of nematode juveniles on wheat seedlings due to decreasing their activity as a result of low temperature during January. In addition to that some climbed juveniles couldn't reach seedling growing point for the same reason, as well as the feeding period of juveniles as an ectoparasite on leaves was less, which itself contributed to decreasing of juvenile's activity.

3-Application of Granstar® and planting dates:

The Results revealed that the herbicide Granstar® caused a non-significant reduction in the infection criteria compared with non-sprayed treatment as a result of nematode infection (Table,7).Non significant differences recorded in the value of leaf area chlorophyll percentage and plant length between sprayed and non-sprayed treatment ,while this herbicide caused significant increasing in the value of the other growth and yield criteria which included : harvest index, weight of seed/spike ,spike length, straw weight and number of seeds/spike. Little reduction in infection criteria as a result of herbicide application attributed to its direct effect on nematode by direct killing of nematode juveniles before their entrance ovaries of the flowers, in addition to its indirect effect on nematode activity especially on its feeding as ectoparasite on wheat seedlings leaves after its absorption as systemic herbicide by wheat plant. As result of this effect, significant increasing occurred in some growth and yield criteria.

Table (7): Effect of Granstar spray in 15/Dec/2010 on growth and infection criteria of wheat(sham6 cv.)

Criteria \ Granstar	Sprayed	Control (Non Sprayed)
Infection percentage	51.97 a	58.68 a
gall/plant	3.50 a	6.75 a
weight of gall (mg)	1.65 a	1.87 a
Number of nematode/gall	2808 a	5949 a
leaf area(cm)	9.43 a	9.98 a
chlorophyll %	31.35 a	32.72 a
Harvest index %	31.77 a	19.49 b
Weight of seed /spike	0.44 a	0.20 b
spike length (cm)	7.37 a	5.62 b
straw weight (gm)	7.63 a	5.47 b
Biological yield (gm)	8.72 a	6.83 b
plant-length (cm)	38.25 a	37.83 a
Number of seed/spike	21.25 a	10 b

*Means followed by different letters significantly differ based on Duncan's Multiple Range test (P=0.05).
*Each value is mean of four replications.

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پوخته

تاقیکردنەوی ژیانی بۆ قرکەرەکانی کەڕوو (Divident® 030FS, Vitavax®, Dithane S-60D® قرکەری گیا Granstar®75D F وو(Trichodermaharzianum) لە سەرAnguinatriticiدار بۆ کە Dithane بۆ یە یزۆرترین ریژەی مردن بە بەراورد لە کەل دەرمانەکانی تر.کەڕووی (Trichodermaharzianum) نیتوانی بە ەی راستەو خۆ پرۆسەی مووشەخۆریلە سەرA.tritici وکات و زۆرترین ریژەی سپۆری کاریکەر لە مردنی A.tritici ژەی (19× 106 spores) بوویە هۆی ریژەی مردنی 53.9% هەرزەکاری نیماتۆدا لە دوای ەفتەیەك لە چاودیری لە تاقیکا.

کەڕوو کاریگەری هەبووە لەسەر کەم کردنەوەی پیوەرەکانی تۆش بوون وزیاد کردنی کانی بەرهەم هیٚنان و بە پیٚی ژمارەی گەنمە پووچەکان کاتی یەکەم (16 کانونی دووەم 2011) باشترینیان بووە. کەرەکان بە تیٚکەلی لەگەل کاتی چاندن کاریگەری معنەویان نەبوو لە ریژەی تووشبوون و اتودا لە گەنمە پووچ و کەمترین ریژەی تووشبوون (35,68%) و کەمترین ژمارەی گەنمە پووچ(3/رووەك) بەکارهیٚنانی Dithane لە کاتی دووەم(15 کانونی دووەم 2011) بەلام کاریگەری تیٚکەلی قرکەر و کاتی چاندن مەعنەوی نەبوو لە سەر کلوروفیل و هەندیٚك پیٚوەری بەرهەم هیٚنان و هەندیٚك کاریگەری بوو لە باشکردنی هەندیٚکیان بە جیاواز لە جیاوازی قرکەرەکان لە کاتی سیٚیەم.Granstarبوویەهۆی زیاد رەکانی بەرهەم ه وەی پیٚوەرەکانی تۆش بوون.

الخلاصة

أظهرت نتائج الاختبار الحيوي لبعض المبيدات (Divident® 030FS, Vitavax® 200Wp, Dithane S-60D®) التي تعامل بها بذور الحنطة عادة و مبيد الأدغال Granstar®75D.F, الذي يستخدم لمكافحة الأدغال في حقول الحنطة بانها سببت موتاً ليافعات الطور الثاني للنيماتودا*A.tritici* بعد اسبوع من غمرها في المبيد و بعد الفترة ذاتها تبين إن المعلق البوغي (السبوري) للمقاوم الحيوي الفطري (*Trichodermaharzianum*) سبب موتاً ليافعات النيماتودا بنسبة وصلت اقصاها 53,9% عند غمر اليافعاتفيهبتركيز $6_{19\times10}$ سبور/مل

حققت المبيدات الفطرية انخفاضاً في معاير الإصابة بالرغم من عدم معنويتها احياناً كما لم تختلف مواعيد الزراعة معنوياً عن بعضها في قيم تلك المعاير و اعتمادا على عدد الثآليل فأن الموعد الثالث (15 كانون الثاني 2011) قد يكون افضلها. كما وجد إن التداخل بين المبيدات الفطرية و مواعيد الزراعية لم يكن معنوياً في تأثيرها في نسبة الإصابة و اعداد يافعات الطور الثاني في الثآليل الجاف و قد سجلت اقل نسبة اصابة (35,68 %) و أقل عدد من الثآليل (3 ثألولة/نبات) عند استخدام المبيد Dithane في الموعد الثالث (15 كانون الثاني 2011) إلا ان التداخل كان معنوياً في تأثيره في نسبة الكلوروفيل و بعض صفات النمو و الحاصل حيث سجل تحسناً في بعض صفات النمو اختلفباختلاف المبيد في الموعد الثالث للزراعة. سبب مبيد الأدغال (Granstar)تناقصاً غير معنوياً في معايير الإصابة فيما اظهر زيادة معنوية في بعض صفات النمو و الحاصل تضمنت دليل الحصاد ووزن البذور و طول السنبلة و وزن القش وعدد البذور.

ESTIMATION OF HETEROSIS AND SOME GENETIC PARAMETERS IN 5 × 5 DIALLE CROSSES OF MAIZE (*Zea Mays L.*)

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ABSTRACT

The study involved full diallel crosses between five inbred lines of maize was carried out at the experimental station of Duhok University. Parents and their F_1 generation including the reciprocals were arranged in Randomizes Complete Block Design with three replication. Data were collected on eleven quantitative traits of the studied genotypes and subjected to full diallel analysis according Griffing method to estimate the combining ability, additive components of genetic variance, heritability in broad and narrow sense and heterosis expression. The results showed, most of the hybrids out-yield mid parents reaching 72% in the combination A119×A132 and A132×DK. The reciprocal DK×A1059 expressed high heterosis for both oil and protein content with respective value of 3.75 and 2.43%. Dominance variation was significantly and higher than that of additive and environmental variation. All studied traits had revealed high broad sense heritability, whereas, heritability in narrow sense was low for almost traits. The genetic advance was high for plant height, ear height, leaf area, 300-kernel weight and grain yield plant^{-1}.

KEY WORD: Combining ability, diallel crosses, heterosis, Maize.

INTRODUCTION

Maize (*Zea mays L.*), a multipurpose crop, plays an important role in cropping systems throughout the word. Advance in genomics breeding and production had significant impact on the lives of a large proportion of the world's population (Xu and Crouch, 2008). Balancing consumer demand for various end-uses of maize and different production practices will be critical for maintaining sustainability of cropping system, food security, feed and fodder supply, and bio-energy demands (Ortiz et al., 2006).

A part of thesis for third researcher.

Maize is widely spread and cultivated crop through-out the word due to its ability to grow in divers climates. In 2010/ 2011, the global area planted with maize was 162.72 million hectares with a total production of 820.02 million tons with average of 5.04 ton per hectares. (USDA, 2011).

Corn production in Iraq saw a sharper decline between the years of 2006 and 2011, currently, Iraq requires approximately 300.000 metric tons of corn per year to satisfy the feed consumption of its growing poultry sector. In 2010, Iraq produced 150.000 metric tons of corn with an average yield of two metric tons per hectare, but imported the other 150.000 metric tons to meet the feed consumption requirement.

The primary objective of most maize breeding program is the development of high yielding and well adapted cultivars (Saleem et al., 2002). Because of very wide utilization of maize, the main goal of all maize breeding programs is to obtain new inbreeds and hybrids that will outperform the existing hybrids with respect to a number of traits. For this purpose, particular attention is paid to grain yield as the most important agronomic traits beside gene effects, breeder would also like to know how much of the variation in genetic and to what extent this variation is heritable, because efficiency of selection depends mainly on additive genetic variance, influence of the environment and interaction between genotype and environment (Novoselovic et al., 2004).

Advancement in the yield of corn requires certain information regarding the nature of combining parents available for use in the hybridization program and also the nature of gene action involved in expression of quantitative and qualitative traits of economic importance. Many researcher reported that beside additive and dominance variance, epistatic gene effect (non – allelic interaction were observed for plant height, number of days to tasseling and silking, number of grains row^{-1} and grain yield plant^{-1} (Jebara et al., 2010 and Dawood et al., 2011). In a series of

crosses, Amanulah et al., 2011 reported that twenty one hybrids expressed positive heterosis for grain yield ha^{-1} and ranged from 16.86 to 39 %. For days to maturity, 16 F_1 hybrids showed positive heterosis and only one hybrid showed heterobeltoisis. A positive heterosis for plant height, ear height and oil percent in maize was recorded by several researchers (Ahmed and Ayoub, 1999, Al-Barodi, 1999). Whereas Mohammed (2005) observed no significant difference for oil and protein percent.

\Pshadry, 2011 and Mohammed 2013 found that the heritability in broad sense was high for plant height and number of rows ear^{-1} while, heritability in narrow sense was high for number of grains row^{-1}. In an attempt to increase the corn production through the use of heterosis hybrids we carried out this study in order to.

- evaluate the expression of heterosis of different hybrid F_1,
- heritability of quantitative traits and some genetic parameters.

MATERIALS AND METHODS

The study consisted of five maize inbred lines, (1) DKC648, (2) Thal-A 1059, (3) ATha7AA, (4) Tha7A-132 and (5) pak which selected based on different agronomic traits. These lines were sown to perform full diallel cross in all possible combination Schame in 15 March, 2012. The resulting 20 F_1 progenies along with their parents were arranged in Randomize Complete Block Design with three replications. Each genotype was planted in a plot of 3m long, 0.75m between rows with a spacing of 0.25m between plants in row. 400 kg/ha of N_{27}, P_{27}, Ko were applied with planting, later 200 kg/ ha urea (46%) were also used. Weed control and other cultural practices were performed to plant requirement. Five plants from the middle of each row were sampled and the following traits were recorded for each genotype: days to 50% tasseling and silking plant and ear height, leaf area, number of row ear^{-1}, number of kernels row^{-1}, 300 kerenel weight, grain yield $plant^{-1}$, protein and oil percent. The data were analyzed by using RCBD design and DMRT was used to compare the means of genotypes (Gomez and Gomez, 1983) means of genotypes.

Then the genetic analysis was based on Griffing method 2- fixed model to determine additive, dominance and environmental variance, average degree of dominance, heritability in broad and narrow sense were determined. Expected genetic advance and percentage was calculated.

Heterosis was estimated as a deviation of F_1 from the mid parents.

RESULTS AND DISCUSSION

The analysis of variance showed that mean square of genotypes (Parents+Hybrids) was highly significant for all studied traits. The general combining ability (GCA) was highly significant for some traits such as days to 50% silking and oil content, and non-significant for number of rows ear^{-1}. The mean square for specific and reciprocal combining ability were also significantly different for all traits, indicating that there was enough variation for a successful in selection of the desirable cross combinations (Table, 1).

Table (1): Mean square of general and specific combining ability of the studied traits

SOV	df	Days to 50% tasseling	Days to 50% silking	Plant height cm	Ear height cm	Leaf area cm2	No. of rows ear-1	No. of kernels row-1	300 kernel weight	Kernel yield plant (g)	Oil parent	Protein percent
replication	2	1.29	4.44	4.72	14.40	20.62	0.15	10.04	3.42	82.84	0.01	0.14
Genotypes	24	** 21.91	** 17.83	** 3409.02	** 747.30	** 20871.57	** 3.22	** 50.83	** 348.64	** 2933.50	** 3.18	** 4.63
GCA	4	** 13.12	** 9.19	** 1888.43	** 408.07	** 7587.27	1.05	** 44.09	** 400.41	** 2347.59	** 6.26	** 4.59
SCA	10	** 23.13	** 21.44	** 6130.45	** 1181.20	** 33315.71	** 2.42	** 62.02	** 18.905	** 2047.00	** 2.60	** 7.36
RCA	10	* 24.20	** 17.66	** 1295.83	** 449.10	** 13741.15	** 4.87	** 42.35	** 487.52	** 4054.38	** 2.53	** 1.92
Mse	10	3.29	2.48	19.68	17.70	517.60	0.6	2.61	12.87	35.29	0.05	0.07
VGCA/ SCA	48	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.08	0.04	0.09	0.02

*and** significant at 5% and 1% level probability, respectively.

The mean performance of the five parents, F_1 and reciprocal hybrids of different traits are presented in Table (2). Among the parental forms, parent 4 was the earliest with 55.66 days to 50% tasseling, while parent 2 the latest with 60.33 days. The differences in parents days to 50% tasseling caused also the difference in their hybrids. Regarding the F_1 hybrids, the hybrid (4×5) was the earliest compared to all genotypes including the earliest parent with 52.00 days. The F_1 hybrids (1×3) and (1×4) were latest with 57.00 days. The reciprocal hybrid (5×3) expressed the shortest period to 50% tasseling with 52.66, whereas, the reciprocal (4×3) revealed the longest period with 63.00 days.

Regarding the number of days to 50% silking, parent 5 that was introduced from Pakistan was the earliest with 59.66 days, whereas parent I was the latest with 63.33 days. It seems that the differences between the crossed parental forms regarding the 50% tasseling and silking periods had influenced the phenology of the obtained hybrids. Concerning the F_1 hybrids, the hybrid (4×5) was the earliest with 55.00 days to 50% silking, while the hybrid (2×5) was the latest with 60.00 days. Among the reciprocals, the hybrid (3×1) was the earliest with 56.00 days to 50% silking. These results were in agreement with results obtained by Haruna (2008) and Wattoo et al., (2009).

The maximum plant height among parents was noticed in parents 5 with 208.00 cm, while the minimum value (132.40cm) was recorded for parent I. F_1 hybrids expressed plant values from a minimum of 222.00cm for (4×5) to 244.00 cm for (1×2). Whereas, reciprocal crosses manifested values between 156.66 cm to 265.33cm for hybrids (4×3) and (3×2), respectively.

For ear height, the maximum value exhibited by parent 1 with 112.00 cm and minimum value (76.66cm) was recorded for parent 3. Regarding the F_1 hybrids, the maximum ear height was noticed for the hybrid (2×5) with 145.66cm and the minimum value was exhibited (1×5) with an ear height of 113.00cm. Reciprocal crosses were restricted between 87.66cm to 130.00 cm for both reciprocal (4×3) and (5×3), respectively. Similar results were reported by (Haruna, 2008).

Maximum leaf area was exhibited by parent 5 with 588.50cm^2,whereas the minimum value (425.50cm^2) was recorded for parent I. the F_1 crosses values ranged between 480.70cm^2 to 733.87cm^2 for crosses (1×4) and (2×5), respectively. Regarding the reciprocal crosses, the maximum value of leaf area (665.60cm^2) was noticed for the cross (4×1), and the minimum value for reciprocal cross (5×3) with 476.67cm^2. Among parental forms, the greats number of row ear^{-1} was recorded by parent 4 with 16.14 and the minimum was noticed by parent I)14.66). among F_1 hybrids, the greatest value was recorded for the hybrid (1×2) with rows ear^{-1} 18.26. Concerning the reciprocal crosses, the cross (3×1) showed maximum value with 18.26, while minimum value (14.73) was recorded for combination (5×2).

The greatest number of kernels row^{-1} (33.06) was noticed for parents 5, whereas parent 4 expressed the lowest number with 26.44 kernels row^{-1}. Among the F_1 crosses, the crossing combination (1×5) showed the highest value with 37.66 kernels row^{-1}, while the minimum (26.73) was observed in the F_1 (1×4). The hybrid of reciprocal crosses ranged between 25.53 to 36.00

kernels row^{-1} for crosses (4×2) and (3×1), respectively.

The kernels weight is an important yield component which may significantly contribute to yield increase in cereal crops including corn. In our experiment, among the parental forms, parent 2 had the greatest kernel size with 300-kernel weight of 76.91g whereas parent 3 exhibited the lowest value with 67.20g. F_1 cross expressed the maximum value for the combination (1×5) with 95.00g, while the minimum weight was noticed for cross (3×5) with 67.26g. The reciprocal crosses ranged between results 48.23 to 89.41g for crosses (4×3) and (3×2), respectively. Similar results were obtained by researchers (Wattoo et al., 2009; Amanullah et al., 2011).

For the practical exploitation of hybrid vigor, the grain yield plant^{-1} remains the most important quantitative trait in corn breeding. In our experiment, the parent 2 was the highest yielding genotypes producing 126.279g plant^{-1}, while parent 4, yielded only 67.33g to rank fifth among the parental forms. The cross (3×4) exhibited the maximum yield with 158.73g, while the minimum yield (105.5^{-1}g) was noticed for cross (1×3). Regarding the reciprocal crosses, grain yield varied between 47.98 to 156.39g for crosses (4×2) and (3×1), respectively. Concerning the most important quality trait of corn, Table (2) shows that parent 5 was superior on other parents for oil content with an average of 6.86% and the lowest value was noticed by parent 2 scoring 5.22%. Regarding F_1 crosses, the combination (1×3) expressed the highest oil content (8.13%), while the, lowest percentage was shown by the hybrid (2×4) with 5.4%. The reciprocal crosses ranged between 4.82 to 8.23% for crosses (5×2) and (2×1), respectively. In Table (2), it is shown that parent 5 was highest in protein content (7.87%), whereas the lowest was noticed for parent 4 with 6.21%. the F_1 cross (1×4) exhibited the highest protein content with 10.29% while the cross (4×5) exhibited the lower percentage which was almost equivalent to the worst parent with 5.99% .The reciprocal crosses ranged between 6.72 to 10.28% for crosses (5×4) and (2×1), respectively.

Table (2):. Mean of parents, F_1 hybrids and reciprocals for studied traits

Parents and hybrids	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	No. of rows ear^{-1}	No. of kernels row^{-1}	300 kernel weight/ (g)	Kernel yield plant/ (g)	Oil percent %	Protein percent %
1	58.33bcd	63.33ab	132.40m	112.00e-g	425.50n	14.66g	29.66g-j	73.38h-k	99.22gh	6.38f	6.62j-k
2	60.33ab	62.33a-d	177.06k	102.33h	539.10jk	15.26e-g	31.74d-h	76.91h-k	126.26c-f	5.22gh	6.44k-m
3	60.00abc	62.66a-c	162.66L	76.66j	438.73mn	15.40e-g	29.93L	67.20k	104.77g	6.84de	6.91ij
4	56.66cdef	62.00a-e	161.60L	107.00gh	463.53m-l	16.40b-e	26.44jk	72.92i-k	67.32L	5.24gh	6.21Lm
5	55.66d-i	59.66e-i	208.00j	91.00i	588.50g-i	15.03e-g	33.06c-f	71.40jk	86.86ij	6.86de	7.87ef
1×2	54.33e-i	58.33g-i	244.00bc	127.00bc	647.37b-d	18.26a	32.53d-g	84.88c-f	135.18c	7.64b	8.60cd
1×3	57.00b-e	58.33g-i	241.33b-d	142.00a	664.77b-e	16.00c-g	32.95d-f	72.92i-k	105.50g	8.139	7.78f
1×4	57.00b-e	59.00e-j	222.66gn	119.66c-e	480.70L	16.13c-g	26.73i-k	90.32a-c	120.01ef	6.35f	10.29a
1×5	53.00h-j	56.66i-k	226.66fg	113.00e-g	679.93bc	17.16a-d	37.66a	94.99a	162.99a	7.31bc	7.70f
2×3	53.33h-j	57.00h-j	214.00ij	119.53c-e	591.60g-i	16.40b-e	26.8i-k	83.08e-g	130.57c-e	6.51ef	8.69b-d
2×4	52.33ij	56.66i-k	242.00b-d	125.00bc	529.93k	16.33b-e	36.53ab	89.10a-d	149.57b	5.47g	9.11b
2×5	57.00b-e	60.00c-h	236.00c-f	145.66a	733.87a	17.40a-c	33.60b-e	79.42f-h	129.83c-e	6.38f	7.22hi
3×4	53.33h-j	56.00jk	224.00gh	121.00cd	700.00ab	17.73ab	36.33ab	92.18ab	158.72ab	7.01d	9.83a
3×5	54.33e-j	57.00h-k	243.33bc	125.00bc	562.00h-k	17.46a-c	36.40ab	67.25k	130.79c-e	7.23b-d	6.96ij
4×5	52.00j	55.00k	222.00gh	123.66bc	536.47jk	15.13e-g	27.04i-k	83.02d-g	124.65c-f	6.27ef	5.99m
2×1	56.00e-h	59.33e-i	248.66b	108.00f-h	641.80c-f	15.60e-g	33.53b-e	86.62b-e	151.57b	8.23a	10.28a
3×1	53.33f-j	56.00jk	232.00ef	115.66d-f	577.50h-j	18.26a	36.00a-c	89.41a-d	156.38ab	7.65b	9.15b
4×1	57.00b-e	59.00e-j	238.66c-e	123.66bc	665.60b-e	16.26b-f	32.73d-g	86.50b-e	155.50ab	7.21b-d	8.70b-d
5×1	54.00e-j	57.66g-k	240.66b-d	127.33bc	602.50f-h	15.00e-g	34.66b-d	87.66b-d	79.01jk	8.25gh	7.00ij
3×2	56.00d-h	60.33c-g	265.33q	127.33bc	625.63e-g	15.16e-g	31.11e-h	80.12e-g	122.65d-f	6.15f	7.04ij
4×2	57.00b-e	61.00b-f	242.00b-d	125.00bc	553.00i-k	15.86d-g	25.53k	66.64k	47.98m	6.20f	8.28de
5×2	56.66c-f	60.00c-h	227.00fg	126.00bc	563.25h-k	14.73fg	30.93e-h	86.44b-e	116.98f	4.82hi	7.68f-n
4×3	63.00a	64.00a	156.66L	87.66i	634.33d-f	16.00c-g	32.48e-h	48.23L	132.08cd	7.44bc	8.93bc
5×3	52.66h-j	57.66g-k	217.33hi	130.00b	476.67mL	15.16e-g	28.96h-j	78.117g-i	89.88ij	5.10g-i	7.30g-i
5×4	56.33d-g	59.00e-i	234.33d-f	108.00f-h	557.27j-L	15.66e0g	30.25f-h	66.64k	70.44kl	4.70i	6.72jk

Results given in Table (3) indicated that all the crosses manifested significant and highly significant and negative heterosis over mid parents except the cross 4×3 exhibited the positive heterosis for days to 50% tasseling and silking and also the cross 5×4 gave the positive heterosis for days to 50% tasseling. For plant and ear height all the crosses (F_1 and reciprocal showed highly significant and positive heterosis, only hybrid (4×3) revealed negative value of -5.47% and -4.17 for both traits. Concerning the estimation of heterosis value for leaf area, the cross 3×4 had the highest positive value (248.82). Heterosis value due to reciprocal crosses varied between -37.00 to 221.08 for crosses 5×3 and 4×1, respectively.

The heterosis values in the same table ranged from -21.83 to 22.60 for F_1 and reciprocal crosses 4×3 and 3×4, respectively for No. of row ear^{-1}. For number of kernels row^{-1}, 6 crosses had highly significant and positive heterosis over mid parents and the rest crosses gave positive or negative heterosis. Regarding to 300-kernel weight, the highest positive significant or highly significant heterosis were recorded by 12 crosses and the value ranged between 2.83 to 12.65 by crosses 2×1and 3×4. The data in Table (3) revealed that the fourteen crosses from twenty crosses recorded positive significant heterosis, cross 3×4 showed maximum positive and significant heterosis (72.67%) followed by 4×1 (72.23%). Table (3) demonstrated that 13 hybrid combination expressed significant heterosis in desirable direction for oil content. The best performance for oil content was recorded for the hybrid combination (1×2) and (1×3). These results are in accordance with those of Amanullah et al., 2011, Bocanski et al., 2011 and Bidhendi et al., 2011.

Estimates of variance for additive, dominance and environmental variances, heritability in broad and narrow sense and average degree of dominance were presented in Table (4). The value of dominance variation was the highest compared to that of additive and environmental variation for all the studied traits, which may indicate the preponderance of over dominance gene effect in the genetic control of these traits. This results is supported by the value of the average degree of dominance which is greater than one for these traits.

Heritability in broad sense was high for all traits. A completely different pattern was noticed for heritability in the narrow sense with very low values for all studied traits Table (4). Traits that revealed high heritability in broad sense reflect the high dominance genetic variation value, signifying the importance of hybridization method to improve these traits. The absolute and relative genetic advance was high for plant height, ear height, leaf area, 300 kernel weight, and kernels yield plant^{-1}. Wannows et al., (2010) and Pshadry, (2011) obtain the same result.

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Table (3): Heterosis relative to the mid parents for studied traits

Parameters	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	No. of rows ear^{-1}	No. of kernels row^{-1}	300 kernel weight (g)	Kernel yield $plant^{-1}$ (g)	Oil percent	Protein percent
1×2	-5.00**	-4.50**	89.27**	19.83**	192.07**	9.74**	3.30**	1.83	22.44**	2.07**	1.84**
1×3	-2.17	-4.67**	93.80**	47.67**	232.60**	1.89	0.97	7.65**	3.50	1.01**	1.52**
1×4	-0.50	-3.67**	75.67**	10.17**	36.18*	17.17**	0.60	-1.32	36.74**	3.87**	0.54**
1×5	-4.00**	-4.83**	56.47**	11.50**	172.93**	22.60**	2.32**	6.30**	69.94**	0.45**	0.70**
2×3	-6.83**	-5.50**	44.13**	30.03**	102.63**	11.03	1.07	0.46	15.05**	2.02**	0.49**
2×4	-6.17**	-5.50**	72.67**	20.33**	28.62	14.19**	0.70	7.44**	52.78**	2.79**	0.24
2×5	-1.00	-1.00	43.47**	49.00**	170.07**	5.26*	2.25**	1.20	23.26*	0.07	0.34
3×4	-5.00**	-6.33**	61.87**	29.17**	248.82**	22.12**	1.83**	12.65**	72.67**	3.27**	0.98**
3×5	-3.50**	-4.17**	58.00**	41.17**	48.33**	-2.05	2.25**	9.40	34.97**	-0.43*	0.38*
4×5	-4.17**	-5.83**	37.20**	22.33**	10.45	10.86**	-0.58	-2.71*	47.56**	-1.06**	0.52**
2×1	-3.33*	-3.50**	93.93**	0.83	159.50**	11.48**	0.63	2.83*	38.83**	3.75**	2.43**
3×1	-5.83*	-7.00**	84.47**	21.33**	145.33**	19.12**	2.70**	10.70**	54.28**	2.39**	1.04**
4×1	-0.50	-3.67**	91.67**	14.17**	221.08**	13.35**	0.73	4.68**	72.23**	2.28**	1.40**
5×1	-3.00*	-3.83**	70.47**	25.83**	95.50**	15.27**	0.15	3.30**	-14.03**	-0.25	-1.37**
3×2	-4.17**	-2.17	95.47**	37.83**	136.67**	8.06**	-0.17	4.77**	7.14	0.36	0.12
4×2	-1.50	-1.17	72.67**	20.33**	51.68**	-8.27**	0.03	-3.56**	-48.82**	1.96**	0.97
5×2	-1.33	-1.00	34.47**	30.00**	-0.55	12.28**	-0.42	-1.47	10.41*	0.53**	-1.22**
4×3	4.67**	1.67	-5.47	-4.17	183.15**	-21.83**	0.10	8.80**	46.04**	2.37**	1.40**
5×3	-5.17**	-3.50**	32.00**	46.17**	-37.00*	8.87**	-0.05	1.97	-5.94	-0.09	-1.75**
5×4	0.17	-1.83	49.53**	9.67**	29.25	-5.52*	-0.05	0.50	-6.65	-0.33	-1.35**

* and ** significant at (0.05 , 0.01) probability level, respectively.

Table (4): Estimation of additive (V_A), dominance (V_D) environment (VE), variance, heritability in broad and narrow sense, average degree of dominance ($\bar{a}$) and genetic advance for studied traits

Parameters	Day to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	No. of rows ear^{-1}	No. of kernels row^{-1}	300 kernel weight (g)	Kernel yield $plant^{-1}$ (g)	Oil percent	Protein percent
VA	7.94	5.37	1494.99	312.27	5655.73	0.36	33.19	310.04	1849.84	4.97	3.62
	6.13±	4.26±	872.23±	18.50±	3505.39±	0.50±	20.37±	184.96±	1084.32±	2.90±	2.12±
VD	198.37	189.66	61107.67±	11634.94	327981.00	18.29	549.14	1761.88	20117.12	25.44	72.95
	94.66±	87.70±	25.27.50	4822.48±	136014.80±	10.01±	253.27±	772.26±	8357.16±	10.63±	30.07±
VE	3.29	2.48	19.69	17.735	617.61	0.60	2.61	12.87	35.29	0.06	0.07
	0.66±	0.50±	3.94±	3.55±	103.52±	0.12±	0.52±	2.57±	7.06±	0.01±	0.01±
h.	0.98	0.98	0.99	0.99	0.99	0.99	0.96	0.99	0.99	0.99	0.99
h.	0.03	0.02	0.02	0.02	0.01	0.01	0.05	0.14	0.08	0.16	0.04
	7.06	8.40	9.04	9.04	9.16	10.04	5.98	3.37	4.66	3.20	6.36
E.G.A	1.12	0.78	12.30	12.30	20.15	0.17	2.72	13.98	25.69	1.85	0.85
E.G.A%	2.02	1.33	5.63	5.63	3.47	1.05	8.67	17.70	21.73	27.73	10.77

CONCLUSION

The study reveals good scope for commercial exploitation of heterosis, most of the hybrids out-yielded mid parents reaching an increase of 72% in the combination3×4 and 4×1. Strong depression was noted only in one reciprocal hybrid 4×2 with a yield reduction of about 48%. Regarding oil content, 13 hybrid combinations manifested positive heterosis effect compared to mid parents (P<0.01) with the best performance recorded for the hybrid combination (1×2) and (1×3).

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8. [illegible]:

- ترقم جميع الجداول والاشكال التي قد ترد في البحث، وتطبع على اوراق منفصلة، وبواقع [illegible] صفحة، ويعطى لكل جدول عنوان مختصر يكتب في اعلاه بخط بارز، اما الاشكال التي قد تكون عبارة عن خطوط بيانية او خرائط او صور فتوضع داخل صفحات [illegible] وتعنون بعناوين مختصرة توضع اسفل الشكل.

المصادر العلمية المعتمدة:

*يفضل استخدام [illegible]طريقة العلمية [illegible] بالنسبة للبحوث العلمية فتكتب كل التفاصيل [illegible] يترك فراغ(1[illegible]) في بداية [illegible] :

[illegible] . اسم المؤلف أو المؤلفين .

[illegible] . تاريخ الطبع أو النشر .

[illegible] . [illegible] ([illegible]) .

[illegible] . دار النشر بالنسبة للكتب ، والمجلة بالنسبة للأبحاث العلمية.

وكما هو مبين في الأمثلة الآتية :

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*أما بالنسبة للبحوث الإنسانية فتكتب مصادرها بالطرق التقليدية المعروفة والمتبعة. [illegible]:

اسم المؤلف أو المؤلفين، اسم المصدر، رقم الطبعة، مكان الطبع ([illegible]) [illegible]. وأما إن كان المصدر من أجزاء متعددة فيكتب الجزء بعد اسم المصدر.

*الانترنيت :

[illegible] الباحث على الانترنيت عليه الرجوع إلى الأبحاث العلمية الخاضعة للتقييم العلمي، [illegible] الانترنيت مثل المجلات الالكترونية والكتب والمراجع العلمية الالكترونية .

9. يحفظ البحث على [illegible] (CD) ويسلم إلى مجلة جامعة دهوك مع أربع نسخ مطبوعة، إما بشكل [illegible] يرسل عن طريق عنوان المجلة البريدي:

إقليم كردستان – [illegible]
رئاسة جامعة دهوك
سكرتارية هيئة تحرير مجلة جامعة دهوك
موبايل: 07508504928
البريد [illegible] :
Email: jdu@uod.ac.

[illegible] :تنشر المجلة الأبحاث التي يرتقي تقويمها الى مستوى الأصيل [illegible] القيم [illegible].

تعليمات النشر في مجلة [illegible] دهوك

يجب ان تكون البحوث المنشورة في المجلة مستوفية لقواعد النشر وخاضعة للتقييم العلمي، ولم يسبق ان نشرت او قدمت للنشر الى اية جهة [illegible] ويجب ان يتضمن البحث خلاصة ومقدمة، وان يتبع الباحث طريقة موحدة ومنهجا [illegible] يحدد النتائج التي توصل اليها والمصادر التي اعتمد عليها، [illegible] لا تتجاوز عدد صفحاته عن (15)عشرين صفحة [illegible]ث العلمية، و(25)خمس وعشرين صفحة [illegible]ث الإنسانية.

التعليمات الخاصة بشكل وترتيب البحث:

1. [illegible]:

يجب ان يكون مطبوعا بنمط (عادي)، خط (Traditional Arabic)، حجم (14)، تباعد الأسطر(تقريبي 12) [illegible] ([illegible]).

2. الهوامش :

تكتب الهوامش في اخر البحث.

3. [illegible]:

يطبع البحث على ورق حجم (A4) مع ترك (2.5 سم)من يمين الصفحة (2 سم) من يسار الصفحة (3 سم)من [illegible]جهتين العليا و السفلى.

4. [illegible]:

[illegible] الجهة اليسرى [illegible].

5. العناوين:

يكتب العنوان الرئيسي للبحث بخط بارز وسط الصفحة، ويفضل ان يكون شاملا ومختصرا، نوع الخط (Traditional Arabic) [illegible] (15).[illegible] العناوين الرئيسة داخل البحث [illegible] (15) وبخط بارز في وسط الصفحة، أما العناوين الثانوية داخل البحث فتكتب بحجم (14) وبخط بارز على يمين الصفحة، مع التأكيد على استخدام طريقة الاعداد (1-1-1) (1-1-2) في ترتيبها.

6. [illegible]:

يتكب [illegible] (الباحثين) والقابهم العلمية وعناوين عملهم [illegible] الرئيسي للبحث [illegible] (Traditional Arabic)[illegible](11).

([illegible])

محمد علي أمين* و ريبر فتاح ظاهر**

*** قسم ادارة الاعمال– كلية الادارة و الاقتصاد– جامعة دهوك– اقليم كردستان العراق– العراق.**

**** قسم الاقتصاد–كلية الادارة و الاقتصاد – جامعة دهوك– اقليم كردستان العراق– العراق.**

7. [illegible]:

يكتب الباحث ملخصاً لبحثه ، يوضح فيه باختصار هدف البحث والنتائج وأهم التوصيات على ان لاتزيد كلمات [illegible] (300) [illegible] و تكتب الخلاصة بخط (Traditional Arabic)، حجم(12)، تباعد الأسطر (مفرد)، يجب على الباحث اختيار ما لا يقل عن أربع كلمات دالة ليتم استخدامها كمفاتيح للبحث، تكتب [illegible](Traditional Arabic) [illegible](12) [illegible] نهاية الخلاصة.

([illegible])

التجارة الدولية، القانون التجاري، منظمة التجارة الدولية، الدول النامية.

من الضروري ان يكتب [illegible] فى نهاية البحث [illegible] باللغتين الكردية والانكليزية [illegible] [illegible]لغة العربية،او بالعربية والانكليزية ان كان البحث مكتوبا باللغة الكردية، او بالعربية والكوردية [illegible] باللغة الانكليزية.

ژێدەر:

پێدڤیە بۆ تومارکرنا ژێدەران، ل دەسپێکێ ناڤێ ڤەکولەری بهێتە نڤێسین، پاشی سال دناڤبەرا دوو کڤانادا، واتە شێوازێ (APA) بهێتە پەیرەوکرن وئەگەر زانیارییێن ژێدەرەکی ژ رێزەکێ بورین، وی دەمی درێزا دبندا دێ هێنە تەواوکرن، ب مەرجەکی(1)سم بۆشایی ل سەرێ رێزێ بمینیت. ئەگەر ژ ژێدەرەکی پتر یێن ئێك نڤێسەر دڤەکولینێدا هاتنە بکارئینان وی دەمی ، هەمان شێوازێ (APA) دێ هێتە بکارئینان ، بەلێ پشتی تومارکرنا سالێ دێ بۆ ژیدەرێ ئێکێ(أ) ب رەخ سالێڤە هێتە نڤێسین و بۆ یێ دوێ(ب) و..هتد .بۆ پتر پێزانینا ل سەر بکارئینانا ژێدەرا چ کتێب بن یان گوڤار و رۆژنامە و تورا ئەنترنێتێ ..هتد. بەرێ خوبدە خالا(References) ژ رێنماییێن بەلاڤکرنێ ل گوڤارا زانکویا دهوك ب زمانێ ئنگلیزی .

پێشکێشکرنا ڤەکولینێ:

پێشکێشکرنا ڤەکولینێ بۆ گوڤارێ دێ بڤی رەنگی بیت :

1- چار دانەیێن کوپیکری ژ ڤەکولینێ .

2- CD یێ ڤەکولینێ کو تێدا فایلەکا (Microsoft word document Format) هەبیت ڤەکولینێ بخوڤە بگریت و ل سەر ڤی ناڤونیشانێ ل خارێ بهێتە پێشکێشکرن بۆ گوڤارێ :

هەرێما کوردستانێ – عێراق
پارێزگەها دهوك
سەروکاتیا زانکویا دهوك
سکرتاریەتا دەستەکا نڤێسەرێن گوڤارا زنکویا دهوك
موبایل : 07508504928
E-mail:jdu@uod.ac

ئەگەر ڤەکولەر یێ ژ دەرڤەی پارێزگەها دهوکێ بیت د شێت ب ڤی ناڤەنیشانێ ژێری ڤەکولینا خو پێشکێشی گوڤارێ بکەت (www.jdu.uod.ac/Submissions.htm)

تێبینی:- کوڤار بتنێ ئەوان ڤەکولینان بلاڤ دکەت ئەوێن ئاستێ هەلسەنگاندنا وان دگەهیتە پلا (رەسەن) یان (بەهادار).

نەگەهیتە هەردوو لایێن ڕاست و چەپێ یێن لاپەڕی . پاشی د ڕێزا دبندا ناڤونیشانێن زانستی و کارییێن ڤەکولەری ، هەروەکو ڤێ نموونا ژێری بهێنە **تومارکرن:**

1- پشکا جوگرافی ، کولیژا ئادابێ ، زانکویا دهوکێ ، عێراق ، هەرێما کوردستانێ ، عێراق .

2- پشکا زانستێ ئاخ و ئاڤێ ، کولیژا چاندنێ ، زانکویا دهوکێ ، عێراق ، هەرێما کوردستانێ ، عێراق .

کورتیا ڤەکولینێ:

پەیڤا (کورتیا ڤەکولینێ) دێ ب خەتەی (Ali-k-traditional) قەباری (15) ل لایێ ڕاستێ یێ لاپەڕی هێتە نڤێسین . نابیت کورتیا ڤەکولینێ ژ (300) پەیڤان تێ بپەڕیت و هەرچار کلیلێن پەیڤان (Key word) دێ کەڤنە بنێ کورتیا ڤەکولینێ و پێدڤیە ب خەتەکێ دیار و لار (Italic) قەبارێ (13) بهێنە نڤێسین. بۆ نموونە:

کلیلێن پەیڤان: زانستێ زمانی ، دەنگسازی ، دەنگسازیا کوردی ، هێز و ئاواز .

دیسان پێدڤیە، ئەگەر ڤەکولین ب چ زمان بوو (کوردی، عەرەبی، ئنگلیزی) کورتیا ڤەکولینێ ب هەردوو زمانێن دیتر ژی د گەلدا بیت. بۆ نموونە: ئەگەر ڤەکولین ب(زمانێ کوردی) بوو، پێویستە کورتیا وێ ب هەردوو زمانێن (عەرەبی و ئنگلیزی) ژی د گەلدا بیت .

وێنە و خشتە:

ژبلی خشتا هەمی هێلکاری و نەخشە و وێنە، وەك وێنە دهێنە هژمارتن . پێدڤیە ژمارێن عەرەبی ل سەر هەمی نەخشە و وێنا بهێنە دانان ، دیسان پێدڤیە ئەڤ نەخەشە و وێنە نەهێنە کەرتکرن بۆ لاپەڕەیەکێ دیتر و جهێ وان د ئێك لاپەڕەدا بکەت و نەکەڤنە سەر پەراوێز و هژمارێن لاپەڕان . هەروەسا پێدڤیە ناڤێن وێنە و خشتا د سەر واندا بهێنە نڤێسین ، کو ناڤەراستێ بگریت و ژ ڕێزەکێ و پتر بۆشایی د ناڤبەرا خشتە و وێنا و ناڤێن واندا هەبیت . بۆ نموونە :

خشتە (1): هندەك زانیاری ل سەر دامەزراندنا کولیژێن زانکویا دهوك

کولیژ	سالا دامەزراندنێ	پشکێن وێ
پزیشکی	1992	نشترگەری ، ..
ئاداب	1994	زمانێ کوردی ، ..

ڕێنماییێن بەلاڤكرنێ ل گوڤارا (زانكويا دهوك) یێ

گشتی:

پێدڤیە ڤەكولین یا بژارە و سەراپایی بیت و پێشوەخت نەهاتبیتە بەلاڤكرن یان شاندن بۆ چ گوڤارێن دیتر. دیسان پوختەیەك و پێشەكیەك و ڕێبازەكا فەكولینێ یا یەكگرتی و ئەنجام و ژێدەران بخوڤە بگریت، زێدەباری وێ چەندێ كو نابیت هیچ ڤەكولینێن لقێ زانستی ژ(15) لاپەڕان پتربن و ڤەكولینێن لقێ زانستێن مروڤایەتی ژی ژ (25) لاپەڕان پتر نەبن.

ناڤەروك:

پێدڤیە ڤەكولین ب ڕێنڤیسەكا ئاسایی (نورمال) بهێتە نڤێسین و ب فۆنتێن نڤێسینا كوردی (Ali-k-traditional) قەبارێ (16) بیت. دەربارەی دەسپێكرنا پەرەگرافان ژی ، پێدڤیە ل دەسپێكا هەر پەرەگرافەكی بۆشایەكا پێویست هەبیت .

پەراوێز:

نابیت پەراوێز د ناڤ تێكستیدا بهێنە بكارئینان .هەمی پەراوێز دێ كەڤنە دوماهییا ڤەكولینێ.

بەرهەڤكرنا لاپەری :

پێدڤیە لاپەڕ ژ جورێ (A-4) بیت و بۆشایا ل سەرێ وی و ل بنێ وی (2,5 سم) بن و لایێ ڕاستێ (3 سم) بیت و لایێ چەپێ ژی (2 سم) بیت .

ڕێزبەندیا لاپەڕان:

دەربارەی ڕێزبەندیا لاپەڕان پێویستە ژمارە ل كوژێیێ چەپێ یێ بنێ هەر لاپەڕەكی بهێتە دانان .

ناڤونیشان:

ناڤونیشانێن ڤەكولینێ دێ ب خەتێ (Ali-k-traditional)قەبارێ(18) فۆنتێن كوردی قەبارێ (18) ل نیڤا لاپەڕی هێنە نڤێسین ، دیسان ناڤو نیشان و سەرەبابەتێن ژ ناڤدا ژی دێ ب نڤێسینەكا دیار هێنە نڤێسین. هەمی ناڤونیشانێن لاوەكیێن ناڤ ڤەكولینێ دێ بڤی ڕەنگێ ژێری هێنە ژمارەكرن ، یێن سەرەكی(1., 2., 3.,..)،یێن لاوەكی ژی (1.1)یێن لاوەكی تر ژی (1.1.1.)وهتد.

ناڤێ ڤەكولەری:

ناڤێ ڤەكولەری پێویستە ب خەتی(Ali-k-traditional)قەبارێ (13) بهێتە نڤێسین و ل نیڤا لاپەڕی ، ب مەرجەكی بكەڤیتە بن ناڤونیشانێن ڤەكولینێ و بۆشایی د ناڤبەرا هەردووكاندا هەبیت ، هەروەسا

گـوڤـارا زانكويـــا دهـــوك

گوڤارا زانكويـــا دهـــوك
زانستێن چاندنێ و ڤیتێرنەری

زانكويا دهوك نیڤ سالانه دەردئێخیت

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چاپكرن: چاپخانا زانكويا دهوك