Effect of Some Agricultural Practices on Yield and Quality of Globe Artichoke (*Cynara scolymus*, L) under New Reclaimed Land

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Abstract: Two field experiments were conducted at Ali Moubark Farm, South Tahrir Research Station, Horticulture Research Institute, during 2003/2004 and 2004/2005 seasons to study the effect of different planting dates, soil solarization and soaking treatments of propagation material on inducing earliness and improving quantity, as well as quality of globe artichoke French cultivar (Hyrious) grown under local conditions of new reclaimed land. Three different planting dates (July 15th, August 5th and September 1st) and two soil solarization treatments (non-solarized and solarized) were used in addition to 4 soaking treatments of propagation material before planting as follow: a) Dipping for 5 seconds in 100 ppm indole butyric acid (IBA) solution. b) Dipping for 20 minutes in fungicide solution of Topsen M 70; Radomel and Rizolex T at rates of 1, 2 and 3 g/ liter, respectively. c) A combination of a and b treatments. d) And control. Planting artichoke on 5th of August increased plant height (cm) and gave the highest early, medium and late yield (ton/feddan). On the other hand, late planting date (1st of September) significantly increased percentage of plant survival and average of head weight (g) and diameter (cm) in early and medium yield, as well as inulin content (mg/g) and total fiber (%) in the edible part (receptacle), during the two growing seasons. Six weeks of soil solarization during summer months markedly increased soil temperatures and subsequently caused a reduction in soil fungi percentage compared with non-solarized soil. Solarized soil gave the best results with all studied parameters comparing with non-solarized one in both seasons. Soaking treatments of propagation material in a combination between IBA and fungicides increased plant survival percentage, plant height and gave the best early, medium and late yield as well as decreased the inulin content and total fibers%, while treating with fungicides alone showed the highest average of head weight and diameter in early and medium yield compared with control treatment, in both seasons. The three ways interaction indicated that, planting globe artichoke on 15th of July in solarized soil with IBA + fungicides treatment gave the highest early yield. While planting in September 1st in solarized soil with the same soaking treatment, increased plant survival percentage but the highest average head weight and diameter of early and medium yield obtained by using fungicides treatment.

Keywords: globe artichoke, planting dates, soil solarization, indole butyric acid, fungicides.

INTRODUCTION

In Egypt, globe artichoke occupies an important position among the leading exportable vegetable crops. The annual acreage of artichoke in Egypt reached 19410 feddan in 2005, with total production of 182946 tons. Egyptian exportation to foreign markets in 2005 reached about 7584 tons with a total income of 6.4 million dollars. Nowadays, the government is paying more attention to promote artichoke production especially in the newly reclaimed areas to satisfy the increasing demand for both local consumption and exportation.

Since, the major production of artichoke in Egypt is obtainable usually during March and April, while the optimum time for export to European markets is during the period from December to February. For this reason, early production with high quality and quantity during December to February represents a vital importance, since demand is great and prices are high which affects the net income of the globe artichoke production (Okasha *et al.*, 1997). Also one of the main problems facing globe artichoke propagation is the low stand percentage, which reached usually 50-60 % (EL-Barkouki *et al.*, 1976). The low stand percentage is mainly due to the soil born diseases which attack the propagation materials (dividing crown pieces) that considered as a proper method for globe artichoke propagation.

Many trails are still required to solve these problems to find out the optimum planting date under our local environmental conditions particularly, in the newly reclaimed areas. Some studies indicated that plant survival and plant height of globe artichoke were affected by planting dates. However, Moustafa (1969) reported that high percentage of plant survival obtained by late planting, while increased plant height was obtained by early planting. Similar results were observed by Aboul-Nasr (1995). Many studies stated the effect of planting date on yield, where Abd El-Al and Moustafa (1974) mentioned that the early planting increased both early and total yield of globe artichoke plants as compared to late one. Also, Pisti *et al.* (2004) reported that the quality of globe artichoke heads was affected by planting date.

Soil solarization is a method of heating the moist soil surface by covering with transparent polyethylene sheet. Solarized soil temperature was higher than non-solarized one and at soil surface, temperature was higher and decreased with soil depth (Hamada *et al.*, 2002; and McGovern, 2003). Soil solarization for six weeks increased growth, yield and quality of different crops (Tjamos and Paplomatas, 1988; Abd El-Aziz, 1998 and Ghanem *et a.*, 2006).

Finally, several studies used some growth regulators, fungicides or a combination of both together to improve and increase both plant stand and plant growth. Many investigators reported that IBA proved to be more satisfactory in producing heavy rooting in most of the ornamental cuttings and due to its non toxic effect, it was used successfully over wide range of concentration and plant species such as rhododendron (Kelly, 1969) and globe artichoke (Kasim *et al.*, 2003). Moreover, fungicides are mainly used as a protective, curative and eradicative procedure in most vegetable crops (Wade and Morris, 1983 and Rod, 1987).

The main objective of the present study is to investigate the effect of planting dates, soil solarization and some soaking treatments of propagation material (crown piece) on inducing earliness and improving quantity, as well as quality, of globe artichoke plants grown under local conditions of newly reclaimed areas of sandy soil.

MATERIALS AND METHODS

Two field experiments were conducted at Ali Moubark Farm, South Tahrir Research Station, Horticulture Research Institute, during 2003/2004 and 2004/2005 seasons. The artichoke variety used in these experiments was French cultivar (Hyrious).

One and Half month, before planting dates of both seasons, the field was cleaned, ploughed, leveled and divided into plots (10 m^2). Each experiment included 24 treatments (three planting dates x two levels of solarization x four soaking of propagation materials).

The treatments were arranged in randomized split split plot design with three replicates. The main plots were occupied by planting dates, solarization treatments were randomly distributed in the sub plots, and soaking treatments were randomly distributed in the sub-sub plots. The soaking treatments were:-

a-Dipping for 5 seconds in 100 ppm indole butyric acid (IBA) solution.

b-Using fungicide solution consisting of Topsen M 70; Radomel and Rizolex T at rates of 1, 2 and 3 g / liter, respectively, for 20 minutes and were lift for about 30 minutes in he open air before planting.

c– A combination of a and b treatments.

d –A control.

All plots were pre-irrigated using drip irrigation system with nozzles of 100 cm apart. Six weeks before each planting date, strips of 50 Mm thickness polyethylene plastic were randomly placed on 12 plots for solarization as described by Abdallah (1991).

Soil temperature was measured two days a week during day time for solarized soil vs. non-solarized at depths of 0, 5, 10 and 15 cm, and maximum temperature was calculated. The plastic sheets were removed after 6 weeks of solarization.

The propagation material (crown pieces) from French cultivar (Hyrious) of artichoke was planting after solarization at a distance of one meter within rows with one meter width and ten meter length in each plot. The agricultural practices required for artichoke production were carried out as recommended. Soil samples were collected from the root rizosfere (top 20 cm) to determine, pathogen fungi percentages, according to Beninashemi and Dezeeuw (1969), 2 months after solarization.

The following data were recorded for artichoke growth, yield and quality:

- Vegetative growth.

percentage of plant stand and plant height (cm) measured from the soil surface up to the tip of the height leaf were recorded at 60 days and 150 days after planting, respectively.

- Yield (early, medium and late yield):

The early *yield* (from the begging of harvest till the end of February), medium yield (during March) and late yield (during April) were determined as flower head weight (ton/feddan).

-physical and chemical characters of Head:

A random sample of 5 heads from each experimental plot was taken at each harvest during the early and medium yield for determining the average weight (g) and diameter (cm) of the head. Inulin content (mg/g) and Total fibers (%) of the edible part in head (receptacle) were determined on dry weight basis during the medium yield according to Winton and Winton (1958) and A.O.A.C.(1990), respectively.

- Statistical analysis:

Data were statistically analyzed as randomized split split plot design, according to Snedecor and Cochran. (1980).

RESULTS AND DISCUSSION

- Effect of solarization on soil temperature:

Results in Table (1), clearly, indicated that soil temperatures (under plastic or uncovered areas) increased during the day time, reaching its maximum values at 4 clock p.m during the three solarization periods. Similar observations have been recorded by Abdallah (1991). Concerning soil depths, the highest soil temperatures recorded at the surface of the soil, and then it decreased with increasing the soil depths. The maximum difference in soil temperature between covered and uncovered areas for the three solarization dates was 16 °C, 11 °C, 7 °C and 6 °C at 0, 5, 10 and 15 cm. depths, respectively as an average of both seasons. The heating effect of the plastic on soil, decreased with soil depth. At 5, 10, and 15 cm depths, the maximum temperatures in covered soil were 14 °C, 21 °C and 25 °C, respectively, lower than that at soil surface, but still higher than uncovered soil at the same depths by 9 °C, 12 °C and 15 °C respectively. Such results were in agreement with Abdallah, 1991; Hamada *et al.*, 2002 and Ghanem *et al.*, 2006. Concerning dates of solarization, data in Table (1) showed that soil solarization raised the average maximum soil temperature to 66 °C, 69 °C and 66 °C on soil surface with soil solarization started in 4th of June, 26th of June and 21st of July, respectively in both growing seasons, corresponding maximum temperature in non-solarized soil surface was 53 °C, 53 °C and 55 °C respectively, with an increase of 13 °C, 16 °C and 11 °C over the non-solarized treatment.

Table (1): Average absolute maximum soil temperatures (C°) at four depths, in solarized and non-solarized soil for 6 weeks before planting dates (means of two seasons).

Solarization started dates	Soil depths (cm)	Day time													
		Solarized soil							Non- solarized soil						
		8 a.m.	10 a.m.	12 a.m.	2 p.m.	4 p.m.	6 p.m.	8 p.m.	8 a.m.	10 a.m.	12 a.m.	2 p.m.	4 p.m.	6 p.m.	8 p.m.
4th of June	0	53	56	61	64	66	64	59	40	43	47	51	53	48	45
	5	41	42	46	50	51	48	46	33	35	38	43	45	43	41
	10	35	37	40	44	46	43	42	32	33	36	39	41	39	37
	15	34	36	37	40	42	40	38	29	31	34	37	39	36	35
	Ambient	32	35	37	39	40	37	35	32	35	37	39	40	37	35
26th of June	0	50	54	61	67	69	67	64	40	44	50	52	53	51	47
	5	37	40	45	52	55	52	49	32	34	37	41	44	42	40
	10	35	37	41	46	48	46	42	31	33	36	39	41	39	38
	15	33	35	39	41	44	42	40	30	31	33	36	38	36	33
	Ambient	33	35	37	38	39	37	34	33	35	37	38	39	37	34
21st of July	0	45	50	58	61	66	62	56	36	42	48	50	55	50	45
	5	36	39	43	49	54	51	46	31	33	36	40	44	42	40
	10	34	36	40	44	47	45	43	30	31	33	37	39	38	37
	15	32	34	37	40	42	41	39	29	31	32	35	37	35	33
	Ambient	32	34	37	38	39	36	34	32	34	37	38	39	36	34

- Effect of solarization on soil fungi:

Obtained data from Table (2) indicated that total fungi were drastically reduced in solarized treatments. Moreover, the three dates of soil solarization caused a markedly reduction in the percentage of fungi population as compared with non-solarized. This influence was more clear with the third solarized dates soil sample in November 1st. This observation may be attributed to the fact that the most effective period for solarization in Egypt is during July and August. In this aspect, many workers indicated that soil solarization is the best method for controlling target pest organisms in soil, and that solarization effectively reduced the population of many fungal and bacterial pathogens in soil (Abd El-Aziz, 1998; Abdallah *et al.*, 1998 and McGovern, 2003). Moreover, all soaking treatments of propagation material reduce soil pathogens as compared with the control. Data were more pronounced with IBA + fungicides treatment.

Table (2): Effect of planting dates, soil solarization and soaking treatments on total fungi isolation (colony forming unit "x 10^{-5} cfu"/1g. dry soil), two months after globe artichoke planting.

Planting dates	Soil solarization	Soaking treatments				
		Control	IBA	Fungicides	IBA+ Fung.	mean
15th of July	Non-solarized soil	11.05	2.87	4.71	0.84	4.87
	Solarized soil	6.04	0.52	0.63	0.42	1.90
	mean	8.55	1.70	2.67	0.63	3.39
5th of August	Non-solarized soil	18.75	7.82	7.92	2.98	9.37
	Solarized soil	10.67	3.66	3.32	0.42	4.52
	mean	14.71	5.74	5.62	1.70	6.94
1st of September	Non-solarized soil	8.50	4.73	4.42	2.69	5.09
	Solarized soil	1.38	0.52	0.42	0.42	0.69
	mean	4.94	2.63	2.42	1.56	2.89

- Vegetative growth:

1) Plant survival percentage:

Results in Table (3) indicate that the 3rd planting date; i.e. September 1st, (after 3rd solarization date) significantly improved the plant survival percentage (81.67 in the 1st season and 54.58% in the 2nd season) comparing to the 1st and 2nd planting dates. In this respect, planting in July 15th gave survival percentage of 47.50 and 41.67% while planting in August 5th gave 61.67 and 44.17% in the first and second seasons, respectively. These results are coincided with Moustafa (1969) who stated that late planting date of globe artichoke significantly increased percentage of plant survival than that of early one. Similarly, under Assiut conditions, Aboul-Nasr (1995) reported that percentage of plant survival obtained by planting late in mid-October was higher than that in mid-September and early October. This means that the later the planting date, the higher is the plant survival percentage. This might be due to the relatively low temperature

prevailing during the third planting date (1st of September) which was more suitable for artichoke sprouting than the high temperature prevailed during the first and second planting dates, in both seasons.

Data in Table (3) also, reveal that soil solarization process significantly improved plant survival percentage, in both seasons. Survival % was higher in solarized soil by about 14.03 and 17.41 % in the 1st and 2nd seasons, respectively compared with the control treatment. These results confirm numerous previous trials on different crops (Tjamos, and Paplomatas (1988) on artichoke; Abd El-Aziz (1998) on garlic and Abdallah *et al.* (1998) on cabbage and lettuce transplants). The increase in plant stand percentage caused by applying soil solarization process may be attributed to the fact established by Abd El-Aziz, (1998); Abdallah *et al.* (1998) and McGovern, (2003), which clear that this process leads to reduce the population of many fungal and bacterial pathogens and weeds in the soil.

Soaking propagation materials in IBA and fungicides either alone or combined together significantly increased plant survival percentage comparing with the control treatment (table3). Combined IBA with fungicides in both seasons gave the highest plant stand percentage. Average percentage of increase over control for the previously mentioned characters in the two seasons was 90.5 and 79.7%, respectively. Concerning the effect of IBA, this caused an increase over control in the plant survival by 62.17% and 30.51% in the two seasons, respectively. Kasim, *et al.* (2003) reported similar results on artichoke. Also, several investigators indicted that IBA proved most satisfactory in producing heavy rooting in most of the ornamental cuttings, Kelly (1969). The effect of fungicides, which caused high plant stand percentage, may be attributed to their effects on decreasing number of fungi population in the soil as stated by Fiori *et al.* (1996). Moreover, fungicides are mainly used as a protective, curative and eradicative procedure in several vegetable crops (Wade and Morris, 1983 and Rod, 1987).

Data in Table (3) indicate no significant differences in plant survival percentage between solarization treatments with any planting date. Although, planting date on September 1st combined with solarized soil was effective in improving this percentage. These results were holding true in both seasons.

During the two growth seasons, Table (3) shows that, within any planting date, soaking treatments of fungicides alone or combined with IBA gave the pest survival percentage comparing with the control treatment.

Soaking treatments of propagation materials in fungicides alone or combined with IBA increased the survival % comparing with the control in solarized and non- solarized soils without significant differences between them in both seasons (table 3).

Results in Table (3) indicated that adding a combination of IBA with fungicides in solarized soil and planting in September 1st gave the highest plant survival percentage in both growing seasons.

2) Plant height:

Data in Table (3) reveal that planting artichoke on 15th of July or 5th of August caused significant increase in this parameter compared with planting on 1st of September, in second season only. Similar results were obtained by Aboul-Nasr (1995) who explained that the highest value of plant height of globe artichoke occurred in earlier planting date due to the favorable conditions (warm weather) that can help in faster growing of plant than cold conditions (later planting date).

Soil solarization caused a significant increase in plant height, during the two growing seasons (table 3). Such effect was also observed on sweet corn (El Seidy, 2001) and on faba bean (Ghanem *et al.*, 2006). The obtained results might be attributed to the role of soil solarization in changing the soil contents, as reported by Chen and Katan (1980) who observed changes in the soil concentration of mineral nutrients and increased concentrations of soluble organic matter, which in turn encourage plant growth.

Concerning soaking treatments, results showed that the combination between IBA and fungicides gave the tallest plants, in both seasons. Similar enhancement in plant growth of globe artichoke treated pre-planting with IBA was proved by Kasim *et al.* (2003) who attributed this response to the more roots produced by treated offshoots. Also, this enhancement in plant growth may be attributed to the fact that fungicides reduced soil born diseases and subsequently permits more healthy and improved growth of plants.

In Table (3) the interactions between planting dates and solarized soil were effective in improving planting height comparing with non-solarized soil during the two growing seasons. However, this interaction was not significant with planting dates on 15th of July and 5th of August during the second season.

Table (3) reveals that all soaking treatments surpassed the control in plant height (cm) in all planting dates, during the two growth seasons. while the tallest plants were obtained by soaking propagation material in a combination of IBA with fungicides and cultivation on 15th of July or 5th of August followed by soaking in IBA and/or fungicides each alone, during 2004/2005 season only.

The same table shows that, using non-solarized soil with soaking treatments of fungicide alone or combined with IBA in the first season and the later treatment in the second one, significantly increased plant height comparing with the control treatment. While in solarized soil, applying IBA+ fungicides gave significant increased plant height followed by soaking in IBA and /or fungicides each alone comparing with the control during the two growing seasons.

Results in Table (3) indicated that soaking in IBA + fungicides treatment in solarized soil and planting in August 5th gave the tallest plant height in both growing seasons.

- Head yield (early, medium and late yield):

Table (3) indicates that planting globe artichoke on July 15th and August 5th gave a significant increase in the early yield (ton/feddan), comparing with planting on September 1st, in the first season. They produced 65.42

and 56.38 % increase in weight of flower heads than planting on September 1st, respectively. Concerning the medium and late yield, data show that planting artichoke in August 5th produced the highest medium and late yield (ton/feddan), followed by planting in July 15th and then September 1st. Similar results were concluded by Abd El-Al and Moustafa (1974) who mentioned that early planting date (May 1st) increased both early and total yield of artichoke plant as compared with late planting date (June 1st or July 1st). Also Aboul-Nasr (1995) planted globe artichoke on mid-September, early October and mid October and found that the first date of planting was better than the third date to obtain the highest early and total yield. This increase in yield might be explained on the basis that the longer the plant remains, the longer the harvesting seasons with large number of heads produced by early planting dates, and to the fact that early planting can give the plants a chance to build up more stored food than later planting.

The same table shows increases in the early, medium and late yield (ton/feddan) with solarized soil as compared with non-solarized one, in both growing seasons. Similar data was obtained by Tjamos and Paplomatas (1988) on artichoke and Ghanem *et al.* (2006) on faba bean. Such increase might be due to the favorable influence of solarization on reducing soil born diseases as well as increasing soil macro and micro elements (El-Seidy, 2001) which in turn encouraged plant growth and so caused yield increases.

Soaking plant propagation materials in IBA and fungicides either alone or combined together gave the best results for early, medium and late yield (ton/feddan) as compared with the control. This was true in the two growing seasons (table 3). Similarly, high artichoke yield was obtained by using IBA (Kasim *et al.*, 2003) and with fungicides (Fiori, 1996).

The interaction between planting dates and soil solarization is presented in Table (3). It is clear that solarized soil was effective and gave the highest early yield (ton/feddan) when artichoke planted on 15th of July. While the highest medium and late yield (ton/feddan), were obtained when artichoke planted on 5th of August comparing with non-solarized soil during 2003/2004 and 2004/2005 seasons.

From Table (3), with any particular planting date, soaking propagation materials in fungicides + IBA surpassed the control in the early yield (ton/feddan). Also, the highest medium and late yield (ton/feddan) were produced with soaking plant propagation materials in fungicides alone or combined with IBA within any planting date compared with the other soaking treatments. These trends were observed in both seasons.

With solarized and non-solarized soil, data show that soaking treatments of fungicides alone or combined with IBA produced the highest early, medium and late yield (ton/feddan) comparing with the control during the two growing seasons (table 3).

Regarding the three ways interaction Table (3) shows that applying IBA+ fungicides in solarized soil and planting on 15th of July gave the highest early yield (ton/feddan), Also, the highest medium and late yield (ton/feddan) were produced with soaking in IBA+ fungicides treatment in solarized soil and planting on 5th August, during the two seasons.

- Head characters:

1) Physical characters:

Data presented in Table (4) reveal that planting on 5th of August and 1st of September significantly increased both averages of head weight (g) and diameter (cm) of early yield as compared to planting on 15th of July in both seasons. In the medium yield, planting on 1st of September produced the highest average head weight and diameter as compared to planting on 15th of July and 5th of August, in both growing seasons, while, no significant differences in the average head diameter were observed between the three planting dates in the 1st season. Similar results were reported by Pisti *et al.* (2004). These findings might be due to the less number of heads produced by late planting date (1st of September) that may reflect on the higher average of head weight and diameter, compared with the other earlier dates, which produced more number of heads.

The same table shows that soil solarization gave the highest value of the average head weight and diameter of early yield in both seasons and medium yield in 1st season as compared with non-solarization. These conclusions agreed with Tjamos and Paplomatas (1988), Abd El-Aziz (1998) and Ghanem *et al.* (2006), who proved that soil solarization for six weeks increased yield and quality in different crops.

Concerning soaking propagation material treatments, data presented in Table (4) reveal that the highest average head weight and diameter of early yield was obtained by all soaking treatments as compared with control treatment in both seasons. On the other hand, the highest values of head weight and diameter of medium yield were generally, obtained by soaking propagation materials in IBA and/or fungicides each alone, in both seasons.

Regarding the interaction between planting dates and soil Solarization, data in Table (4) reveal that, within any particular planting dates solarized soil recorded increased average head weight (g) and diameter (cm) of early yield compared by non-solarized one in 1st and 2nd seasons. Whereas, no significant differences were obtained by cultivating on 5th of August and 1st of September in the second season for the two characters. Concerning the average head weight and diameter of medium yield, results showed that with solarized soil and planting date in September 1st gave the highest values comparing with non-solarized soil and planting date in July 15th in both seasons.

Table (4) indicates that soaking in IBA and/or fungicides treatments, each alone and planting on 1st of September produced the highest head weight and diameter of early and medium yield, during the two seasons.

The same table shows that all soaking treatments increased head weight and diameter of early yield comparing with control treatment with solarized and non-solarized soil, in both seasons. Concerning medium yield, the average head weight and diameter increased with soaking in IBA and/or fungicides treatments, each alone in solarized soil, in both season.

Within any particular planting date Table (4) show that using IBA and fungicides each alone and/or combined together, in solarized soil gave the highest average head weight and diameter of early yield during the two seasons. In medium yield, soaking in IBA and/or fungicides each alone in solarized soil and planting in September 1st recorded the highest average head weight and diameter in 1st and 2nd seasons.

2) Chemical characters:

As shown in Table (4) the highest inulin (mg/g) and fiber (%) contents were obtained from planting on 1st of September compared to the other two planting dates, in both seasons.

Soil solarization significantly gave the highest inulin (mg/g) content in the edible part in solarized soil compared with the non-solarized one. Average percentage of increase over non-solarized for inulin content in the two seasons were respectively, 12% and 15.6%, as shown in the same table. Likewise, results were proved by Abdallah *et al.* (1998). On the contrary, the lowest total fibers % produced by solarized soil, in the 2nd season only.

All soaking treatments of propagation material decreased significantly the inulin and the total fiber contents in the edible part as compared with the control treatment, during 1st and 2nd seasons (table 4).

Regarding the interaction between planting dates x soil Solarization, within any individual planting dates, it was observed that solarization increased the inulin content of the edible part comparing by the non-solarization during the two seasons. The highest inulin content was recorded when planting in September 1st in solarized soil with average percentage of increase over planting in non-solarized soil in July 15th by 29.4 and 88.1% respectively. As for total fiber content, soil solarization significantly gave the lowest total fibers with solarized soil compared to non-solarized soil in both seasons.

Data in Table (4) shows that all soaking treatments tended to lower the inulin and total fiber contents comparing by the control during the three planting dates, during the two growing seasons. In addition, using IBA and fungicides treatments gave the lowest results for inulin (mg/g) and total fiber %, respectively.

The same table, indicate that all soaking treatments of propagation material gave the lowest inulin and total fiber contents comparing with the control treatment in both solarized and non- solarized soil, during the two growing seasons.

Concerning the three ways interaction (table 4) show that planting artichoke on 1st of September in solarized and non-solarized soil, and the control treatment (without soaking), gave the highest inulin and total fiber contents in the edible part, respectively, In both seasons.

Table (3): Effect of planting dates, soil solarization, soaking treatments and the interaction of planting dates x soil solarization on vegetative growth and yield of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments		Survival (%)		Plant height (cm)		Head yield (ton / fedden)					
						Early yield		Mid-season yield		Late yield	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates:											
15th July		47.50	41.67	24.80	36.62	0.311	0.287	0.865	0.795	0.928	0.858
5th August		61.67	44.17	24.83	37.95	0.294	0.235	1.107	0.948	1.678	1.014
1st September		81.67	54.58	23.11	27.24	0.188	0.213	0.792	0.550	0.885	0.703
L.S.D at 0.05		9.30	4.43	NS	2.92	0.035	NS	0.158	0.118	0.229	0.098
Soil solarization:											
Non solarized soil		59.44	43.06	22.01	31.41	0.139	0.175	0.656	0.488	0.905	0.659
Solarized soil		67.78	50.56	26.48	36.45	0.390	0.315	1.187	1.041	1.422	1.058
L.S.D at 0.05		7.59	5.13	1.55	2.45	0.040	0.070	0.057	0.085	0.110	0.143
Soaking treatments:											
Control		41.11	32.78	19.86	28.59	0.071	0.102	0.389	0.318	0.449	0.408
IBA		66.67	42.78	25.06	34.26	0.240	0.197	0.985	0.713	1.081	0.671
Fungicides		68.33	52.78	24.84	34.61	0.321	0.294	1.071	0.989	1.487	1.011
IBA + fungicides		78.33	58.89	27.22	38.29	0.426	0.387	1.241	1.037	1.638	1.343
L.S.D at 0.05		8.33	7.15	1.89	1.93	0.052	0.056	0.145	0.128	0.205	0.150
Planting dates x soil solarization:											
15th July	Non solarized soil	43.33	36.67	22.39	34.49	0.161	0.195	0.588	0.491	0.731	0.635
	Solarized soil	51.67	46.67	27.21	38.74	0.462	0.379	1.141	1.100	1.124	1.081
5th August	Non solarized soil	58.33	41.67	23.08	36.60	0.150	0.182	0.823	0.599	1.305	0.807
	Solarized soil	65.00	46.67	26.58	39.31	0.438	0.289	1.391	1.297	2.051	1.222
1st September	Non solarized soil	76.67	50.83	20.56	23.15	0.106	0.148	0.556	0.373	0.680	0.535
	Solarized soil	86.67	58.33	25.65	31.33	0.270	0.278	1.029	0.728	1.090	0.870
L.S.D at 0.05		13.16	8.88	2.69	4.25	0.070	0.122	0.099	0.148	0.192	0.248

Table (3) ***continued***: Effect of the interaction of planting dates x soaking treatments and soil solarization x soaking treatments on vegetative growth and yield of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments		Survival (%)		Plant height (cm)		Head yield (ton / fedden)					
						Early yield		Mid-season yield		Late yield	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates x soaking treatments:											
15th July	Control	23.33	28.33	20.67	31.75	0.067	0.084	0.366	0.326	0.350	0.373
	IBA	56.67	38.33	26.31	36.33	0.310	0.250	1.011	0.686	0.933	0.664
	Fungicides	50.00	46.67	25.05	36.71	0.376	0.353	0.995	1.127	1.123	1.066
	IBA + fungicides	60.00	53.33	27.16	41.68	0.492	0.461	1.087	1.042	1.305	1.329
5th August	Control	28.33	26.67	21.50	29.67	0.075	0.110	0.423	0.387	0.605	0.486
	IBA	65.00	36.67	24.72	39.63	0.279	0.193	1.178	0.944	1.627	0.789
	Fungicides	71.67	55.00	25.31	39.32	0.376	0.264	1.291	1.210	2.146	1.225
	IBA + fungicides	81.67	58.33	27.81	43.20	0.448	0.374	1.537	1.251	2.334	1.557
1st September	Control	71.67	43.33	17.41	24.35	0.071	0.114	0.377	0.241	0.392	0.364
	IBA	78.33	53.33	24.15	26.83	0.131	0.147	0.766	0.510	0.681	0.561
	Fungicides	83.33	56.67	24.17	27.79	0.211	0.266	0.927	0.631	1.193	0.743
	IBA + fungicides	93.33	65.00	26.69	29.99	0.339	0.326	1.100	0.819	1.275	1.141
L.S.D at 0.05		14.43	12.39	3.28	3.35	0.090	0.097	0.251	0.222	0.355	0.259
Soil solarization x soaking treatments:											
Non solarized soil	Control	36.67	28.89	19.58	25.98	0.043	0.063	0.229	0.164	0.345	0.293
	IBA	61.11	38.89	21.53	32.66	0.122	0.133	0.643	0.452	0.824	0.522
	Fungicides	65.56	48.89	22.86	31.80	0.168	0.197	0.794	0.641	1.171	0.764
	IBA + fungicides	74.44	55.56	24.08	35.22	0.223	0.309	0.958	0.694	1.280	1.056
Solarized soil	Control	45.56	36.67	20.14	31.19	0.099	0.142	0.548	0.472	0.553	0.523
	IBA	72.22	46.67	28.59	35.87	0.358	0.261	1.327	0.975	1.337	0.821
	Fungicides	71.11	56.67	26.83	37.42	0.473	0.392	1.348	1.338	1.803	1.258
	IBA + fungicides	82.22	62.22	30.36	41.35	0.630	0.466	1.524	1.381	1.995	1.629
L.S.D at 0.05		11.78	10.12	2.68	2.73	0.074	0.079	0.205	0.181	0.290	0.211

Table (3) *continued*: Effect of the interaction of planting dates, soil solarization and soaking treatments on vegetative growth and yield of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments			Survival (%)		Plant height (cm)		Head yield (ton / fedden)					
							Early yield		Mid-season yield		Late yield	
			1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates x soil solarization x soaking treatments:												
15th July	Non solarized soil	Control	20.00	23.33	20.67	29.50	0.00	0.00	0.207	0.127	0.232	0.224
		IBA	50.00	33.33	21.61	36.86	0.170	0.172	0.635	0.497	0.678	0.520
		Fungicides	46.67	40.00	23.22	33.83	0.207	0.222	0.719	0.642	0.923	0.736
		IBA + fungicides	56.67	50.00	24.04	37.78	0.267	0.387	0.792	0.698	1.091	1.060
	Solarized soil	Control	26.67	33.33	20.68	34.00	0.135	0.168	0.525	0.525	0.468	0.522
		IBA	63.33	43.33	31.00	35.81	0.451	0.328	1.387	0.876	1.189	0.807
		Fungicides	53.33	53.33	26.88	39.58	0.545	0.485	1.272	1.612	1.323	1.396
		IBA + fungicides	63.33	56.67	30.28	45.58	0.717	0.536	1.381	1.385	1.518	1.599
5th August	Non solarized soil	Control	26.67	23.33	20.78	29.22	0.059	0.089	0.238	0.254	0.483	0.308
		IBA	60.00	33.33	23.67	39.67	0.130	0.123	0.758	0.515	1.197	0.542
		Fungicides	70.00	53.33	23.50	36.72	0.199	0.206	1.029	0.820	1.756	0.986
		IBA + fungicides	76.67	56.67	24.39	40.78	0.213	0.310	1.267	0.807	1.784	1.391
	Solarized soil	Control	30.00	30.00	22.22	30.11	0.090	0.131	0.607	0.521	0.728	0.664
		IBA	70.00	40.00	25.78	39.58	0.428	0.264	1.599	1.372	2.057	1.036
		Fungicides	73.33	56.67	27.11	41.75	0.552	0.323	1.552	1.600	2.536	1.463
		IBA + fungicides	86.67	60.00	31.22	45.61	0.684	0.439	1.807	1.695	2.884	1.723
1st September	Non solarized soil	Control	63.33	40.00	17.30	19.22	0.070	0.100	0.241	0.112	0.321	0.347
		IBA	73.33	50.00	19.30	21.44	0.067	0.102	0.535	0.342	0.598	0.504
		Fungicides	80.00	53.33	21.85	24.83	0.099	0.163	0.633	0.461	0.835	0.570
		IBA + fungicides	90.00	60.00	23.80	27.11	0.190	0.229	0.816	0.576	0.966	0.718
	Solarized soil	Control	80.00	46.67	17.53	29.47	0.072	0.127	0.512	0.370	0.463	0.382
		IBA	83.33	56.67	29.00	32.22	0.195	0.192	0.997	0.678	0.765	0.618
		Fungicides	86.67	60.00	26.49	30.75	0.323	0.369	1.221	0.802	1.551	0.915
		IBA + fungicides	96.67	70.00	29.58	32.86	0.488	0.423	1.385	1.062	1.583	1.565
L.S.D at 0.05			20.41	17.53	4.64	4.74	0.128	0.138	0.355	0.314	0.502	0.366

Table (4): Effect of planting dates, soil solarization, soaking treatments and the interaction of planting dates x soil solarization on the physical and chemical head characters of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments		Average head weight (g)				Average head diameter (cm)				Chemical			
		Early yield		Mid- yield		Early yield		Mid- yield		Inulin (mg/g)		Total fibers (%)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates:													
15th July		165.50	207.54	176.49	199.08	6.58	7.20	7.55	7.65	5.06	4.12	4.81	7.75
5th August		189.72	247.47	173.34	188.85	7.17	8.40	7.40	7.55	4.40	4.05	5.00	8.31
1st September		197.19	265.40	193.47	221.80	7.72	8.30	7.61	8.15	5.84	6.57	5.19	10.69
L.S.D at 0.05		15.73	31.72	8.96	20.83	0.31	0.64	NS	0.46	0.31	0.27	0.21	0.85
Soil solarization:													
Non solarized soil		147.47	221.15	175.96	195.91	6.53	7.59	7.38	7.76	4.81	4.56	5.04	9.42
Solarized soil		220.80	259.12	186.24	210.57	7.78	8.35	7.65	7.80	5.39	5.27	4.96	8.42
L.S.D at 0.05		16.93	15.82	6.79	NS	0.26	0.26	0.17	NS	0.26	0.22	NS	0.38
Soaking treatments:													
Control		134.51	187.47	180.32	195.21	5.86	6.48	7.32	7.43	5.92	5.35	5.50	9.67
IBA		189.84	246.58	184.70	226.11	7.58	8.23	7.57	7.82	4.36	4.46	5.17	8.58
Fungicides		214.60	269.93	185.64	209.83	7.88	8.79	7.71	8.07	4.95	4.90	4.50	8.58
IBA + fungicides		197.59	256.56	173.75	181.82	7.30	8.37	7.46	7.81	5.19	4.95	4.83	8.83
L.S.D at 0.05		15.59	22.28	7.26	21.60	0.37	0.57	0.20	0.32	0.26	0.32	0.24	0.41
Planting dates x soil solarization:													
15th July	Non solarized soil	117.34	168.66	166.71	194.95	5.34	6.11	7.33	7.68	4.80	3.79	5.00	8.25
	Solarized soil	213.65	246.42	186.27	203.22	7.83	8.30	7.77	7.61	5.32	4.45	4.63	7.25
5th August	Non solarized soil	156.39	234.90	169.14	182.88	6.79	8.30	7.39	7.55	4.17	3.87	5.00	9.13
	Solarized soil	223.06	260.05	177.54	194.81	7.54	8.49	7.40	7.56	4.64	4.24	5.00	7.50
1st September	Non solarized soil	168.68	259.90	192.03	209.91	7.45	8.35	7.44	8.06	5.47	6.02	5.13	10.88
	Solarized soil	225.70	270.90	194.92	233.68	7.98	8.26	7.78	8.24	6.21	7.13	5.25	10.50
L.S.D at 0.05		29.32	27.39	11.76	35.29	0.46	0.45	0.31	NS	0.46	0.39	0.38	0.66

Table (4) *continued*: Effect of the interaction of planting dates x soaking treatments and soil solarization x soaking treatments on the physical and chemical head characters of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments		Average head weight (g)				Average head diameter (cm)				Chemical			
		Early yield		Mid- yield		Early yield		Mid- yield		Inulin (mg/g)		Total fibers (%)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates x soaking treatments:													
15th July	Control	81.45	99.94	176.07	189.45	3.55	3.95	7.27	7.42	6.05	4.59	5.25	8.75
	IBA	179.04	235.10	183.00	224.30	7.27	8.17	7.68	7.49	3.81	3.72	5.00	7.00
	Fungicides	214.09	254.11	185.25	214.77	8.02	8.70	7.76	7.97	4.62	4.15	4.75	8.00
	IBA + fungicides	187.40	241.01	161.63	167.82	7.50	8.00	7.48	7.71	5.77	4.02	4.25	7.25
5th August	Control	152.66	222.11	173.13	180.91	6.63	8.03	7.34	7.18	5.51	4.40	5.50	9.00
	IBA	197.72	246.85	176.09	217.87	7.47	8.43	7.40	7.64	3.72	3.71	5.00	8.50
	Fungicides	214.26	264.17	174.65	189.31	7.62	8.75	7.45	7.76	4.37	4.02	4.50	7.50
	IBA + fungicides	197.25	256.76	169.49	167.30	6.95	8.37	7.39	7.63	4.01	4.09	5.00	8.25
1st September	Control	169.42	240.38	191.76	215.27	7.40	7.47	7.35	7.69	6.19	7.06	5.75	11.25
	IBA	195.77	257.80	195.00	236.15	8.02	8.08	7.63	8.33	5.54	5.97	5.50	10.25
	Fungicides	215.45	291.53	197.01	225.43	8.00	8.93	7.93	8.48	5.85	6.53	4.25	10.25
	IBA + fungicides	208.13	271.90	190.12	210.33	7.45	8.73	7.52	8.09	5.79	6.74	5.25	11.00
L.S.D at 0.05		27.01	38.59	12.58	37.41	0.64	1.00	0.35	0.56	0.46	0.55	0.42	0.72
Soil solarization x soaking treatments:													
Non solarized soil	Control	102.65	149.93	175.43	184.09	4.60	5.36	7.34	7.37	5.54	4.97	5.67	10.33
	IBA	145.85	228.05	178.19	218.70	6.93	8.13	7.35	7.77	4.11	4.09	5.17	9.17
	Fungicides	181.23	259.13	181.57	206.24	7.48	8.57	7.52	8.09	4.64	4.56	4.50	9.17
	IBA + fungicides	160.15	247.50	168.64	174.62	7.10	8.29	7.32	7.82	4.97	4.60	4.83	9.00
Solarized soil	Control	166.37	225.02	185.21	206.33	7.12	7.61	7.30	7.48	6.29	5.72	5.33	9.00
	IBA	233.83	265.12	191.20	233.51	8.23	8.32	7.79	7.87	4.60	4.84	5.17	8.00
	Fungicides	247.97	280.74	189.70	213.42	8.28	9.02	7.90	8.05	5.26	5.23	4.50	8.00
	IBA + fungicides	235.03	265.61	178.85	189.02	7.50	8.44	7.60	7.80	5.41	5.30	4.83	8.67
L.S.D at 0.05		22.05	31.51	10.27	30.55	0.53	0.81	0.29	0.46	0.37	0.45	0.34	0.59

Table (4) *continued*: Effect of the interaction of planting dates, soil solarization and soaking treatments on the physical and chemical head characters of globe artichoke plant, during the two successive seasons of 2003/2004 and 2004/2005.

Treatments			Average head weight (g)				Average head diameter (cm)				Chemical			
			Early yield		Mid- yield		Early yield		Mid- yield		Inulin (mg/g)		Total fibers (%)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Planting dates x soil solarization x soaking treatments:														
15th July	Non solarized soil	Control	0.00	0.00	164.49	180.83	0.00	0.00	7.28	7.43	5.85	4.34	5.50	9.50
		IBA	123.96	204.89	174.86	219.64	6.37	7.90	7.37	7.46	3.45	3.14	5.00	7.00
		Fungicides	186.47	241.79	177.34	213.68	7.67	8.63	7.43	8.04	4.46	3.98	5.00	9.00
		IBA + fungicides	158.95	227.95	150.13	165.63	7.33	7.90	7.23	7.79	5.45	3.69	4.50	7.50
	Solarized soil	Control	162.90	199.88	187.65	198.07	7.10	7.90	7.26	7.40	6.25	4.84	5.00	8.00
		IBA	234.13	265.31	191.13	228.96	8.17	8.43	7.99	7.52	4.16	4.30	5.00	7.00
		Fungicides	241.71	266.43	193.16	215.86	8.37	8.77	8.09	7.89	4.79	4.31	4.50	7.00
		IBA + fungicides	215.85	254.08	173.13	170.00	7.67	8.10	7.74	7.62	6.08	4.35	4.00	7.00
5th August	Non solarized soil	Control	141.17	211.05	170.79	166.78	6.40	7.97	7.35	7.27	5.02	4.14	5.50	10.00
		IBA	154.80	235.95	168.32	217.37	6.97	8.40	7.34	7.53	3.63	3.63	5.00	10.00
		Fungicides	178.32	245.00	170.65	189.39	7.27	8.47	7.44	7.77	4.12	3.87	4.50	8.00
		IBA + fungicides	151.26	247.58	166.81	158.00	6.53	8.37	7.43	7.62	3.89	3.82	5.00	8.50
	Solarized soil	Control	164.14	233.17	175.47	195.04	6.87	8.10	7.33	7.08	6.00	4.66	5.50	8.00
		IBA	234.64	257.75	183.86	218.37	7.97	8.47	7.46	7.75	3.81	3.79	5.00	7.00
		Fungicides	250.21	283.34	178.64	189.22	7.97	9.03	7.46	7.76	4.62	4.17	4.50	7.00
		IBA + fungicides	243.24	265.93	172.18	176.60	7.37	8.37	7.35	7.65	4.14	4.35	5.00	8.00
1st September	Non solarized soil	Control	166.79	238.73	191.00	204.67	7.40	8.10	7.40	7.42	5.74	6.44	6.00	11.50
		IBA	158.80	243.30	191.40	219.09	7.47	8.10	7.34	8.32	5.25	5.51	5.50	10.50
		Fungicides	178.89	290.60	196.72	215.67	7.50	8.60	7.69	8.45	5.33	5.84	4.00	10.50
		IBA + fungicides	170.25	266.97	188.98	200.22	7.43	8.60	7.32	8.05	5.58	6.29	5.00	11.00
	Solarized soil	Control	172.06	242.02	192.52	225.87	7.40	9.83	7.30	7.97	6.64	7.68	5.50	11.00
		IBA	232.73	272.30	198.61	253.22	8.57	8.07	7.93	8.34	5.84	6.43	5.50	10.00
		Fungicides	252.00	292.45	197.31	235.19	8.50	9.27	8.16	8.52	6.37	7.22	4.50	10.00
		IBA + fungicides	246.00	276.83	191.26	220.45	7.47	8.87	7.72	8.12	6.00	7.19	5.50	11.00
L.S.D at 0.05			38.20	54.58	17.80	52.91	0.91	1.41	0.50	0.79	0.65	0.79	0.60	1.02

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تأثير بعض التطبيقات الزراعية على محصول و جودة الخرشوف تحت ظروف الأراضى الجديدة المستصلحة

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** قسم البطاطس و الخضر خضرية التكاثر- معهد بحوث البساتين- مركز البحوث الزراعية- جيزة.

أجرى هذا البحث فى مزرعة على مبارك التابعة لمحطة بحوث البساتين بجنوب التحرير - محافظة البحيرة خلال موسمى زراعة ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ لدراسة تأثير ميعاد الزراعة والتعقيم الشمسي و معاملات نقع للتقاوى قبل الزراعة مباشراً فى الحقل على التبكير وتحسين جودة وكمية محصول الخرشوف تحت ظروف الأراضي الجديدة المستصلحة و إتباع نظام الرى بالتنقيط. كان الصنف المستخدم فى الزراعة الفرنساوى. وفى كل موسم تم تقسيم أرض التجربة إلى أحواض (١٠م٢). وكان تصميم التجربة قطع منشقة مرتين فى ٣ مكررات بحيث إشتملت القطع الرئيسية على معاملات ميعاد الزراعة والقطع المنشقة الأولى على معاملات التعقيم الشمسي والمنشقة مرتين على معاملات نقع قطع التقاوي.

و قد إشتملت المعاملات على الأتى:-

١- ميعاد الزراعة:- ١٥ / يوليو - ٥ / أغسطس - ١ / سبتمبر

٢- تعقيم شمسي للتربة لمدة ٦ أسابيع قبل الزراعة فى المواعيد السابقة و ذلك لمعاملات التعقيم الشمسي باستخدام تغطية سطح التربة بالبولي اثيلين الشفاف سمك ٥٠ ميكرون مع ترك أحواض المقارنة بدون تغطية. و أثناء تغطية سطح التربة بالبلاستيك خلال عملية التعقيم الشمسي تم تسجيل درجات الحرارة على سطح التربة و فى أعماق ٥، ١٠، ١٥ سم و ذلك خلال ساعات النهار من الثامنة صباحاً للثامنة مساءاً كل ساعتين لمدة يومين أسبوعياً. و عقب انتهاء مدة التعقيم تم رفع غطاء البلاستيك ورى الأحواض قبل الزراعة فى كل موعد. و عقب الزراعة بشهرين فى كل موعد أخذت عينات من سطح التربة حتى عمق ٢٠ سم (فى منطقة الجذور) من أحواض التعقيم الشمسي و أحواض المقارنة لتقدير محتواها من الفطريات الكلية. :-

٣ – معاملات التقاوي:-

- النقع فى حمض أندول بيوتيرك بتركيز ١٠٠ جزء فى المليون لمدة ٥ ثوانى.
- النقع فى خليط من المطهرات فطرية توبسن أم ٧٠: رادوميل: ريزوليكس تى بمعدل ١: ٢: ٣ جم /لتر.
- النقع فى حمض الأندول بيوتيرك ثم المطهرات الفطرية بنفس التركيزات السابقة.
- المقارنة.

و خلصت النتائج المتحصل عليها على الأتى:-

١- أظهرت النتائج أن زراعة الخرشوف فى الميعاد الثاني (٥/أغسطس) أعطت أعلى محصول مبكر و متوسط و متأخر للنورات بالطن للفدان، أما الميعاد الثالث (١/سبتمبر) أدى إلى تحسين نسبة نجاح التقاوي و زيادة معنوية فى متوسط وزن و قطر النورة فى المحصول المبكر و المتوسط و سجل أعلى قيم بالنسبة لمحتوى الجزء الذى يؤكل (التخت) من الأنيولين والألياف خلال موسمى الزراعة.

٢- أدى استخدام التعقيم الشمسي لمدة ٦ أسابيع خلال أشهر الصيف إلى زيادة واضحة فى درجات حرارة التربة و سبب نقص فى أعداد الفطريات المسببة للأمراض مقارنة بالتربة الغير معقمة و كذلك أدى إلى زيادة فى كل الصفات المدروسة فى الجزء الذى يؤكل من النورة (التخت) خلال موسمى النمو.. كما أظهر التعقيم الشمسي زيادة فى محتوى النورات من الأنيولين وإنخفاضاً فى محتوى الألياف.

٣- أشارت النتائج أن معاملة التقاوي قبل الزراعة مباشراً فى الحقل بالأندول بيوتيرك أسيد مع المطهرات الفطرية أدت إلى زيادة نسبة نجاح التقاوي، إرتفاع النباتات و المحصول المبكر والمتوسط والمتأخر بالطن للفدان و سببت نقص فى محتوى الأنيولين والألياف فى التخت، بينما أظهرت معاملة التقاوي بالمطهرات فقط أعلى متوسط وزن وقطر للنورة فى المحصول المبكر والمتوسط مقارنة بمعاملة الكنترول و ذلك خلال الموسمين.

أظهر التفاعل الثلاثي بين العوامل المدروسة أن زراعة الخرشوف فى ١٥ يوليو فى تربة معقمة تفوقاً فى المحصول المبكر (طن للفدان) مع استخدام معاملة النقع فى محلول حمض الأندول بيوتيرك + المطهرات، أما الزراعة فى ١ سبتمبر فى تربة معقمة مع استخدام نفس معاملة النقع أدى إلى زيادة نسبة نجاح قطع التقاوي المنزرعة، بينما أدى النقع فى معاملة المطهرات إلى زيادة صفات الجودة للنورات (متوسط وزن و قطر النورة).