

**Effect of Organic Manure, tuber weight and ascorbic acid spraying on  
some vegetative parameters and marketable yield of potato  
( *Solanum tuberosum* L.) grown in sandy soil**

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**Abstract**

Field experiment was conducted in AL-Najaf Governorate during the season of 2011 in two cultivations (spring and autumn) .The aim was to study the effect of different concentrations of organic manure ,different sizes of tuber seeds and Ascorbic acid spraying on growth and yield of potato plants (*Solanum tuberosum* L.) cv. Proventa.

The experiment included 24 treatments, i.e. the interactions of four levels of organic manure (0, 75,100 and 125 kg/furrow), three tuber sizes (big, medium and small) and two concentration of ascorbic acid (0 and 150 mg/l.,the ascorbic acid was sprayed twice during the growing season with 15 days intervals, that was done on 45 days from cultivations.

Factorial experiment conducted with Randomized Complete Block Design (R. C. B. D.) was used with three replications. Means were compared according to Duncan's Multiple Range Test at probability of 0.05.

Results can be summarized as follow:

1- The use of different amounts of organic manure had significant effect on all measured vegetative growth parameters (plant length, aerial stem number and shoot dry weight(g),125 kg/furrow gave the highest means for the measured parameters for both cultivations. On the other hand , tuber size that used in cultivation plants produced from big size tuber gave significantly bigger plants with higher means for measured parameters compared to that plants produced from small and medium tuber.

Meanwhile, ascorbic acid addition on vegetative growth had a positive significant effect on most measured parameters. The interaction among the three factors gave the same trends on vegetative growth parameters.

2- There were significant effects for the use of organic manure on marketable yield for both cultivations. Treatment of 125 kg/furrow gave the highest means for the measured parameters compared to control treatment that gave the least means values. Moreover, the size of used tuber at cultivation produced significant effects on marketable yield for both seasons. Bigger tubers produced the highest marketable yield compared to that plants produced from medium and small tuber size at cultivation for both seasons.

Ascorbic acid spraying gave higher amount of marketable yield compared to non sprayed plants (control).

Interactions of the three tested factors were significant on marketable yield amounts giving 35.93 and 24.98 ton/h. from the interaction of 125 kg/furrow big tuber size at cultivations and spraying with ascorbic acid compared to that amount of marketable yield (11.81 and 10.07ton/h.) obtained from the interaction of with out using organic manure (control), small size tuber at cultivation and with out ascorbic acid spraying (control).

## Introduction

Potato, *Solanum tuberosum* L., is the most important agronomic tuber crop in the world. Today, potato is grown in more than 130 countries and over a billion people worldwide eat it, making it the third most important food crop in the world after wheat and rice. It is a major source of inexpensive energy. Potato produces more food per unit of water than any other major crops. Potato is also an excellent source of complex carbohydrates. No other crop can match potato crop in its production of food energy and food value per unit area (Nevain et al., 2007). The United Nations (FAO) reports that the world production of potatoes in 2009 was 330 million tones.

The use of compost in Agriculture in most countries of the world is gradually increasing as promising results achieved through their experiences with its management. Compost application to the soil has several beneficial effects on crop yield and soil fertility by improving and increasing soil organic matter, water holding capacity, nutrient contents, soil aggregation, and microbial activity (Griffin and Porter, 2004; Elisabetta and Nicola, 2009). Also, compost application has positive effects on the crop yield, root system and stimulation of plant-growth due to plant hormones (García-gil et al., 2000).

Generally, potato is cultivated through tuber planting and eyes number influences potato yield (Siddique et al., 1987). The cost of seed tuber is very high and occupies about 40% of total production cost (Farooque et al., 1984). For this reason the large seed tubers are usually to consumer and small tubers which used to cultivate and thus minimizing the seed cost. Proper vegetative growth is needed for potato cultivation because more tubers are obtained from the plants of more vegetative growth and development.

Vitamin C functions as antioxidant, an enzyme factor and as growth regulating factor. It plays an important role in different processes, including photosynthesis, photoprotection, cell wall growth and cell expansion resistance to environmental stresses of synthesis of ethylene, gibberellins, anthocyanins and hydroxyproline (Nicholas and Wheeler, 2000).

The aims of this study are:

- 1- Study the production of potato crop according to organic agriculture technique by using different concentrations of organic manure to keep human health and environment clean from the harmful effects of chemical fertilizers.
- 2- Cultivation of potato in desert soils and irrigated with salty wells water and assesses the tolerance of the potato plants.
- 3- Using Antioxidants such as ascorbic acid to increase the tolerance of stressed plants and increasing the productivity.
- 4- Codification in using the tuber size through using small, medium and large tubers because of costing.

## Materials and Methods

An experiment was conducted during the growing season of 2011/2012 in the spring and autumn cultivations. Seeds (tubers) were sown on 30/1/2011 for spring cultivation and on 20/9/2011 for autumn cultivations that harvested on 21/5/2011 for spring and on 19/1/2012 for autumn cultivations. Both cultivations were grown at desert region between Najaf and Kerbala provinces." potato tuber c.v. Proventa ". was chosen which introduced by ard company which imported from Netherlands, divided into three sizes according to their weights and volumes (Big, Medium and Small).then, the ground was divided in to 12 furrows at the 20 m. length distance between furrows was one

meter. and each furrow was divided in to three parts with length of 6.6 m. and then each part was divided into 3.3 m. length. Tubers of the three sizes were cultivated at 40 cm. apart on both sides of the furrow. The experiment design was Split-split design with R.C.B.D. i. e.

1: Organic manure with three levels (75, 100 and 125 kg/furrow) besides, control treatment

2: Tuber size (Big, Medium and Small).

3: Ascorbic Acid (Antioxidant) spraying on vegetative part, with two levels 150 mg/l and without spraying (control treatment).

Cultural practices were done equally and when it is considered necessary as cultivation, weeding, etc. as mentioned in (Matlob et al, 1989).

Irrigation was done from well water with E.C. 5.3 ds.m<sup>-1</sup> by dripping system.

Duncan's Multiple Range Test was used to compare means when it is considered significant at probability of 0.05

**Table (1): Chemical and Physical characters for field soil before and after experiment**

Characters	Before Expt.	After Expt.	Unit
pH	٧.٢	٧.٠	--
Ec	١.٠	١.٥	ds.m <sup>-1</sup>
Ca <sup>2+</sup>	١٥.٤	١٦.٨	mM.L <sup>-1</sup>
Mg <sup>2+</sup>	٥.٥	٥.٩	
Na <sup>+</sup>	٢.٩	٣.٢	
K <sup>+</sup>	٠.٨	١.٧	
SO <sub>4</sub> <sup>-2</sup>	١٠.٧	١٣.٢	
Cl <sup>-</sup>	١٥.٥	١٩.٦	
HCO <sub>3</sub> <sup>-</sup>	٠.٨	١.١	
CO <sub>3</sub> <sup>-</sup>	-	-	
Soluble P	٠.١٨	٢.٤	mg.L <sup>-1</sup>
O.M.	٨.٠	١٢.٧	g.kg <sup>-1</sup>
Total soluble solvent	٠.٦	٠.٩	dS.cm <sup>-1</sup>
CaCO <sub>3</sub>	٢٨٥.٥	٢٨٧.٣	g.kg <sup>-1</sup>
Bulk density	١.١	١.٣	g.cm <sup>3</sup>
Clay	٢٠	٣٠	g.kg <sup>-1</sup>
Silt	٧٠	٨٠	
Sand	٩١٠	٨٩٠	
Texture	Sandy loam	Sandy loam	

**Table2: Analysis of well water.**

Characters	unit	Well water
EC		٥.٣
pH	Ds.m <sup>-1</sup>	٧.٨٩
Soluble ions		
Ca <sup>+2</sup>		٣.١
Mg <sup>+2</sup>		١١.١
Na <sup>+</sup>		٤٠.٦
K <sup>+</sup>		٠.٩
Cl <sup>-</sup>		٣٠.١
SO <sub>4</sub> <sup>-2</sup>	mMol/L	٧.٦
HCO <sub>3</sub> <sup>-</sup>		٥.٩
CO <sub>3</sub> <sup>-2</sup>		٢.٢

**Table (3): Analysis of organic manure**

Characters	Value	Units
pH	6.5	--
Ec	0.93	Ds.m <sup>-1</sup>
Ca <sup>+2</sup>	60.2	ppm
Mg <sup>+2</sup>	389.1	
Na <sup>+</sup>	---	
soluble N <sup>+</sup>	١١٢	
soluble K <sup>+</sup>	65	
SO <sub>4</sub> <sup>-2</sup>	96	
Cl <sup>-</sup>	886	
HCO <sub>3</sub> <sup>-</sup>	244	
Soluble P	36.09	
Water Concentration	10.11	

**Studied parameters:**

1: Vegetative growth parameters: This included the following:

1:1 Plant length (cm)

1:2 Main stems number (Stem/plant)

1:3 Shoot dry weight (g.)

2: Marketable yield (ton.ha-1)

According to following equations:

$$\text{Marketable yield} = \frac{\text{Hectare area}}{\text{Area occupied from plant}} \times \text{Plant yield}$$

(Al-Dobybi,2003)

Hectare area =8800 m2 is the net area that was cultivated.

## Results

### 1- Vegetative growth

#### 1-1 plant length (cm)

Results in table (4) illustrated a significant difference between the treatments of organic manure treatments the level 125 kg/furrow gave the highest value for plant length were 80.2, 72.2 cm for both seasons, respectively compared with control treatment (0 kg/furrow) that gave 40.6, 36.8 cm in both seasons, respectively.

Also, the tuber size significantly affected the potato plants length and gave largest length 64.5, 56.5cm with the largest size( B3) for both seasons, respectively, meanwhile the smallest size gave the lowest plant length which were 59.8, 53.5 cm for both seasons ,respectively.

On the other hand ,spraying the plants with ascorbic acid was clearly affected the plant length which gave the best values of plant length 65.5, 57.3 cm for both seasons compared with treatment (without spraying of ascorbic acid) that gave the lowest values of 62.9, 55.6 cm for both seasons, respectively.

The interaction among three factors (organic manner, tuber size and ascorbic acid spraying) showed significant variance on plant length, and treatment (125 kg/furrow (a4) × largest tuber (b3) × ascorbic acid spraying (C2)) gave the largest length of plant 89.5, 75.00 cm while, treatment of (0 kg/furrow (a1) × smallest tuber size (b1) × without ascorbic acid spraying (c1)) which gave the lowest values of plant length 32.00, 33.5 cm for both seasons, respectively.

#### 1-2: Number of Main stems

Table (5) showed a significant difference between treatments of organic manure and the differences were found clearly in treatment (a4) that gave the largest values for main stem 5.2, 4.2 for both seasons compared with control treatment (a1) that gave 2.5, 1.9 stems for both seasons, respectively.

On the other hand, tuber size showed a significant effect on number of main stems that the big tuber size (b3) gave the highest values of 3.9, 3.1 main stems for both seasons, respectively. While, the smallest size of potato tuber gave the least values for main stems which were 3.6, 2.8 main stems for both seasons, respectively.

Ascorbic acid Spraying (C2) affected the main stems number which gave the best values 4.0, 3.2 for both seasons, compared with treatment (without ascorbic acid spraying) that presented the lowest values 3.8, 3.0 main stems for both season, respectively.

The interaction among three factors showed significant differences on main stems number, and treatment of (125 kg/furrow a4 × largest tuber b3 × ascorbic acid spraying c2) gave the largest main stems number 5.6, 4.6 main stems whereas, the treatment of (0 kg/furrow a1 × smallest tuber size b1 × without ascorbic acid spraying of c1) which revealed the lowest values of main stems number 2.1, 1.6 main stems for both seasons, respectively.

**Table (4): Effect of organic manure, tuber size and ascorbic acid spraying on plant length at age 75 days from cultivation.**

Treatments			Spring season	Autumn season	
Organic manure( A)			a1	40.6 d	37.8 d
			a2	61.4 c	51.8 c
			a3	74.6 b	64.0 b
			a4	80.2 a	72.2 a
Tuber size( B)			b1	59.8 c	53.5 c
			b2	62.0 b	54.9 b
			b3	64.5 a	56.5 a
Ascorbic Acid( C)			c1	62.9 b	55.6 b
			c2	65.5 a	57.3 a
Organic manure × Tuber size × Ascorbic acid	a1	b1	c1	32.0 o	33.5 p
			c2	34.9 n	35.0 op
		b2	c1	41.4 m	36.4 o
			c2	44.0 l	38.2 no
		b3	c1	44.2 l	39.8 n
			c2	46.9 k	44.0 m
	a2	b1	c1	57.0 j	48.3 l
			c2	58.8 j	49.5 l
		b2	c1	60.2 i	51.3 k
			c2	62.5 h	52.8 jk
		b3	c1	63.8 h	53.7 j
			c2	66.1 g	55.1 i
	a3	b1	c1	70.6 f	60.1 h
			c2	72.1 e	61.6 h
		b2	c1	74.7 d	63.5 g
			c2	76.5 cd	65.5 f
		b3	c1	76.4 cd	65.9 f
			c2	77.2 c	67.5 e
	a4	b1	c1	75.7 d	69.4 d
			c2	77.4 c	70.8 cd
		b2	c1	76.8 cd	71.5 c
			c2	80.0 b	72.5 bc
		b3	c1	81.9 b	73.7 b
			c2	89.5 a	75.0 a

Means sharing with the same letter don't statistically difference according to Duncan's Multiple Range Test at probability of 0.05.

**Table (5): Effect of organic manure, tuber size and ascorbic acid spraying on number of main stems at age 75 days from cultivation.**

Treatments			Spring season	Autumn season	
Organic manure( A)	a1		2.5 d	1.9 d	
	a2		3.5 c	2.8 c	
	a3		4.4 b	3.5 b	
	a4		5.2 a	4.2 a	
Tuber size( B)	b1		3.6 b	2.8 b	
	b2		3.8 a	3.0 a	
	b3		3.9 a	3.1 a	
Ascorbic Acid( C)	c1		3.8 b	3.0 b	
	c2		4.0 a	3.2 a	
Organic manure × Tuber size × Ascorbic acid	a1	b1	c1	2.1 m	1.6 i
			c2	2.5 l	1.8 hi
		b2	c1	2.4 l	1.9 hi
			c2	2.7 k	2.0 h
		b3	c1	2.7 k	2.0 h
			c2	2.9 jk	2.2 gh
	a2	b1	c1	3.1 j	2.3 g
			c2	3.4 i	2.6 f
		b2	c1	3.4 i	2.7 f
			c2	3.7 h	2.9 ef
		b3	c1	3.6 h	2.8 f
			c2	3.9 g	3.1 e
	a3	b1	c1	3.9 g	3.2 e
			c2	4.2 f	3.3 e
		b2	c1	4.2 f	3.4 e
			c2	4.5 e	3.7 d
		b3	c1	4.6 e	3.8 cd
			c2	4.9 d	3.9 cd
	a4	b1	c1	4.8 d	3.9 cd
			c2	5.1 c	4.0 c
		b2	c1	5.0 cd	4.0 c
			c2	5.2 c	4.3 b
		b3	c1	5.3 ab	4.4 ab
			c2	5.6 a	4.6 a

Means sharing with the same letter don't statistically difference according to Duncan's Multiple Range Test at probability of 0.05.

### 1-3 Dry weight of shoot (gm)

Results in table (6) exemplified that there was a significant difference between the treatments of organic manure: the treatment (a4) gave the highest value of shoot dry weight 50.31, 47.97 g. for both seasons compared with the control treatment (a1) that gave 12.44, 11.42 g. in spring and autumn seasons, respectively.

Also, the tuber size significantly affected shoots dry weight that gave the largest weight 32.63, 30.83g. in b3, meanwhile, the smallest tuber size at cultivation gave the lowest values of shoot dry weight which were 28.05, 26.62 g. in both seasons, respectively.

The foliar application of ascorbic acid clearly affected shoot dry weight which gave the best values of dry weight 33.60, 31.75 g. in both seasons compared with treatment (without spraying ascorbic acid) that gave the lowest values 30.77, 29.23g. for both season, respectively.

The interaction among three factors was significant on shoot dry weight the interaction of (125 kg/furrow  $\times$  largest tuber  $\times$  ascorbic acid spraying) presented the largest shoot dry weight 54.55, 51.89 while, the interaction of (0 kg/furrow  $\times$  smallest tuber size  $\times$  without spraying of ascorbic acid) which presented the lowest values of shoot dry weight 6.07, 5.08 g. in spring and autumn seasons, respectively.

### 2: Marketable yield

Concerning the effect of amount of organic fertilizer that added to the soil results in table (4-12) clearly showed that organic fertilizer showed a significant difference between treatments of using organic fertilizer and difference was clear in treatment (a4) that presented the highest values of marketable yield i. e. 31.17 and 23.03 ton.ha<sup>-1</sup> in both seasons compared with the productivity of plants grown at control treatment that gave 13.68 and 11.67 ton.ha<sup>-1</sup> in spring and autumn seasons, respectively.

Tuber size factor also appeared significant effect on marketable yield and presented the highest values of this character, i. e. 23.87 and 18.46 ton.ha<sup>-1</sup> came from the largest tuber treatment in both seasons, respectively, whereas, the smallest size of potato tuber produced the lowest values of marketable yield which was 20.74 and 16.29 ton.ha<sup>-1</sup> in both seasons, respectively.

Spraying of ascorbic acid had a positive effect on marketable yield which produced the highest values 23.08 and 17.83 ton.ha<sup>-1</sup> in both seasons compared with no ascorbic acid spraying that gained the lowest values 21.53 and 17.14 ton.ha<sup>-1</sup> in both seasons, respectively.

The interactions among the experimental studied factors indicated significant differences on marketable yield, 125 kg/furrow of added organic fertilizer  $\times$  largest tuber  $\times$  ascorbic acid spraying gave the largest marketable yield, i. e. 35.93 and 24.98 ton.ha<sup>-1</sup>, while, with no organic fertilizer  $\times$  smallest tuber size at cultivation  $\times$  with no ascorbic acid spraying addition which produced the lowest values of marketable yield, i. e. 11.81 and 10.07 ton.ha<sup>-1</sup> in spring and autumn seasons, respectively.

**Table (6): Effect of organic manure, tuber size and ascorbic acid spraying on shoot dry weight (g.) at age 75 days from cultivation.**

Treatments			Spring season	Autumn season	
Organic manure( A)	a1		12.44 d	11.42	
	a2		26.27 c	24.86	
	a3		39.71 b	37.71	
	a4		50.31 a	47.97	
Tuber size( B)	b1		28.07 c	26.62 c	
	b2		30.53 b	28.97 b	
	b3		32.63 a	30.83 a	
Ascorbic Acid (C)	c1		30.77 b	29.23 b	
	c2		33.60 a	31.75 a	
Organic manure × Tuber size × Ascorbic acid	a1	b1	c1	6.07 m	5.08 l
			c2	10.16 l	9.20 k
		b2	c1	12.81 l	11.77 k
			c2	14.88jk	13.83jk
		b3	c1	14.98 jk	13.93 jk
			c2	15.74 j	14.69 j
	a2	b1	c1	20.25 i	19.30 i
			c2	21.59 i	20.52 i
		b2	c1	24.34 h	23.14 h
			c2	28.45 g	26.29 g
		b3	c1	29.06 g	28.00 g
			c2	33.93 f	31.89 f
	a3	b1	c1	34.12 f	32.59 f
			c2	38.30 e	36.34 e
		b2	c1	39.12 de	37.16 de
			c2	40.21 de	38.29 de
		b3	c1	41.43 d	39.44 d
			c2	45.10 c	42.46 cd
	a4	b1	c1	45.59 c	43.40 c
			c2	48.48 bc	46.52 bc
		b2	c1	49.46 bc	47.11 b
			c2	51.78 b	49.04 ab
		b3	c1	51.97 b	49.86 ab
			c2	54.55 a	51.89 a

Means sharing with the same letter don't statistically difference according to Duncan's Multiple Range Test at probability of 0.05.

**Table (7): Effect of organic manure, tuber size and ascorbic acid spraying on marketable yield (ton/h.) at harvest.**

Treatments			Spring season	Autumn season	
Organic fertilizer (A)		a <sub>1</sub>	13.68 d	11.67d	
		a <sub>2</sub>	18.11 c	16.05 c	
		a <sub>3</sub>	26.26 b	19.18 b	
		a <sub>4</sub>	31.17 a	23.03 a	
Tuber size (B)		b <sub>1</sub>	20.74 c	16.29 c	
		b <sub>2</sub>	22.3 b	17.69 b	
		b <sub>3</sub>	23.87 a	18.46 a	
Ascorbic acid (C)		c <sub>1</sub>	21.53 b	17.14 b	
		c <sub>2</sub>	23.08 a	17.83 a	
Organic fertilizer × Tuber size × Ascorbic acid	a <sub>1</sub>	b <sub>1</sub>	c <sub>1</sub>	11.81 i	10.07 h
			c <sub>2</sub>	13.3 hi	11.39 gh
		b <sub>2</sub>	c <sub>1</sub>	13.45 hi	11.86 gh
			c <sub>2</sub>	14.28 h	12.06 g
		b <sub>3</sub>	c <sub>1</sub>	14.31 h	12.13 g
			c <sub>2</sub>	14.93 h	12.52 g
	a <sub>2</sub>	b <sub>1</sub>	c <sub>1</sub>	16.01 g	14.81 f
			c <sub>2</sub>	16.99 g	15.16 f
		b <sub>2</sub>	c <sub>1</sub>	17.41 g	15.98 ef
			c <sub>2</sub>	18.72 fg	16.57 e
		b <sub>3</sub>	c <sub>1</sub>	18.92 fg	16.62 e
			c <sub>2</sub>	20.58 f	17.16 e
	a <sub>3</sub>	b <sub>1</sub>	c <sub>1</sub>	24.28 e	17.57 de
			c <sub>2</sub>	25.08 e	18.57 d
		b <sub>2</sub>	c <sub>1</sub>	25.52 de	19.02 d
			c <sub>2</sub>	27.13 d	19.19 cd
		b <sub>3</sub>	c <sub>1</sub>	26.92 d	19.9 cd
			c <sub>2</sub>	28.6 cd	20.83 c
	a <sub>4</sub>	b <sub>1</sub>	c <sub>1</sub>	29.02 c	21.27 c
			c <sub>2</sub>	29.43 c	21.51 b
		b <sub>2</sub>	c <sub>1</sub>	29.92 c	22.88 b
			c <sub>2</sub>	31.97 b	23.96 b
		b <sub>3</sub>	c <sub>1</sub>	30.75 bc	23.56 b
			c <sub>2</sub>	35.93 a	24.98 a

Means sharing with the same letter don't statistically difference according to Duncan's Multiple Range Test at probability of 0.05.

## Discussion

The effect of organic manure on the vegetative growth parameters (plant height, main stem number and shoot dry weight) could be related to the role of nitrogen, phosphorus and potassium presented in organic manure (table 3) in building plant tissues which is reflected on vegetative growth and play vital role in photosynthesis, carbohydrate transport, protein formation, control of ionic balance, regulation of plant stomata functions, water use and activation of plant enzymes and other processes (El-Ghamry, 2011). These results were in agreement with those of Najm et al. (2010), Al-Hisnawy (2011), Al-Zehawi (٢٠٠٧) who found that, growth was significantly in plant height, aerial stem numbers and dry matter percentage of vegetative parts as a results of manure fertilizers applications as compared to untreated plants during both growing seasons.

Tables (4, 5 and 6) showed that tuber size had a significant influence on most vegetative growth studied parameters i.e. plant length, aerial main stem and shoot dry weight. This increase can be attributed mainly to the bigger size of cultivated tuber that contains big stored carbohydrate materials which in turn increased plant growth (Maree et al., 1988), besides, increased number of aerial stems that present on the big tuber, and increased the weight of vegetative growth. This result was in agreement with Stevenson and James, 2000, Qurban et al. 2001 and Al-Barazanchi and Sadik, 2001.

Spraying potato plants with ascorbic acid had significant effects on all vegetative growth parameters such as main stem number, plant height and shoot dry weight. The reason of this effect can be returned to ascorbic acid effect on many physiological processes including the regulation of growth, differentiation and metabolism of plants under saline conditions and increasing physiological availability of water and nutrients (Azooz et al., 2002 and Barakat, 2003). In addition, ascorbic acid protect metabolic processes against  $H_2O_2$  and other toxic derivatives of oxygen, which affected many enzyme activities, minimize the damage caused by oxidative processes through synergic function with other antioxidants and stabilize membranes (Cvelkorska et al., 2005, Pourcel et al., 2007 and Shao et al., 2008) and this confirmed present results.

Ascorbic acid is not only an important antioxidant, it also appears to link flowering time, developmental senescence, programmed cell death and responses to pathogens (Pastori et al 2003; Barth et al 2004 and Pavet et al 2005). Furthermore, it affects nutritional cycle's activity in higher plants and plays an important role in the electron transport system (Liu et al 1997).

These results were in agreement with El-Banna et al., 2006, Farahat et al. (2007) and Khalil et al. 2010.

On the other hand, organic manure showed superiority in marketable tuber yield. This was possibly due to the fact that organic manure increased soil organic matter, water holding capacity, nutrient contents, soil aggregation, root system and microbial activity (Carter et al., 2001 and John et al., 2002). Similar results were obtained by Al-Zehawi (٢٠٠٧), and Al-Hisnawy (2011) who used organic manure which inducing most of yield components.

Tuber size also, had a significant influence on marketable yield of the plants which produced from the cultivation of big tuber mother size were superior compared with the other treatment of cultivated tuber size. The reason for this increase was due to the increase in weight of tubers and size of plant produce this lead to increase in marketable yield (Qurban et al. 2001) This results was in agreement with Maree et al ,1988 ,EL-Nashar et al ,1995 .Moreover, reason of increment in marketable yield due to the emergence speed ,increase of stem number and vegetative growth which affected

positively tuber weight and number of resulted tuber and then increased marketable yield (Kasim,1999).

The spraying of ascorbic acid had positive effect on marketable yield of potato and this attributed to the increase in nutrients uptake and assimilation. Moreover, the increase in yield and its components might be due to the effect of antioxidants role on enhancing protein synthesis and delaying senescence (Hammam et al, 2001). The remarkable protective effect of exogenous ascorbic acid appeared to be specifically related to its anti-oxidant activity, rather than its possibly utility as an organic substrate for energy respiratory metabolism as mentioned by Shalata and Neumann(2001) .This result was in agreement with El-Hariri et al., 2010 , El-Hifny and El-Sayed (2011) , El-Tohamy et al. (2008) and Eid et al. (2010) who found the spraying of ascorbic acid on their plants which improved most of productivity parameters. The interaction among the three factors of this study had significant effects on the growth parameters and marketable yield because of the single effect of each factor.

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## تأثير السماد العضوي، ووزن التقاوي والرش بحامض الاسكوريك في بعض المؤشرات الخضرية والحاصل القابل للتسويق في البطاطا النامية بالترب الرملية.

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### المستخلص

نفذت تجربة حقلية في محافظة النجف لموسم ٢٠١١ ولعروتين ربيعية وخريفية لدراسة تأثير تراكيز مختلفة من السماد العضوي واحجام مختلفة من التقاوي والرش بحامض الاسكوريك في نمو وحاصل البطاطا *Solanum tuberosum* L. صنف "بروفنتو". تضمنت التجربة اربع وعشرون معاملة عبارة عن التداخل بين أربعة مستويات من السماد العضوي هي (٠، ٧٥، ١٠٠، ١٢٥ كغم/مرز) وثلاثة احجام من الدرناات هي (كبير، متوسط وصغير) وحامض الاسكوريك بتركيز ٠ و ١٥٠ ملغم/لتر وبواقع رشيتين أثناء موسم النمو وكل (١٥) يوماً، وبدا الرش بعمر ٤٥ يوم من الزراعة.

أستعمل تصميم التجارب العاملية في نظام القطاعات العشوائية الكاملة بثلاث مكررات، وقورنت المتوسطات باستعمال اختبار دنكن متعدد الحدود عند مستوى احتمال ٠.٠٥ وتلخصت النتائج بما يأتي:

١- أظهرت المستويات المختلفة من السماد العضوي تأثير معنوي في جميع صفات النمو الخضري وهي (ارتفاع النبات (سم)، عدد السيقان الهوائية / نبات والوزن الجاف للنمو الخضري (غم) إذ أعطت معاملة التسميد بمستوى (١٢٥ كغم/مرز) أعلى متوسطات للصفات المدروسة قياساً بمعاملة المقارنة (بدون تسميد) والتي أعطت اقل المتوسطات للصفات أعلاه ولكلا العروتين. كما أن حجم التقاوي كان له اثر معنوي في صفات النمو الخضري المدروسة ولكلا العروتين فقد تفوقت النباتات المزروعة من الدرناات الكبيرة مقارنة بالنباتات الناتجة من الدرناات الأمام المتوسطة والصغيرة .

اما الرش بحامض الاسكوريك فكان له اثر معنوي في اغلب صفات النمو الخضري المدروسة مقارنة بالنباتات التي لم ترش.

وأظهرت نتائج التداخل الثلاثي وجود تأثير معنوي لعوامل الدراسة في اغلب صفات النمو الخضري أعلاه .

٢- في حين كان للمستويات المختلفة من السماد العضوي تأثيراً معنوياً في الحاصل القابل للتسويق (طن / هكتار) إذا أعطت معاملة التسميد بمستوى (١٢٥ كغم/مرز) أعلى متوسطات للصفات المدروسة قياساً بمعاملة المقارنة والتي أعطت اقل المتوسطات للصفات أعلاه ولكلا العروتين. كما كان لحجم التقاوي تأثير معنوي في الحاصل القابل للتسويق فقد تفوقت النباتات الناتجة من الدرناات الكبيرة مقارنة بالنباتات الناتجة من الدرناات الام المتوسطة والصغيرة ولكلا العروتين.

وكان للرش بحامض الاسكوريك اثر معنوي في كمية الحاصل القابل للتسويق مقارنة بالنباتات التي لم ترش.

وأظهرت نتائج التداخل الثلاثي وجود تأثير معنوي لعوامل الدراسة في الحاصل القابل للتسويق اذ تفوقت النباتات ذات مستوى تسميد (١٢٥ كغم/مرز) واحجام درناات كبيرة والمرشوشة بالاسكوريك في الحاصل القابل للتسويق وبلغت (35.93 و ٢٤.٩٨) طن/هكتار مقارنة بالنباتات ذات مستوى (٠ كغم/مرز) واحجام درنة صغيرة والتي لم ترش بالاسكوريك وبلغت (11.81 و 10.07) طن/هكتار ولكلا العروتين، على التوالي.