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PHYSIOLOGICAL STUDIES ON JERUSALEM ARTICHOKE 1- PRODUCTIVITY AND QUALITY OF JERUSALEM ARTICHOKE IN THE NEW RECLAIMED LANDS.

Alian, Fatma S.* and Manal M. Attia**

*** Potato and vegetatively propagated crops Dept. , Horticulture Res. Inst., Agric. Res. Center, Giza, Egypt.**

****Postharvest and Handling of Vegetable Crops Dept. Horticulture Res. Inst., Agric. Res. Center, Giza, Egypt.**

ABSTRACT

A field experiment was carried out in sandy soil in EL-Kattba, Manofya Governorate Egypt, during the successive growing seasons of 2007 and 2008 on Jerusalem artichoke. The main objective of this investigation was to study the effect of cultivars (Local and Fusaeu) and two planting dates(15th April and 15th May) with two harvesting dates (15th Nov. and 15th Dec.) on vegetative growth , total yield , marketable yield and its components of Jerusalem artichoke. The results indicated that Local cultivar showed higher foliage (plant height) than Fusaeu, but there was no significant effect on number of lateral branches / plant .In addition, Local cultivar showed significant increases in total yield and its components and tuber contents of dry matter, inulin and total sugar compared with Fusaeu .

Concerning planting dates, results showed that the planting on 15th of April increased significantly the vegetative growth parameters, total yield and its components, and tuber contents of dry matter, inulin and total sugar in comparison with planting on 15th May. Regarding the harvest date, data revealed a positive effect of tubers harvest on 15th of Nov. on total yield and its components, and tuber contents of dry matter, inulin while total sugar decreased compared with tubers harvest on 15th Dec.

The interactions between cultivars and planting dates showed that Local cultivar and planting on 15th of April increased significantly the vegetative growth, total yield and chemical constituents of tubers under sandy soil conditions .Also, Local cultivar tubers harvested on 15th of Nov. produced higher significant total yield and its components, and tuber contents of dry matter, inulin while total sugar decreased compared with tubers harvested on 15th of May. The interactions among cultivars, planting dates with harvesting dates, showed that the Local cultivar planted on 15th of April and harvested tubers on 15th of Nov. produced higher significant increases in yield parameters and chemical constituents of tubers under sandy soil conditions.

Finally, it could be concluded that the optimum planting dates of Jerusalem artichoke (Local cultivar) was on 15th of April and the ideal harvesting date was on 15th of Nov. for a highly production and quality of tubers under sandy soil.

INTRODUCTION

Jerusalem artichoke **(***Helianthus tuberosus* L.) is an agricultural crop with a great potential for high sugar yields per he^{-1} (9-3 t / ha**,** Klaushofer, 1986). This crop is known as tuberous crop, which is recently introduced to Egypt for its high nutritional and medicinal values. In France, it has been considered as a source of fructose sugar and fuel alcohol in inulin

production. It is most favored as a food in Europe and China (Galindo and Guiraud, 1997). Tubers are rich in nutrients and polysaccharides especially inulin which possible utilization as a fructose sweetener (Chubey and Dorrel, 1974). Jerusalem artichoke is one of the most important candidates for use as a raw material for the industrial production of biological fructose and inulin. It is a particularly interesting and suitable crop, for southern European countries and especially in low-requirement environments (Paolini *et al*., 1996; D'egidio *et al*., 1998). Furthermore, the crop produced large haulm that can be used as green fodder or silage .The total yield of tubers and quality were affected by cultivars and new clones of Jerusalem artichoke. This result was recorded by Galindinio and Guiraud (1997), Tawfik *et al*, (2003) , and Balidini (2004) .Planting and harvesting dates play an important role for high tuber yield production (Leible,1988).Similar results were obtained by (Soja *et al.,* 1990, and Galindinio and Guiraud(1997). The aim of this study was to compare the planting dates, harvest dates and cultivars under sandy soil conditions on growth, yield and chemical constituents of Jerusalem artichoke.

MATERIALS AND METHODES

The field experiment was carried out during two successive summer growing seasons of 2007 and 2008 at EL-Katatba in sandy soil and drip irrigation system. Two cultivars (Fusaeu and Local) and two planting dates (15^{th} of April and 15^{th} of May) were tested .The experimental design used was split plot with three replicates. The cultivars were in the main plots and the planting dates were in the sub plots. The harvest dates (15^{th} of November, and 15^{th} of December) were in sub-sub plot. The tubers were planted in rows 20 m length and one meter in width and the distance between tubers were 50 cm. The area of the experimental unit was 20 m^2 and consisted of one row. All treatments received an identical amount of composted farmyard manure at a rate of 20 m^3/fed. and mineral fertilizers. Three plants were taken randomly from each treatment at 90 days after planting (beginning of the blooming stage) to determine the stem length, and number of main lateral branches/plant. At harvest time, total yield, marketable yield per fed^{-1}, total tuber yield per plant and fresh weight of tuber were recorded as well as dry matter of tuber (calculated by drying 100 grams of fresh tuber in an oven at 70 °C till a constant weight) (A.O.A.C ,1990).

Inulin percentage of tubers was determined according to Winton and Winton (1958) and total sugar percentage in tubers according to Nelson (1974) and Somogi (1952). Data were statistically analyzed by using a General Liner Model procedure of SAS Institute (1989). Fishers protected least significant (LSD) at $P<0.05$ was employed to separate the treatment means.

RESULTS AND DISCUSSION

Vegetative growth

Local cultivar showed significant increment in plant height and number of lateral branches compared with Fusaeu cultivar (Table 1).However the difference in number of branches between two cultivars was not significant in the second season. Similar, findings among Jerusalem artichoke cultivars and clones had been previously reported by Khereba (1979) and Spitters (1987).

Table (1): Effect of cultivars and planting dates on vegetative growth on Jerusalem artichoke plants in 2007 and 2008 seasons.

Treatment	Plant height (cm)		No. of lateral stems/plant	
	2007	2008	2007	2008
Cultivars (C.V)				
Fuaesu	189.98	208.4	6.84	10.35
Local	202.06	214.7	7.22	10.53
Planting date (P.D)				
15 April	191.77	219.73	5.90	9.50
15 May	196.33	201.11	7.93	10.23
C.V * P.D				
Fusaeu				
15 April	182.22	228.93	5.86	10.86
15 May	186.66	171.33	7.60	9.93
Local				
15 April	201.33	210.53	5.93	8.13
15 May	206.00	230.90	8.26	10.53
LSD AT 0.05%	2007	2008	2007	2008
C.V	3.31	1.13	N.S	N.S
P.D	3.38	2.08	N.S	N.S
C.V * P.D	4.78	2.93	N.S	N.S

Regarding the effect of planting date, 15th of May was increased significantly plant height in the first season whereas 15th of April increased the stem height in the second season. The number of lateral branches was not affected by planting dates.

The interaction had significant effect on plant height, plants of Local cultivar planted April on 15th of May the highest compared with other interactions in both seasons.

Results show also that no significant differences in number of main lateral branches per plant in treatments were tested in both seasons. These variations could be due to the genetically condition of the two cultivars under this study .Similar finding were reported by Soja *et al*.(1990).

Yield and its components.

Data in Table (2) clearly indicated that Local cultivar produced higher in total yield per fed^{-1}. and in marketable yield , tuber weight per plant and average tuber weight in two seasons .However, the differences were only significant in the second for total yield and in the two seasons for tuber weight. Superiority could be attributed to the varietal differences between the

two cultivars. This results was also reported by Hamed (2001) .Also, differences in productivity between the Local and Fusaeu cultivars could be explained based on the genetic differences of the two cultivars. Similar findings among Jerusalem artichoke cultivars and clones had been previously reported by Khereba (1979) and Spitters (1987). Results presented in Table (2) showed that planting dates did not significantly affect tuber yield and its components, i.e., total and marketable yield in ton per fed., total yield per plant and average tuber fresh weight in two seasons. These results may be due to that Jerusalem artichoke plants produced quickly vegetative growth under long day and high temperature but to the formation of producing tubers depends on a low temperature and short day harvest time (Arslan, 1985). Results revealed that the harvesting date 15th Nov. increased total and marketable tubers yield in ton per fed, tuber yield per plant and average tuber fresh weight. In general compared with the harvesting date15th Dec. This might be due to environmental conditions at harvest time in 15th Nov. such as temperature at day and night and short day all these factors stimulated increasing tubers yield. Similar conclusions were obtained by (Leible and Kahnt, (1988), Soja *et.al* ,(1990), and Saengthongpinit, and Sajjaanantakul ,(2005).

Table (2): Effect of cultivar, planting dates and harvesting dates on total yield and its components on Jerusalem artichoke tubers during 2007 and 2008 seasons.

Treatments	Total yield(ton/ fed)		Marketable yield(ton / fed)		Tuber fresh Weight (gm)		Tuber yield / plant (kg)	
	2007	2008	2007	2008	2007	2008	2007	2008
Cultivars (C.V)								
Fusaeu	20.30	16.42	15.41	14.67	41.10	39.22	3.62	3.49
Local	21.50	19.31	15.62	14.80	46.22	43.93	3.99	3.86
Planting dates (P.D)								
15 April	21.41	18.45	16.07	15.07	46.03	43.79	3.62	3.49
15 May	20.39	17.28	14.96	16.40	41.29	39.36	3.99	3.86
Harvesting dates (H.D)								
15 /11	23.49	18.43	17.78	15.70	46.60	45.41	4.21	3.19
15 /12	18.31	17.09	13.25	15.76	39.72	37.74	3.39	3.61
LSD at 0.05 %	2007	2008	2007	2008	2007	2008	2007	2008
C.V	N.S	0.92	N.S	N.S	4.60	4.45	N.S	N.S
P.D	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
H.D	2.58	N.S	1.16	N.S	7.11	7.37	0.72	N.S

Regarding the interactions between cultivars and planting dates, data in Table (3) show that the maximum values of total yield and marketable yield in ton per fed^{-1} were always recorded by planting on 15th April with Local cultivar in both seasons. While ,the interaction between Local cultivar and planting date 15thApril had no significant effect on total tubers yield per plant in two seasons , and average tuber fresh weight in first season only. This could be due to the relationship between the vegetative growth .specially plant height of plant and yield parameters .Similar opinion were reported by EL-Banna and Haggag (2005).

Table (3): Effect of interactions between cultivars * planting dates, cultivars* harvesting dates and planting dates * harvesting dates on its components during 2007 and 2008 season.

Treatments	Total yield (ton / fed)		Marketable yield (ton / fed)		Tuber fresh weight(gm)		Tuber yield / plant (kg)	
	2007	2008	2007	2008	2007	2008	2007	2008
C.V * P.D								
Fusaeu								
15 April	21.08	17.54	16.00	13.79	42.57	40.49	3.62	3.45
15 May	19.51	15.29	14.82	15.55	39.63	37.95	3.67	3.54
Local								
15 April	21.74	19.29	16.15	16.15	49.50	47.65	3.61	3.53
15 May	21.27	19.27	15.10	17.25	42.95	40.21	4.30	4.19
C.V*H.D								
Fusaeu								
15 Nov.	22.92	15.81	17.19	14.04	45.03	43.16	4.26	3.42
15 Dec.	17.69	17.02	13.63	13.63	37.18	35.28	3.04	3.57
Local								
15 Nov.	24.07	21.46	18.38	17.37	50.18	47.10	4.17	3.81
15 Dec.	18.95	17.17	12.87	16.23	42.27	40.21	3.74	3.90
P.D* H.D								
15 April								
15 Nov.	24.55	18.91	18.41	15.28	50.28	47.71	4.07	3.55
15 Dec.	18.28	17.99	13.74	14.86	41.79	39.88	3.16	3.43
15 May								
15 Nov.	22.43	18.26	17.16	16.13	44.93	43.10	4.36	3.68
15 Dec.	18.36	16.20	12.76	16.66	37.65	35.61	3.62	4.05
LSD at 0.05%	2007	2008	2007	2008	2007	2008	2007	2008
C.V* P.D	2.22	2.00	N.S	3.12	N.S	N.S	N.S	0.70
C.V* H.D	2.59	1.08	1.65	2.04	10.06	10.42	1.02	N.S
P.D*H.D	2.59	2.00	1.65	N.S	10.06	10.42	1.02	N.S

Results presented in Table (3) also, reported that the interactions between cultivars and harvesting dates were significant effects. Therefore, Local cultivar plant harvested on 15 Nov .produced high total tuber yield, marketable yield ,tuber fresh weight and total yield per plant in both seasons. These results are in harmony with those obtained by Baldini *et al*. (2004) and, Soja et *al.* (1990), and Saengthongpinit, and Sajjaanantakul , (2005).

The interactions between planting dates and harvesting dates in Table (3) had also significant effect on total tubers yield and its components .Data showed that planting date 15th April with harvesting date 15th Nov. significantly increased total yield and marketable yield. Results also indicated that planting date 15thApril with harvesting date 15thNov. increased tuber fresh weight during two seasons.

Concerning the effect of the interactions between cultivars and planting dates with harvesting dates in Table (4), data show that Local cultivar planted

on 15th April and harvested on 15th Nov. produced a highly significant increase in total yield, marketable yield and average tuber weight compared with other treatments under this study in two seasons. Similar results were obtained on total yield per plant in second season. These results due to that the cultivars had different response patterns at different times of planting and harvesting of the year Baldini *et al*. (2004).

Table (4): Effect of interactions between cultivars, planting dates and harvesting dates on yield and its component during 2007 and 2008 seasons.

Treatments			Total yield (ton / fed)		Marketable yield (ton / fed)		Tuber fresh weight(gm)		Tuber yield / plant (kg)	
Cultivars	Planting dates	Harvesting dates	2007	2008	2007	2008	2007	2008	2007	2008
Fusaeu	15 April	15/11	24.23	17.37	17.48	13.18	44.37	42.06	4.20	3.45
		15/12	17.94	17.71	14.52	14.40	40.78	38.91	3.04	3.45
	15 May	15/11	21.59	14.26	16.89	14.90	45.60	44.26	4.31	3.39
		15/12	17.43	16.33	12.75	16.20	33.58	31.65	3.04	3.69
Local	15 April	15/11	24.87	20.47	19.33	17.38	56.19	53.36	3.94	3.69
		15/12	18.62	18.26	12.97	15.33	42.81	40.84	3.29	3.40
	15 May	15/11	23.26	22.47	17.44	17.13	44.18	41.95	4.40	3.97
		15/12	19.28	16.07	12.76	17.13	41.72	39.58	4.20	4.40
LSD at 0.05%			2007	2008	2007	2008	2007	2008	2007	2008
Cultivars X Planting dates X Harvesting dates			3.66	2.79	2.33	2.89	14.22	14.74	N.S	0.96

Dry matter, Inulin and total sugar of tubers.

Local cultivar produced tubers with significantly higher content of dry matter; inulin and total sugar than Fusaeu, in both years, Table (5).Dry matter of Local cultivar were 22.44 and 24.21% in comparison to 22.15 and 23.65 % for the Fusaeu .during two seasons, respectively. Inulin of Local cultivar was 10.03, and 8.90% in comparison to 9.43, and 8.64% for Fusaeu in both seasons. Regarding the content of total sugar increased 8.34, and 8.86 % in Local cultivar to 8.03, and 8.59 % for Fusaeu in two seasons, respectively. Differences in tuber DM, inulin and total sugar might be due to genetic differences among Jerusalem artichoke cultivars (Baldini *et al.,*2004).Opposite results were indicated by Tawfik *et al* .(2003). This could be related to the differences in the prevailing environmental conditions at the each study.

The higher contents of dry matter, total sugars in tubers Jerusalem artichoke were recorded at planting date of 15thApril (Table 5). This superiority might be due to the favorable effects of high temperature and long day during the periods, which simulate the plant metabolism and increase the vegetative growth of the plant and consequently more metabolites are stored in tubers. Similar conclusions were obtained by EL- Banna and Haggag (2005).

Table (5): Effect of cultivars, planting dates and harvesting dates on dry matter ,inulin and total sugars percentage in tubers during 2007 and 2008 seasons.

treatments	Dry matter (D.W)		Iulin (D.W)		Total sugars (F.W)	
	2007	2008	2007	2008	2007	2008
Cultivars						
Local	**22.44**	**24.21**	**10.03**	**8.90**	**8.34**	**8.86**
Fusaeu	**22.15**	**23.65**	**9.43**	**8.64**	**8.03**	**8.59**
Planting dates						
15/4	**22.88**	**24.51**	**9.91**	**8.97**	**8.35**	**8.84**
15/5	**21.71**	**23.35**	**9.05**	**8.57**	**8.02**	**8.62**
Harvesting dates						
15/11	**22.98**	**24.68**	**10.09**	**9.29**	**8.02**	**8.59**
15/12	**21.61**	**23.18**	**9.21**	**8.25**	**8.34**	**8.86**
LSD at 0.05 %						
Cultivars	**0.11**	**0.12**	**0.19**	**0.10**	**0.12**	**0.09**
Planting dates	**0.13**	**0.15**	**0.20**	**0.12**	**0.13**	**0.10**
Harvesting dates	**0.22**	**0.19**	**0.21**	**0.13**	**0.08**	**0.10**

Regarding harvesting dates, it was found that the percentage of dry matter, inulin in tubers were significantly increased while total sugars decreased when harvested on 15th Nov.Compared with tubers harvested on 15th Dec. This result is in the same trend with Galindo and Guiraud, (1997) and Saengthongpinit and Sajjaanantakul,(2005).They reported that chemical constituents in tubers were affected by climate changes during harvest period which increasing storage roots total carbohydrate in early harvest .

The interactions in Table (6) between cultivars and planting dates had significant effect on the tubers contents of dry matter, inulin and total sugar in two seasons. Local cultivar plants planted on 15thApril showed higher contents of dry matter, inulin and total sugar compared with other treatments in both seasons.

Data presented in Table (6), explained that the interactions between cultivars and harvesting dates also had significant increases in tuber contents of dry matter, inulin and total sugar .Local cultivar tubers harvested on 15th Nov. showed higher contents of dry matter, inuln and total sugar than those Fusaeu harvested on 15th Dec. and during two seasons. The positive effects of Local cultivar (at harvesting date 15th Nov.) on increasing tuber carbohydrate could be due to allowing more carbohydrate synthesis and translocation of the assimilates from the vegetative growth to tubers (Soja *et al* ,1990). Differences of tuber dry matter ,inulin and total sugar among Jerusalem artichoke cultivars were reported by Zubr *et al* ,(1993) ,Hamed ,(2001), Baldini *et al(* 2005).

Also, the interaction between planting dates and harvesting dates (Table 6) , indicated that planting date 15th April with harvesting date 15th Nov. recorded higher contents of dry matter , inulin and total sugar than those

planted on 15th May with harvest on 15th Dec. Similar results were reported by Soja *et al* (1990) , and Baldini *et al* (2005).

Table (6): Effect of interactions between cultivars and planting dates (C.V*P.D), cultivars and harvesting dates (C.V*H.D) and planting dates, harvesting dates (P.D*H.D) on dry matter, inulin and total sugars percentage during 2007 and 2008 seasons.

Treatment	Dry matter (D.W)		Inulin (D.W)		Total sugars (F.W)	
	2007	2008	2007	2008	2007	2008
C.V*P.D						
Local*15/4	23.01	24.74	10.28	9.07	8.51	8.99
Local *15/5	21.87	23.68	9.78	8.73	8.17	8.73
Fusaeu *15/4	22.78	24.28	9.54	8.87	8.19	8.68
Fuseau *15/5	21.55	23.00	9.31	8.41	7.87	8.51
C.V *H.D						
Local *15/11	23.12	24.87	10.57	9.36	8.13	8.74
Local *15/12	21.76	23.54	9.48	8.42	8.54	8.97
Fusaeu *15/11	23.34	24.48	9.92	9.20	7.91	8.43
Fusaeu *15/12	21.46	22.82	8.93	8.07	8.11	8.74
P.D * H.D						
15 April						
15/11	23.55	25.33	10.42	9.44	8.12	8.69
15/12	22.21	23.68	9.40	8.49	8.57	8.97
15 May						
15/11	22.91	24.01	10.07	9.13	7.91	8.49
15/12	21.01	22.68	9.01	8.00	8.11	8.74
LSD at 0.05%	2007	2008	2007	2008	2007	2008
C.V*P.D	0.13	0.15	0.14	0.16	0.11	0.11
C.V*HD	0.14	0.17	0.16	0.17	0.13	0.13
P.D*H.D	0.16	0.18	0.18	0.18	0.13	0.13

Concerning the effect of the interactions among cultivars, planting dates and harvesting dates on tuber contents of dry matter, inulin total sugar (Table 7). Local cultivar planted on 15th April and harvested tubers on 15th Nov. produced a significant increases on tubers contents of dry matter, inulin and total sugar compared with other factors under this study.

Table (7): Effect of interactions between cultivars, planting dates and harvesting dates on dry matter, inulin and total sugars percentage in tubers during 2007 and 2008 seasons.

Treatment	Dry matter (D.W)		Inulin (D.W)		Total sugars (F.W)	
	2007	2008	2007	2008	2007	2008
Local						
15 April						
15/11	23.65	25.53	10.82	9.48	8.24	8.85
15/12	22.37	23.95	9.74	8.65	8.78	9.12
15 May						
15/11	22.58	24.21	10.32	9.25	8.02	8.64
15/12	21.15	23.14	9.23	8.20	8.31	8.82
Fusaeu						
15 April						
15/11	23.44	25.14	10.03	8.90	8.34	8.53
15/12	22.75	23.42	10.02	9.40	8.01	8.82
15 May						
15/11	23.23	23.82	9.82	9.01	7.81	8.34
15/12	20.86	22.22	8.80	7.81	7.92	8.67
LSD at 0.05%	2007	2008	2007	2008	2007	2008

C.V*P.D*H.D	**0.18**	**0.19**	**0.19**	**0.21**	**0.15**	**0.14**

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دراسات فسيولوجية على الطرطوفة
(١) الانتاجية و الجودة لدرنات الطرطوفة تحت ظروف الاراضى الجديدة.

فاطمة سليمان عليان * و منال محمد عطية **

***قسم بحوث البطاطس والخضر خضرية التكاثر – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة – مصر.**

****قسم معاملات ما بعد الحصاد – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة – مصر**

اجريت تجربتان حقليتان فى منطقة الخطاطبة تحت ظروف الاراضى الرملية بمحافظة المنوفية – مصر خلال موسمى نمو ٢٠٠٧ و ٢٠٠٨ على محصول الطرطوفة وكان الهدف الرئيسى لهذا البحث هو دراسة تأثير الاصناف (البلدى وفيوزا) وموعدين الزراعة (١٥ ابريل ، ١٥ مايو) وموعدين حصاد (١٥ نوفمبر ، ١٥ ديسمبر) على النمو الخضرى والمحصول الاقتصادى والكلى ومكوناتهم على نبات الطرطوفة .

اوضحت النتائج ان الصنف البلدى اظهر زيادة فى المجموع الخضرى (ارتفاع النبات) عن الصنف فيوزا ولم توجد فروق معنوية فى عدد الافرع الرئيسية للنبات لكلا الصنفين – اضافة الى ان الصنف البلدى اظهر زيادة معنوية فى المحصول الكلى ومحتوى الدرنات من المادة الجافة والانيولين والسكريات الكلية.

اما فيما يتعلق بمواعيد الزراعة – اوضحت النتائج ان الزراعة فى ١٥ ابريل اعطت زيادة معنوية فى القياسات الخضرية والمحصول الكلى للفدان ومحتوى الدرنات من المادة الجافة

والانيولين والسكريات الكلية بالمقارنة بموعد الزراعة فى ١٥ مايو وبملاحظة تأثير مواعيد الحصاد – لوحظ ان هناك تأثير ايجابى للدرنات التى تم حصادها فى ١٥ نوفمبر بالنسبة للمحصول الكلى ومكوناته ومحتوى الدرنات من المادة الجافة والانيولين بينما قلت السكريات الكلية بالمقارنة مع الدرنات التى تم حصادها فى ١٥ ديسمبر.

اوضح التفاعل بين الصنف البلدى وموعد الزراعة (١٥ ابريل) زيادة معنوية فى النمو الخضرى والمحصول الكلى والمحتوى الكيماوى للدرنات تحت ظروف الاراضى الرملية وايضا الصنف البلدى وموعد الحصاد (١٥ نوفمبر) انتج زيادة معنوية فى المحصول الكلى ومكوناته ، محتوى الدرنات من المادة الجافة والانيولين بينما قلت السكريات الكلية وذلك بمقارنتها بالدرنات التى حصدت فى ١٥ ديسمبر – اوضح التفاعل بين الاصناف ومواعيد الزراعة ومواعيد الحصاد ان الصنف البلدى مع موعد الزراعة ١٥ ابريل وموعد الحصاد فى ١٥ نوفمبر اعطى زيادة معنوية فى قياسات المحصول والمحتوى الكيماوى للدرنات تحت ظروف الاراضى الرملية.

واخيرا اوضحت النتائج انه يمكن التوصية بأن موعد الزراعة الامثل للطرطوفة هو ١٥ ابريل (الصنف البلدى) وان موعد الحصاد المناسب هو ١٥ نوفمبر لاعطاء اعلى انتاجية وجودة للدرنات فى الاراضى الرملية.

قام بتحكيم البحث

أ.د / سمير طه العفيفى — **كلية الزراعة – جامعة المنصورة**

أ.د / ابراهيم ابراهيم العكش — **كلية الزراعة – جامعة عين شمس**