J. Plant Production, Mansoura Univ., Vol.6 (4): 665 - 684, 2015

EFFECT OF SOME STIMULATION EMERGENCE TREATMENTS AND PLANTING DATES OF NURSERY ON ARTICHOKE (*Cynara scolymus* L.) AND SUBSEQUENTLY YIELD AND QUALITY

Ismail, Sh. A. and F.S.S. Alian

Potato and vegetatively propagated vegetable crops Res. Dept. Hort. Res. Inst. Agric. Res. Cent. Giza, Egypt

ABSTRACT

Two field experiments were conducted during the two successive seasons of 2011 /2012 and 2012/ 2013 at Kaha Research Farm, Kaluobia Governorate Egypt, to study the effect of some treatments that stimulate germination, and planting dates on artichoke stumps which were sprayed with 1-Bio rooting compound by 10cm/liter every week for 45 days, 2- spraying stumps with 6-benzylamino purine (BA) at 20mg /liter weekly for 45 days, 3-dipping stumps for 30 minutes in 100 ppm indol butric acid (IBA) , 4- stumps were inoculated with a mixed inoculums consisted of 3 VA Mycorrhizal fungi i.e. *Glomus etunictum*, *Glomus intraradices* and *Glomus monosporum* , 5- Stump were cooled at (5°C) for two weeks. and 6-control plants without treatments. Two experiment were conducted first experiment was carried out in nursery in which treated stumps were planted in nursery in two planting dates, June1st and July 1st and transplanting in field after 45 days after every planting date. Data were recorded in nursery; on plant high, leaves number, offshoots number and roots number ,roots length and survival percentage after 45 days from every planting date. Second experiment was conducted in field to subsequent plants treated until production of flower heads. Data recorded in field on survival percentage, early, and total yield per fed. as a number, number of heads per plant, quality parameters of flower head and edible part in both early and total yield. Dry matter and inulin concentration in edible part in early and total yield were also recorded.

Obtained data in first experiment indicated that the second date (July 1st) gave increase significantly plant height after 45 days from planting. cooling and BA treatments affected plant height significantly compared with all other treatments after 45 days. The best number of offshoots was obtained from the first planting date and there were no significant differences after 45 days .The highest number of offshoots were achieved by the cooling treatment all over stages of nursery growth. It was noted that there was no significant effect of planting dates on the number of leaves after 45 days after planting , Results indicated that both of BA, the bio- rooting and mycorrhiza treatments increased the number of leaves during the nursery stage. Results show that all the interactions between cooling, BA and bio rooting treatments had increased in all vegetative nursery growth in both planting dates. The bio rooting and mycorrhiza improved roots number in first planting date. While the BA was the best treatment for the root length in first planting date. Survival% of plants in the nursery was not affected by planting dates. The highest percentages of survival in nursery were obtained from the cooling ,BA and bio-rooting treatments . The highest percentages of survival in field were obtained from the cooling and bio-rooting treatments in the second planting date. The second planting date gave the maximum number of head in early yield, also BA and bio-rooting treatments significantly influenced on early head yield and its quality. There were no significant effect of planting dates on the total yield and its quality. The cooling treatment improved significantly the total heads yield . But fresh weight of receptacles increased significantly with the BA, IBA and mycorrhiza, while the diameters of heads and receptacles were affected by the cooling treatment.

Also, late planting date (July 1st) significantly increased dry matter and inulin content in total yield. Three pre- treatments of nursery mycorrhiza, BA and IBA enhanced dry matter and inulin content in early yield .While, cooling treatment significantly increased dry matter and inulin content in total yield.

It can be concluded that stumps were planted in nursery on June 1st and treated with BA, bio- rooting and cooling improved all vegetative growth parameters in nursery, while planting date in July 1st with the same treatments gave the maximum values of early , total yield and quality parameters , as well as dry matter and inulin contents in both early and total yield.

Keywords: planting dates, nursery treatments, cooling, BA, bio- rooting, survival % early and total yields.

INTRODUCTION

Globe artichoke (*Cynara scolymus l.*) is a herbaceous perennial dicot and one of most important vegetable crops in the countries bordering the Mediterranean basin region which grown for its flower bud. Export –windows of globe artichoke at the time from November to February are very important for European markets. Globe artichoke are usually propagated vegetatively from root division, offshoots and ovoli (underground dried shoots).These methods were produced low level of survival percentage in field production and quality .Some agricultural practices or pre-treatments are desire, to stimulate vegetative growth of the stumps in nursery, It would have been more effective if it had included an increasing in early yield and quality of globe artichoke.

Planting date is one of most important major factors effect earliness of globe artichoke El Abagy (1993) showed that late planting on September 1st gave a significant higher survival % than of early planting on August 1st. Inulin content significantly affected by planting date, Pesti *et al.,* (2006) indicated that plants transplanted from seed earlier produced higher total yields, while those transplanted later produced buds of higher quality. Macua *et al.* , (2007) found in early planting, the failure percentage was high indicating an important decrease in the total yield (in early July), and the autumn yield was high (end of August) and the winter frost also had a negative influence on early yield .

6- benzylamino purine (BA) is considered as potent growth regulator with cytokinine activity and has been successfully used as a foliar spray to stimulate auxiliary shoot development and improve the branching of potted plants . Henny , (1986), Wang, (1990) and Browne, *et al.,*(2001). Foliar application of BA to the artichoke plantlets from tissue culture increased the offshoot number and influenced the earliness of auxiliary bud emission (Mariateresa, *et al.,* 2005; and Temperini, *et al.,* 2005)

Vesicular –arbuscular mycorrhiza VAM are type of fungi that interact with numerous plant species and produce vesicules and arbuscules in root tissue along with extraordinary hyphae in the soil. (Harley and Smith 1983) .They also showed that VA mycorrhizal fungi could alleviate drought stress in their host plants via direct uptake and transfer of water and nutrients through the fungal hyphae to the host plants. The Mycorrhizal artichoke plantlets

registered a survival of between 90 and 95 % for rooting shoots and 60% for the non –rooting shoots ,(Irene *et al.,* 2005). Mycorrhizal symbiosis always positively affected acclimatization of micro propagated plants and an increase in the percentage survival ranging from 21 to 57 units compared with control (Cavallaro *et al.,* 2007). Some studies have demonstrated that inoculation with Mycorrhizal fungi is a sustainable method to improve plant growth and productivity (Ahmed *et al.,* 2006 and Huang *et al.,* 2011) .Also it had generally improved plant vegetative growth and salt tolerance of artichoke hybrid seedling (Angela *et al*., 2012).

Vernalization has been induced in globe artichoke plants by exposing them to cold treatment before planting, in this respect (El-abagy 1993) found, that cooling of crown pieces at 2 c before planting significantly increased weight and number of flower heads per plants and per Fadden. Several investigators indicated that cooling may profitability be utilized on later sowing of artichoke which have a negative impact on earliness and yield (Mauromicle *et al*., 2005). Abd El-Hameid *et al.,* (2008) showed that vernalization of stored old crowns to 5c for 7 days before transplanting enhanced plant height while both of leaves and offshoots number per plant were significantly decreased with vernalization. Lopez *et al.,* (2007) found that with this pre-treatment for stumps will begin to sprout in 4-5 days after 8-10days of such storage , while if the stumps are planted directly without undergoing this preparatory phase sprouting will start 15-30 days after plantation. In the last case, it is necessary to keep the moisture level in the ground constant by the frequent provision of water for short periods, since the planting months (July and August)are a time of extremely high evapotranspiration. Ranagarajan *et al.,* (2000) indicated that ,vernalization treatment increased the number of plants producing buds and the marketable yield, when transplants were set after 15 May and at later planting dates ,Vernalizing the transplants increased the number of plants producing apical buds compared with nonvernalized plants .

Some studies indicated that IBA proved to be satisfactory and enhancing roots and become healthy and a good growth root to disease resistance, especially root rots which resulted in fungi and bacteria in soils (Kelly, 1969). Different concentrations of IBA solutions are used in globe artichoke to development the root growth by dipping stumps and offshoots before planting , (Kasim *et al.,* 2003 and El-Sayed *et al.,* 2007). In addition to the effect of some bio stimulant substances on globe artichoke, Alian ,(2005) found that artichoke plants treated with bio magic (containing of macro and micro nutrients, amino acids, organic acids, and vitamins) gave the highest values in some quality parameters of flower head compared with untreated plants.

Therefore, the aim of this present work was to produce good plants in nursery and subsequently earliness, high quality and yield in field by applying some of different pre-treatments in nursery in two planting dates.

MATERIAS AND METHODS

Two experiments were carried out in Kaha Research farm, Kaluobia Governorate Egypt during two successive summer growing seasons of 2011-2012 and 2012- 2013 to study the effect of two nursery planting dates and 5 pre-treatments which may promote growth or stimulate sprouting stump buds of globe artichoke plants and untreated stumps (control) on the growth, production and chemical constituents of globe artichoke (*Cynara scolymus* L.) cv.Herious.

1-Exp.In nursery: Globe artichoke stump cuttings were taken with the old artichoke plants and treated with the following was 6PRE- treatments.

1-Control plants without pre- treatments.

2- Foliar spraying of stumps with Bio rooting compound (registered number is 5270 of Agriculture ministry) at 10 gm/l every week for 45 days (guaranteed analysis in Table 1).

3- Foliar spraying of stumps with chemical growth regulator 6-benzylamino burine (BA) at 20 mg /l weekly for 45 days.

4-Dipping Stumps for 30 minutes in 100 mg/l of indol butric acid.

5-Stumps were inoculated with a solution of mixed inoculum consisted of 3 vesicular –arbuscular mycorrhizal fungi i.e. *Glomus etunictum*, *Glomus intraradices* and *Glomus monosporu* .The inoculum was provided by Microbial Inoculants Activity,(Faculty of Agriculture Ain Shams University).

6- Stumps were stored at 5 ° C for two weeks.

Stumps were treated and cultivated in two planting dates i.e., June 1st and July 1st under shading and mist conditions , the stumps were planted in rows 10 m length and 50 cm in width and the distances between stumps were 30 cm. The area of the experimental unit was 10m^2 ,the experimental design used was split plot with three replicates .The planting dates of nursery were in the main plots and the stumps pre-treatments were in the sub plots. A fertilization program, commonly used in the area for globe artichoke nurseries, was adopted (48 m^3 /fed of farmyard manure +180 kg /fed of agricultural sulfur + 180 kg /fed of ammonium sulfate) under Surface irrigation.

Table (1) : Guaranteed Analysis (W/V) % of bio-rooting.

Salicylic acid (SA)	2.5%
Free Amino acid (L.A.A)	11.0%
Glutaric acid (GLA)	1.5%
Glutamic acid (GL.T.A)	1.00%
Total Organic acid	16%
Chelated Zinc.	2%
Chelated Iron.	3.5%
Chelated Mn.	1.2%
Mo.	0.03%
Co.	0.005%

However, plant height, number of leaves, number of offshoots per stump, roots number and length and survival % in nursery were measured. Plants were transferred after 45 days from planting dates of each cultivation to the open field.

2- Exp. 2 in open field.

All sprouted stumps obtained from the nursery have been transferred to the open field. All pre-treatments received an identical amount of composted farmyard manure at a rate of 40 m3/fed., and mineral fertilizers as a traditional recommended under clay soil conditions. The plants were grown in rows 20 m length and 1 meter in width and the distance between plants were 1 meter. Irrigation was regularly carried out at intervals according to weather conditions to keep the moisture content of the soil to field capacity. Survival % of the transplanting after two weeks from planting were evaluated, expressed as the percentage of well survived plants based on number of plant pieces grown in each plot. Data recorded on the early yield (EY) was calculated from the start of harvest until the end of February were evaluated for each plot in both seasons, early yield as well as, number of heads per fed. Total yield(TY) was calculated from start of harvest to the end of May and evaluated for each plot in both seasons. Number of heads per plant and total number of heads per fed were evaluated. Five heads from each plot were randomly taken (early and total yield) and estimated head quality as follow, average of fresh weight(FW) (g) and diameter (cm) of heads(It was measured by calipers), average of fresh weight(FW) (g) and diameter(cm) of edible part (receptacle) in early and total yield in both seasons. Samples of the edible part were taken at the beginning, early and the end of harvesting season and dried in an electric oven to constant weight at 70 ^{O}C in order to calculated dry matter content (in early and total yield). Inulin concentration was determined according to Winton and Winton, 1958. All collected data were statistically analyzed with variance using MSTSTC software; the mean values were compared at 5% levels of LSD as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1-Exp. 1 Nursery experiment.

Results tabulated in Table (2) show that plant height was greatly affected by planting dates in the first season only. Planting of stump on July 1st produced the highest plants significantly compared with those in June1st .This finding was negligible in second season. Similar results obtained by Moustafa (1969) who reported that plant high was increased by late planting. With regard to treatments of nursery, plants were sprayed by 6-benzylamino purine (BA) or these received cooling treatment produced the highest plant height compared to other treatments during growth stages after 45 days from stump planting in two seasons . Such effect could be due to that BA had a beneficial effect on promoting auxiliary and rhizome bud swelling due to increasing in cells number reflected on the plant growth. Similar results were obtained by Mariateresa, *et al.,* (2005) conclude that globe artichoke plants growth can be improved by foliar application of BA (200 mg L-^{1}) to stock

plants. Interaction between both studied factors showed that in first season the high significant plant height (52.05cm) was produced with stumps treated with BA and planted in July 1st However, the least significant plant height (17,33cm) was obtained with stumps treated with stumps treated with mycorrhiza and planted on June 1st . Data in Table (2) indicate that offshoots number were not significant affected by planting dates in two seasons. It was noted that the first planting date June 1st gave a good vegetative growth which might be due to that temperature degree was less than the second planting date July 1st,this climate makes the vegetative growth strong. Similar results were obtained by Mauromicale and Ierna, (1995) and Mauromicale *et al.,* (2005).

Table (2):Effect of planting dates of nursery and treatment of nursery on vegetative growth of globe artichoke plants in nursery after 45 days from planting in two seasons (2012and 2013).

Treatment		Plant height /plant(cm)		Off Shoots No./plant		Leaf No./plant	
P.d.nursery		٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
June1st		٢٥.٥٤ b	٣٠.٩٨a	3.33 a	٤.٨١ a	٦.٥١a	٧.٥٣ a
July1st		٣٩.٢٣ a	٢٨.٩١a	3.75 a	٣.٨٣ a	٩.٩٠ a	٦.٨٢ a
Treat. of nursery							
Control		٢٨.٣٣ b	١٨.٤٦c	١.٨٣ c	١.٩٤ d	٧.٨٨ bc	٨.٢٧ ab
B. rooting		٢٧.٢٢ b	٣٠.٠٨b	٢.٢٧ c	٣.١٠ bc	٧.١٦ c	٦.١٠ b
BA		٤١.٩١ a	٤٤.٠٥a	٣.٤٩ b	٤.١٦ b	١٠.٣٨ a	٩.٧٧ a
IBA		٣٠.١٠ b	٢٨.٦٩b	٢.١٦ c	٢.٣٢cd	٧.٧٢ c	٦.٤٩ b
Mycorrhiza		٢٦.٢١ b	٢٥.٩٩b	٢.٤٤ c	٣.١٠ bc	٧.١٠ c	٥.٨٣ b
Cooling		٣٩.٨٣ a	٣٢.٤١b	٩.٠٥ a	١١.٢٧ a	٨.٩٩ b	٦.٦٠ b
The interactions							
June1st	**June1st**						
	Control	٢٤.٦٦ h	٢٠.١٦ef	٢.١٠ e	١.٨٨ d	٦.٢٢ de	٩.٢٢ ab
	B. rooting	١٨.٢٢ i	٢٨.٨٣cde	٢.٣٣ de	٤.١١ c	٥.٣٣ e	٧.٢١abc
	BA	٣١.٧٧ g	٤٧.٣٣a	٣.٣٣ cd	٤.٢٢c	٧.٦٦ cd	١٠.١٠a
	IBA	١٧.٧٧ ij	٢٩.٧٧cde	٢.٤٤ de	٢.٣٢d	٥.٧٧ e	٦.١١bc
	Mycorrhiza	١٧.٣٣ j	٣٠.٦٦cd	٢.٣٣ de	٤.١٠ c	٥.٢١ e	٥.٤٤c
	Cooling	٤٣.٤٩ b	٢٩.١٦cde	٧.٤٤ b	١٢.٢٢ a	٨.٨٨ bc	٧.١٠ abc
July1st	**July1st**						
	Control	٣٢.٠٠ g	١٦.٧٧f	١.٥٥ e	١.٩٩ d	٩.٥٥ b	٧.٣٣abc
	B. rooting	٣٧.٦٦ d	٣١.٣٣bc	٢.٢٢ e	٢.١٠ d	٨.٩٩ bc	٤.٩٩ c
	BA	٥٢.٠٥ a	٤٠.٧٧ab	٣.٦٦ c	٤.١٠ c	١٣.١٠ a	٩.٤٤ ab
	IBA	٤٢.٤٤ c	٢٧.٦١cde	١.٨٨ e	٢.٣٣ d	٩.٦٦ b	٦.٨٨ abc
	Mycorrhiza	٣٥.١٠ f	٢١.٣٣def	٢.٥٥ de	٢.١١ d	٨.٩٩ bc	٦.٢٢bc
	Cooling	٣٦.١٦ e	٣٥.٦٦ bc	١٠.٦٦ a	١٠.٣٣ b	٩.١٠ bc	٦.١٠ bc

P. d.=planting dates, B. rooting= Bio. rooting

Means with the same letter (s) in the same column are not significantly differ from each other according to Duncan ' s multiple tests at 5% level.

As regard to nursery treatments, data in Table (2) show that plants treated with cooling before planting gave the maximum values (10.66) offshoots number after 45 days from planting, while the least significant offshoots number (1.55) was produced with untreated stumps in two seasons. This

results may be due to being globe artichoke plants required to cool temperature (chilling) for initiate buds, so occurs increasing in number of offshoots. This results agree with Ranagarajan *et al.,* (2000)

Concerning to the interactions between both studied factors, results in Table (2) revealed that plants treated with cooling and planted in June 1st or July1st produced the highest number of offshoots in both seasons. With respect to the number of leaves, results in Table (2) showed that there were no significant differences in number of leaves in two planting dates (June1stand July1st) in the two seasons. Nursery treatments had significant effects on the leaves number of plant. Data in Table (2) showed that stumps treated with BA produced the highest number of leaves per plants (10.38 and 9.77) in two tested seasons. However the least significant number of leaves (7.10 and 5.83) were obtained with stumps treated with mycorrhiza .Interaction between both studied factors showed that in first season the high significant number of leaves (13.10) was produced with stumps treated with BA and planted in July1st , as well as , in the second season

Data in Table 3 showed that, planting dates had no significant differences in roots number in two seasons. While plants treated with bio- rooting gave the highest number of roots comparing with the other treatments in the first season, in addition to plants which inoculated with mycorrhiza in the second season. With respect to the effect of the interaction between planting dates and nursery treatments on root number, results indicated that plants treated with bio-rooting, mycorrhiza and cooling which planted on June 1st produced the maximum number of roots in the both seasons. These results were in agreement with these of Fortunato *et al.,* (2005) who found a highly significant effect on the root length when globe artichoke plants inoculated with mycorrhiza.

Obtained data in Table (3) reported that roots length was increased significantly in the first planting date in the first season, while there were no significant differences between two planting dates in the second season. In the same table, it is noted that plants treated with BA gave longest roots compared with the all treatments in the two seasons. As for the interaction effect between the planting dates and nursery treatments on root length, results reported that the highest values of root length were obtained from BA treatment in the first planting date in the two seasons.

Results tabulated in Table (3) show that survival plants in nursery was not affected by planting dates in the two seasons. These findings in disagree with El-Abagy, 1993 who found that the survival percentage was increased in late planting date (September 1st) compared with early planting date (August 1st)

As respect to the effect of nursery treatments on the survival percentage data in Table (3) indicate that stumps treated with both Bio-rooting, BA and cooling produced the highest percentages of plant survival in two tested seasons .On the other hand, IBA and mycorrhiza treatments gave higher values compared with non treated plants. These result are in agreement with La Malfa and Foury (1973) they found losses of about 30-

40% for offshoots of early artichoke cultivars when it is grown in traditional nurseries without any treatments .

The interaction between both studied factors in Table (3) show that cooling treatment gave the superiority plant survival percentages followed by BA and Bio-rooting treatments in the two tested seasons. Also the same nursery treatments produced the highest values of survival percentage in the first planting date (June1st) compared with the other treatments.

Table (3): Effect of planting dates and treatments of nursery on some roots traits and survival % of globe artichoke in nursery in two seasons (2012 and 2013)

Treatments		Roots No.		Roots length(cm)		Survival % in nursery	
P.d.		2012	2013	2012	2013	2012	2013
June1st		10.05a	10.77a	9.69a	10.44a	73.85a	75.84a
July1st		8.55a	8.61a	8.00b	10.36a	71.34a	69.74a
Treat. Of nursery							
Control		6.00d	5.83c	6.08d	7.00c	47.48d	42.82b
B. rooting		13.66a	13.33a	7.41cd	9.83b	80.54ab	81.76ab
BA		8.33cd	7.66bc	13.75a	14.50a	86.69a	82.14ab
IBA		6.33d	8.50b	8.33bc	11.33b	65.74c	67.86c
Mycorrhiza		10.50bc	12.83a	7.58cd	9.41b	68.71bc	75.80b
Cooling		11.00b	10.00b	9.91b	10.33b	86.43a	86.38a
The interactions							
June1st	Control	6.33def	6.33d	6.33e	6.83f	47.60d	47.01f
	B. rooting	13.66a	15.00a	8.16cde	8.50def	80.50abc	84.36ab
	BA	9.00bcde	8.66bcd	16.50a	15.33a	88.85a	84.58ab
	IBA	7.66cdef	10.00bc	9.33bcd	12.33bc	65.50c	79.13de
		11.66ab	14.66a	7.83cde	8.83def	70.01bc	78.25bcd
	Cooling	12.00ab	10.00bc	10.00bc	10.83cd	90.65a	91.73a
July1st	Control	5.66ef	5.33d	5.83e	7.16ef	47.37d	38.63f
	B. rooting	13.66a	11.66ab	6.66e	11.16bcd	80.59abc	79.17bc
	BA	7.66cdef	6.66cd	11.00b	13.66ab	84.52ab	79.71bc
	IBA	5.00f	7.00cd	7.33de	10.33cd	65.98c	66.58e
	Mycorrhiza	9.33bcd	11.00b	7.33de	10.00cd	67.41c	3.36cde
	Cooling	10.00bc	10.00bc	9.83bcd	9.83cde	82.21bc	81.02bc

P. d.=planting dates, B. rooting= Bio rooting

Means having the same letter (s) in the same column are not significantly differ from each other according to Duncan ' s multiple tests at 5% level.

2-Exp. 2 in field:

Regarding to the survival percentage in the field, data in Table (5), show that the highest values were obtained with the second planting date during two seasons. It was noted that plants treated with cooling gave the highest significant differences in survival percentage compared with other treatments in the two seasons, also spraying plants with bio- rooting or

treated with cooling storage produced the maximum values of survival percentage and with significant difference from all other interactions. Similar results were reported with El-Abagy, (1993) who found that the survival percentage was increased in late planting date (September 1st) compared with early planting date (August 1st), and also the vernaliziation treatment produced the highest survival percentage in field compared with untreated (control plants). Also the mycorrhiza inoculation of plants increased significantly survival percentage in the first season, this results are in agreement with Cavallaro *et al*., (2007) . These result may be attributed to the mycorrhizal plant has greater growth capacity and was able to overcome adverse environmental conditions more easily, (Brutti et al, 2000 and Ordas *et al.,* 1990).

In the same Table (5), it was noted that plants sprayed with bio-rooting gave the highest survival percentage compared to with other treatments under this study in the second season. These results may be due to that bio rooting contained different compounds such as free amino acids , salicylic acid and micro nutrients (Fe, Zn, Cu) which promoted growth and more increasing cells division which reflected on all vegetative parameters.

In two seasons, results in Table(5) indicated that BA treatment increased the survival percentage of plants when compared with those untreated.

Also , regards to BA it was considered as growth regulator with cytokinin activity which promoted auxiliary shoot development and reducing the apical dominance (Temperini, *et al*., 2005).

Data presented in Table 4 show the effect of planting dates and treatments of nursery on early yield (EY) expressed as the average number of artichoke heads per fed., fresh weight in g(FW) and the diameter in cm (DM) of heads and the edible part (receptacle) during the two growing seasons. Plants sown on July 1st in the nursery and transferred to the field on August 15th gave greater number of early heads per fed., compared with the others that sown in the nursery on June 1st and transferred on July15th. These results may be due to, that plants sown on the second date in nursery (July 1st)and transferred to the open field on August 15th ,which considered as the ideal date for planting, produced the strong vegetative growth due to flowering bud initiation and producing early heads. These results were in agreement with those of El-Sayed *et al.*, (2007).Fresh weight and diameter of flower heads and the receptacle were not affected with planting dates of nursery during the two growing seasons, except in the second season, since the globe artichoke plants which sown in nursery on June 1st and transferred on July 15TH showed significant increases in both fresh weight and diameter of receptacle (edible part). Concerning the effect of nursery treatments on early yield and quality in Table 4, results show that all treatments of nursery showed significant increases in the head early yield/ fed., comparing with the control one .Whereas, plants treated with BA and Mycorrhiza in the two seasons and those subjected to cooling treatment, in the first season only, produced the highest values of early yield compared with other treatments. As regard to the effect of BA foliar application at rates up to 5, 10, and 20

mg.L^{-1}, that cause increasing in the total number of globe artichoke offshoots and become a good plants produced earlier rate of heads. Similar results were obtained by Mariateresa, *et al.,* (2005). These results may be attributed to the beneficial effect of BA on promoting auxiliary and rhizomic bud swelling, since ,BA is considered to be a potent growth regulator with cytokinin activity, and has been successfully used as a foliar spray to stimulate auxiliary shoot development in ornamental crops (Browne *et al*., 2001; and Wang, 1990). As for the enhancement effect of (VAM) which induced early production of artichoke heads, several studies have demonstrated that inoculation with Mycorrhizal fungi is a sustainable method to improve plant growth and productivity (Ahmed *et al*., 2006 and Huang *et al*., 2011). Also it generally improved plant vegetative growth and salt tolerance of artichoke hybrid seedling (Angela *et al.*, 2012). The earliness of yield as affected by vernalization might be explained on the bases that vernalization of seed and seedling significantly reduced the time to bolting, but this effect was less evident than that found in Michigan (USA) by Harwood and Markarian (1968) and Gerakis *et al*., (1969).This is probably due to devernalization influence might be induced by the high temperature (above 33^0C as found by Gerakis *et al*., (1969). Obtained data were in agreement with those of Mauromicale *et al*., (2005)who reported that, plants which received cold treatment and GA_3 application showed earliness in start of harvest (about 10 days before) and higher rate of head production at an earlier date than plants treated only with GA_3 . Obtained data in Table (4), generally, show, that plants treated with bio- rooting gave higher values in all quality parameters e.g. fresh weight and diameter of flower head and receptacle than all untreated plants. These results are in agreement with Alian, (2005) who found that artichoke plants sprayed with Bio magic compound (containing amino acids, organic acid and some macro and micro nutrients)had more developed and best quality parameters. It may be due to that these components of bio- rooting or bio magic as important tool for heads formation which depending on carbohydrates status and nitrogen concentration. Application of bio fertilizer at 1000mg/L, on globe artichoke plants increased photosynthetic pigment (chlorophyll and carotenoids content) and biochemical composition (Sorial *et al.,* 1989). In the two growing seasons, the interaction between planting dates and treatments of nursery indicated that, globe artichoke plants sown on July 1^{st} in the nursery and transferred to the field on August 15^{th}, showed significant increases in the head early yield/ fed., with the all treatments of nursery comparing with the control one. Whereas, plants treated with BA, IBA and cooling treatment in the first season and IBA and mycorrhiza in the second season produced the highest values of early yield compared with other treatments.

The effect of interaction between planting dates and treatments of nursery on the yield quality , results in Table 4 indicated that in two seasons, plants planted in first planting date and dipping in IBA solution before planting or treated with bio- rooting gave the maximum fresh weight of heads ,however in the second season results in table 4 clearly indicate that the highest values of head diameter were obtained from bio- rooting treatment and untreated plants .

4

It is evident_from results there were no significant differences between nursery treatments and the two planting dates except the IBA and mycorrhiza treatments where recorded the lowest values of head diameter in the first season.

Also in the second season there were no significant differences between nursery treatments and the two planting dates on head diameter of early yield in first date while both of IBA and cooling treatments were recorded the highest values however, in the second planting date Bio- rooting and cooling treatments produced the highest values.

As for the effect of the interaction between planting dates and treatments of nursery on the fresh weight of receptacle the highest weights were produced from the bio- rooting, IBA and BA nursery treatments in the first planting date of the first season .On the other hand, results presented in Table (4) clearly indicate that ,the lowest values of fresh weight of receptacle were obtained from the all nursery treatments in the second planting date. In addition in the second season, there were no significant differences among all treatments in both planting dates except the highest value of the fresh weight of receptacle which was noticed by the mycorrhiza treatment in the second planting date.

The effect of interaction between planting dates and treatments of nursery on the effect of interaction between planting dates and treatments of nursery on the diameter of receptacle, data shown in Table (4) treatments of BA, IBA, bio- rooting and cooling had the highest values in the first planting date. Also both of cooling and bio- rooting treatments had the highest values in the second dates of planting in addition to untreated plants .While the lowest value was recorded by the mycorrhiza treatment and there were no significant differences between treatments in the first planting date. Only the power rooting treatment had the highest value in the second planting date.

Obtained data in Table, (5) indicated that planting dates in the open field had no significant effects on the total yield number/ fed. These results are in disagree with El-Sayed *et al*., (2007) who found that planting artichoke on August ^{15th} gave the highest early, medium and late yield (ton /fed.).Concerning the effect of treatments of nursery on total yield /fed. In the same table, results, generally, show that all treatments of nursery showed significant increases in the head total yield/ fed., comparing with the control one. Whereas, plants subjected to cold treatment in both seasons, and those treated with power rooting and BA treatments in the second season produced highest number of flower heads (TY/fed.) compared to other tested treatments. The interaction between planting dates of open field and the pre treatments in the nursery is presented in Table (5). It is clear that the highest total yield as number of flower heads per Fadden was produced by plants subjected to cooling treatment with any particular planting date of nursery compared with the other pre-treatments of nursery during the first season. Whereas, in the second season, it is clear that plants sown in nursery on June ^{1st} and treated with BA and mycorrhiza and those sown on July ^{1st} and treated with power rooting and BA as well as cooling treatments showed the best results.

Obtained data in Table(6) indicated that, fresh weight (g) and diameter (cm) of both flower heads and the receptacle of the total yield were not significantly affected by planting dates of nursery during the two growing seasons. Results presented in Table (6) show that there was no significant effect between the two planting dates on the receptacle diameter character of heads in the two tested seasons. The effect of different nursery treatments on receptacle diameter of head, data in Table (6) revealed that untreated plants had the highest value of receptacle diameter (cm) and there were no significant differences between it and some nursery treatments such as BA and IBA in the first growing season .Also the same trend was observed in the second season with IBA and mycorrhiza nursery treatments.

Table (5): Effect of planting dates and treatments of nursery on total yield of globe artichoke and Survival % in field in two seasons (2012 and 2013)

	Treatments	TY/fed. (N0. Of Heads)		TY/plant. (N0. of Heads)		Survival % in field	
	P. d.	2012	2013	2012	2013	2012	2013
	July15th	٥١٥٥٥a	٤٢٢٢١a	11.97a	10.38a	64.74 b	69.56 b
	August15th	٥٣٨٥١a	٤٤١٤٧a	١٣.31a	11.08a	73.23 a	75.14 a
	Treat. Of nursery						
	Control	٣٩٣٣٣e	٣١٧٨٠d	١٠.88c	7.94c	37.19 d	46.20e
	Bio. rooting	٥٤٤٤٤b	٤٦٨٨٨ab	13.60ab	11.22ab	83.85 a	81.75b
	BA	٥٦٤٤٤b	٤٩٥٦٠ab	12.60abc	12.38ab	75.25 b	77.22c
	IBA	٤٥١١٠d	٣٦٢٢٢cd	11.27bc	9.05c	56.01 c	62.68d
	Mycorrhiza	٤٩٩٩٩c	٤٣١١٠bc	12.83abc	10.94b	78.91ab	76.65c
	Cooling	٧٠٨٨٨a	٥١٥٦٠a	١٤.66a	12.88a	82.75a	89.59a
	The interactions						
	June1st						
July15th	Control	٤٤٠٠٠d	٣٩٥٦٠bc	10.99c	9.88c	33.55g	40.43e
	B. rooting	٤٨٠٠٠cd	٣٧٣٣٠c	11.99bc	٨.٣٣cd	81.17abc	77.87b
	BA	٥١٥٦٠c	٤٩٣٣٠ab	12.88bc	١٢.٣٨ab	71.73de	77.30b
	IBA	٤٤٤٤٠d	٣٣٧٨٠cd	11.11c	٨.٤٤cd	45.12f	55.97d
	Mycorrhiza	٤٨٤٤٠cd	٤٩٧٨٠ab	12.77bc	١٢.٤٤ab	76.22cd	75.63bc
	Cooling	٧٢٨٩٠a	٤٣٥٦٠bc	12.11bc	١٠.٨٨bc	80.69abc	90.18a
	July1st						
August15th	Control	٣٤٦٧٠e	٢٤٠٠٠d	10.77c	٥.٩٩.d	40.84fg	51.98d
	B. rooting	٦٠٨٨٩b	٥٦٤٤٠a	١٥.22ab	١٤.١٠a	86.54a	85.63a
	BA	٦١٣٣٠b	٤٩٧٨٠ab	12.33bc	١٢.٤٤ab	78.77bcd	77.16b
	IBA	٤٥٧٨٠cd	٣٨٦٧٠c	11.44c	٩.٦٦c	66.89e	69.40c
	Mycorrhiza	٥١٥٦٠c	٣٦٤٤٤c	١٢.88bc	٩.٤٤c	82.60abc	77.68b
	Cooling	٦٨٨٩٠a	٥٩٥٦٠a	17.22a	١٤.٨٨a	84.80ab	89.02a

TY=total yield , P. d.=planting dates, B .rooting =Bio rooting

Means having the same letter (s) in the same column are not significantly differ from each other according to Duncan ' s multiple tests at 5% level

As for the effect of interaction between the two planting dates and the nursery treatments on the receptacle diameter of head, data in Table (6) indicate that in the two seasons and on July 15th planting date untreated plants and plants treated with BA or IBA nursery treatments recorded the highest values of this trait during the two tested seasons. The same trend was observed with the BA, IBA and mycorrhiza nursery treatments on August 15th only in the first season. On the other hand, the lowest values of receptacle diameter were obtained from almost treated and untreated nursery plants.

Obtained data in Table, (7) indicated that planting dates had no significant effects on the dry matter of flower heads in both early and total yield except total yield in the first season. Stumps planted on July 1st in the nursery and transferred to the field on August 15th showed greater value of dry matter of heads. Concerning the effect of treatments of nursery on dry matter of flower heads, in the same table, results, show that plants inoculated with mycorrhiza in the nursery and those of control without treating show higher values of this property comparing with the other nursery treatments in the early yield. All treatments of nursery showed no significant differences in the flower head dry matter in the total yield comparing with the control one. Obtained data in Table, (7) indicated that planting dates in the nursery had no significant effects on the inulin content of the flower heads in both early and total yield except total yield in the second season. Plants sown on July 1st in the nursery and transferred to the field on August 15th produced flower heads with greater inulin content. The effect of interaction between planting date and nursery pre-treatments on early yield of dry matter percentage was non- significant in the two planting dates in the first season , on the other hand ,only mycorrhiza treatment and untreated plants recorded the highest values of dry matter percent in the first planting date. Moreover the highest values were obtained by mycorrhiza and IBA treatments in both second season and the second planting date. Results in Table (7) show also that the effect of interaction between planting date and nursery pre-treatments on the dry matter percentage of the total yield .The highest values were observed at mycorrhiza and cooling treatments in both first season and planting date, while in the second planting date, the treatments of BA, cooling ,Bio rooting and untreated plants were recorded the highest values of dry matter percent ,however, in the second season there were no significant differences noticed among most treatments in both planting dates. As regards to inulin in total yield ,in the first season there were no significant differences among the under taken treatments .In the contrary, in the second season data in Table (7), showed that inulin content reached to the highest value with cooling treatment followed by Bio rooting treatment in the second planting date. As for the interaction effects between the two studied factors planting date and nursery pre-treatments on inulin content, results in Table (7) indicated that, there were no significant differences among all the treatments in inulin content of early yield in the two planting dates except, the BA treatment had the highest content in the first season and second date.

Table (7):Effect of planting dates and treatments of nursery on dry matter and inulin content in receptacle of globe artichoke plants in two seasons (2012 and 2013)

Treatment	Dry matter %				Inulin		(mg/100gm)	
	E Y (head)		T Y(head)		E Y(head)		T Y (head)	
P. d.	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
July15th	٣٣.٠٤a	٣١.٥٤a	22.16b	٢٠.٥٨a	٠.٨٤a	١.٦٥a	١.٤٨a	١.٤٠b
August15th	٣٢.٧٩a	٢٨.٢٨a	27.59a	٢٠.٠٤a	٠.٩٢a	١.٦٣a	١.٥٣a	١.٤٩a
Treat. Of nursery								
Control	29.90a	25.30d.	19.98b	17.98a	٠.٨٤b	١.٥٠b	1.57a	١.٣٤b
Bio. rooting	٣٧.٠٩a	34.80ab	٢٢.٩٣ab	21.27a	٠.٨٠b	١.٧٢ab	١.٣٨a	١.٣٨b
BA	33.88a	٢٨.٠٧cd	٢٧.١٠ab	٢١.٢٣a	١.١٠a	١.٧٣ab	1.42a	١.٣٢b
IBA	٣٥.٨٧a	٢٩.٧٨bc	25.28ab	19.20a	٠.٨٨b	١.٨٦a	١.٢٩a	١.٢٥b
Mycorrhiza	٣٠.٢٥a	٣٥.٠٤a	٢٤.٨١ab	٢٢.٦٥a	٠.٨٠b	١.٥٢b	١.٦٥a	١.٤١b
Cooling	٣٠.٥٠a	٢٨.٤٨cd	٢٩.١٦a	١٩.٥٤a	٠.٨٤b	١.٥٢b	1.71a	١.٩٨a
The interactions								
July15th								
Control	٣٨.٩٠a	٤١.٩٥a	٢١.٧٨bcd	٢٠.٣٧abc	٠.٨٥b	١.٥١a	١.٦٧a	١.٤٠cde
Bio. rooting	٣٨.٧٥a	٢٥.٥٦d	٢١.٤٢bcd	١٧.٠٤c	٠.٧٥b	١.٧٢a	١.٣٥a	١.١٣e
BA	٢٧.٥٧bc	٢٤.٤٧d	١٦.٧٥cd	٢٦.٠١ab	٠.٩٤b	١.٨٣a	١.٥٦a	١.٣٧cde
IBA	٣٦.٩٥ab	٢٤.٦٥d	١٥.٨٠d	١٥.١١c	٠.٨٩b	١.٨٩a	١.٣٥a	١.٢٣de
Mycorrhiza	٢٣.٦٨c	٣٧.٦٩ab	٢٧.٣٤abcd	٢٦.١٧a	٠.٨٠b	١.٥١a	١.٦٠a	١.٢٦de
Cooling	٣٢.٤٢abc	٣٤.٩٢bc	٢٩.٨٨ab	١٨.٨٢bc	٠.٨٣b	١.٤٥a	١.٣٤a	٢.٠٢a
August15th								
Control	٢٨.٨٦abc	٢٣.٦٥d	٢٨.٧٨abc	٢٢.١٨abc	٠.٨٤b	١.٥٠a	١.٤٧a	١.٢٩cde
Bio. rooting	٣٥.٤٤ab	٢٥.٠٣d	٢٤.٤٤bcd	٢١.٣٦abc	٠.٨٦b	١.٧٢a	١.٤٢a	١.٦٤bc
BA	٣٢.٢٣abc	٣١.٦٨c	٣٧.٤٥a	١٦.٤٦c	١.٢٦a	١.٦٤a	١.٨٦a	١.٢٧de
IBA	٣٤.٨٠ab	٣٤.٩١bc	٢٤.١٦bcd	٢٠.٨٥abc	٠.٨٨b	١.٨٣a	١.٢٤a	١.٢٦de
Mycorrhiza	٣٦.٨٣ab	٣٢.٣٩bc	٢٢.٢٩bcd	١٩.١٤abc	٠.٨٠b	١.٥٣a	١.٦٩a	١.٥٦cd
Cooling	٢٨.٥٧abc	٢٢.٠٥d	٢٨.٤٤abc	٢٠.٢٦abc	٠.٨٦b	١.٥٩a	١.٥١a	١.٩٤ab

EY=early yield of heads, TY=total yield of heads, P. d.=planting dates

Means having the same letter (s) in the same column are not significantly differ from each other according to Duncan ' s multiple tests at 5% level.

REFERENCES

Ahmed, A. M. A. and R.A.Abdel-monsief.(2006). Effect of VA mycorrhizal inoculation on growth ,yield and nutrient content of cantaloupe and cucumber under different water regimes Research Journal of Agriculture and Biological Science 2(6):503-508.

Alian, F. S. S. (2005). Response of globe artichoke to organic manure and mineral nitrogen levels, and bio stimulant treatments under sandy soil conditions. Ph.D. Thesis, Fac. Agric. Cairo Univ., Egypt

Angela, C., C., Ruta , I.,M. Fortunato , and G., De Mstro (2012). Influence of Mycorrhizal on the salt Tolerance of Artichoke Hybrid Seedlings. Journal of Agriculture Science and Technology,20:1071-1079.

A.O. A. C (2000). Official Methods of Analysis .13th Ed. Association of Official Chemists Washington DC. USA

Brutti, C.,Apostolo, N.M.,Ferraotti,S. A. Liorente. and B. E Krymkiewicz(2000) . Micropropagation of cynara scolymus.L employing cyclodextrins to promote rhizogenesis . Sci. Hort. 38:1-10.

Browne, R.D., C. G. Davidson, S. M. Enns, T. A. Steeve, and D. I. Dunstan(2001)
Foliar application of benzyladenine (BA) as a means to enhance shoot production for asexual propagation of young jack pine *(Pinus bankisana*. Lamb.) seedlings. New Forests 22: 229-237.

Cavallaro,V.Castiglione,G.Avola and E. Finocchiaro (2004) Influence of different substrates on the In Vitro Rhizogenesis Process of Early Artichoke[Cynara cardunculus L.subsp. scolymus(L.) Hegi] . Acta Hort. 660: 267 – 272.

El-Sayed, A. ;A. Gharib; S. Mansour; and S. Kh. H. Hasan (2007). Effect of some agriculture practices on yield and quality of globe artichoke (*Cynara scolymus* L.)under new reclaimed land.Agric. Res. J. Suez Canal Uni. V.7(2):43-56.

El-Abagy,H.M.H.(1993).Physiological study on growth ,yield and quality of artichoke Ph.D. Thesis Fac .Agric. Agric. Zagazig Univ.Egypt.

Fortunato, I. M., C., Ruta. A. Castrignano, and F. Saccardo (2005).The effect of mycorrhizal symbiosis on the development of micro propagated artichokes. Sci. Hort. 106: 472-483.

Gerakis, P.A., Markarian, D. and Honma, S. (1969). Vernalization of globe artichoke (*Cynara scolymus* L.) J. Amer. Sci. Hort. Sci.94:254-258.

Harly,J.L.and S.E.Smith., (1983).Mycorrhizal Symbiosis . New York, USA: Academic Press.

Harwood, R. R. and D. Markarian, (1968). Annual culture of globe artichoke (Cynara scolymus L.). I. Preliminary Report Proc. Amer. Soc. Hort. Sci. 92: 400-409.

Henny, R.J. (1986). Increasing basal shoot production in a non branching Dienffenbachia hybrid with BA. HortScience 21:1386-1388.

Hill, D. (2001): Management of yield using induced or natural vernalization. Conn. Agr. Exp. Sta. Bull.975.6pp.

Huang, Z., Zou, Z. He , Z. Zhang J. and J. Li, (2011). Physiological and morphological response of melon (Cucumis melo) seedlings to three Glomus species under water deficit . Plant Soil .339 :391-399.

Irene ,M. F., Ruta,C. , Castrignano.A, and F.Saccardo(2005) The effect of mycorrhizal symbiosis on the development of micropropagated artichokes Scientia Horticulturae 106 : 472-483 .

Kasim, Afaf T. M. Safaa A. A. Mansour and A. M. Abd El-Hameid(2003). Effect of some propagation practices on early, total yield and head quality of artichoke. Zagazig J. Agric. Res. 30:109-127.

Kelly, Y.C.(1969). Rooting hybrid rhododendron cutting . Granrs chron, 165:29 (c.a. Hort.Abstr., 40:1744,1979).

Mauca ,G. Onzalez,J. i. lahoz,G.,I,Santos, and A.,Garnica (2007).Temperature and planting dates of Blanca de Tudela in ebro Vallay. Acta Hort.730:351-356.

Mariateresa , C. Youssef,R. Franccesco , S. and G. colla (2005) . Annovative propagation system for large –scale production of globe artichoke transplants . part 1. Propagation system setup .Hort technology 15: (4)812-816.

Mauromicale, G. and Ierna, A. (1995). Effect of gibberellic acid and sowing date on harvest time and yields of seed-grown globe artichoke *(Cynara scolymus* L.)

Mauromicale, G.; A. Ierna, and V. Cavallaro . (2005). Effect of vernalization and gibberellic acid on bolting, harvest time and yield of seed- grown globe artichoke. Acta Hort. 681.243-250.

Agronomy 15:527-538.

Moustafa, S. S. (1969): Effect of method of propagation, planting date and spacing on the yield and quality of globe artichoke (*Cynara scolymus* L.) M.Sc. Thesis Fac. of Agric. Alex. Univ. Egypt.

Lopez , J.,Gonzalez, A., Vicente , F.E. Condes L.F.and J.A.Fernandez(2007) Artichoke production in the province of Murcia (SE Spain) Acta Hort.630:223-227

Rangarajan, A., A. I Betsy and V.C.Zeppelin (2000) Vernalization strategies to enhance production of annual globe artichoke . HortTechnology 10:585-588.

Pesti, N.O., Ombodi, A.Szocs, A.,Kassai,T. and J. ,Dimeny (2006). The effect of sowing dates and seedling state of advancement on the yield and bud quality of globe artichoke in Hungary. Acta Hort.660:

Snedecor,G. W.and W.G. Cochran (1980).Statistical methods. Iowa State Univ. Press, USA.

Sorial, M. E.; Abd El-Fattah, M. A. and I. M. Ghoniem (1998). Some attempts to change the production pattern of globe artichoke to meet the export requirement. II. Physiological change in plant growth. Biochemical composition, earliness and productivity of globe artichoke plants (*Cynarascolymus* L) following biofertilizer application. Annals of Agric. Sci. Moshtohr,36(2):801-825.

Temperini,O., and , F.Sccardo (2005).Artichoke :A New In Vivo Agamic Propagation Technique.Acta Hort. 681:391-395.

Wang, T. Y. (1990). Growth substance , light, fertilizer, and misting regulate propagation and growth of golden pothos. Hort Science. 25: 1602-1604.

Winton, A. L. and K. B. Winton (1958). The analysis of foods. Johan-Wiley and Sons, Inc. London, p. 857.

تـأثير بعـض معـاملات الانبـات ومواعيـد زراعـة المشـتل والحقـل علـى الخرشـوف ومتابعتها على صفات المحصول والجودة

شادية عبد اللاه إسماعيل –فاطمة سليمان سلامه
قسم بحوث البطاطس و الخضر خضرية التكاثر-معهد بحوث البساتين- مركز البحوث الزراعية

أجريـت هـذه الدراسـه فـى تجـربتين خـلال موسـمي٢٠١١-٢٠١٢ و ٢٠١٢ - ٢٠١٣ فـي المزرعة البحثية بقها محافظة القليوبية لدراسة تأثير بعض المواد التي تشجع على الإنبـات ومواعيد زراعة قطع الخرشوف والتي رشت بمركب البيوروتنج بمعدل ١٠سم/لتر اسبوعيا لمدة ٤٥ يوم بعد الزراعـة ،الـرش بمركـب بنزيل ادنين٢٠ ملجم /لتر اسبوعيا لمدة ٤٥ يوم،النقع في مركب إنـدول بيوتريك اسيد لمدة 30 دقيقة بتركيز ١٠٠ جزء في المليون ،التلقيح بثلاث سلالات من الميكروهيزا *Glomus etunictum*, *Glomus intraradices* and *Glomus monosporum* ، تعـريض قطـع الخرشـوف لدرجـة بـرودة ٥ درجـة مئويـة لمـدة أسـبوعين قبـل الزراعـه ، المعاملـة الكنترول بدون أي معـاملات. التجربـة الأولـى أجريت فـي المشتل فـي موعدي زراعـة ١ يونيـه و١ يوليه وعوملت بالمعاملات السابقة ثم نقلت للحقل المستديم بعد ٤٥ يـوم من الزراعة،أخذت البيانـات في المشتل كالتالي: إرتفاع النبات ،عدد الاوراق والخلفات بعد و نسبه البقاء بالمشتل بعد ٤٥ يوم من الزراعة ،التجربة الثانية زرعت ١٥ يوليو و١٥ أغسطس في الحقل لمتابعة النباتات التي عوملت في المشتل بالمعاملات السابقة حتى إنتاج النورات. سجلت البيانـات في الحقل علـى نسبه البقـاء فـى الحقل و المحصول المبكر والكلي للنورات كعدد وكذلك محصول النبات الواحد، وصفات الجودة للنورات للمحصول المبكر والكلي،وتركيز المادة الجافة والانيولين في التخت في كلا المحصولين المبكر والكلي.

أشارت النتائج الى أنة ١ - فى تجربه المشتل : زاد إرتفاع النبات معنويا في الموعد الثـاني للزراعة (١ يوليه) بعد ٤٥ من الزراعة، ولوحظ أن معاملة البنزيل أمينو بيورين بتركيز زادت من إرتفاع النبات معنويا تلاتها معاملة التبريد فى كلا الموسمين. لم يكن هنـاك فرق معنـوى لميعـادى الزراعه على عدد الخلفات بالنسبه للنبات ،وأعطت معاملة التبريد أفضل عدد للخلفات في المشتل و بالنسبه للتفاعل فقد أعطت معامله التبريد أعلى عدد من الخلفات فى كلا الميعادين مقارنـه بباقى المعاملات .لم يوجد تأثير معنوي لموعدي الزراعـة علـى عدد الاوراق بعد ٤٥ يوم من الزراعـة. وتشير النتائج الى أن معاملات المشتل بماده البنزيل أمينو بيورين أو بأستخدام مركب البيوروتنج أو تبريد القطع قبل الزراعه قد أدت الى تحسين النمو الخضري خلال مراحل النمو في المشتل في كلا موعدي الزراعة. ويلاحظ أن معامله الميكروهيزا ومركب البيوروتنج قد زادتا من عدد الجذور في الموعد الاول للزراعة في حين أن كان الرش بالبنزيل أمينو بيورين أفضل معاملة لطول للجذور مع الموعد الاول للزراعة، وقد تم الحصول على أعلى نسبه بقاءللنباتات بالمشتل عند معاملـه القطـع بالتبريـد قبـل الزراعـه أومعاملتهـا فـى المشـتل بمـاده البنزيـل أمينـو بيـورين أو بأسـتخدام مركـب البيوروتنج .

٢-فى تجربه الأرض المستديمه : سجل الميعاد الثانى للزراعه فى الأرض المستديمه (١٥ أغسـطس) زيـاده معنويـه فـى نسـبه بقـاء النباتـات وأعطـت المعاملـه بمركـب البيـوروتنج والتبريـد والميكروهيـزا ثـم البنزيـل أمينـو بيـورين أعلـى نسـبه بقـاء للنباتـات فـى كـلا الموسـمين علـى التوالـى. وسجلت أعلى نسب مئويه للبقاء فى موعد الزراعة الثانى مع كلا من المعـاملات التبريد والـرش بمركب البيوروتنج وكذلك الميكروهيزا .

وجـد أن الموعد الثـاني للزراعـة(١٥ أغسطس)قد أعطـى أعلـى عدد للنـورات للمحصـول المبكر وأيضا معاملات البنزيل أمينو بيورين أو مركب البيوروتنج زودت بمعنوية المحصول المبكر و حسنت من صفات الجودة، وقد اتضح أنه لا يوجد تأثير معنوي لموعدي الزراعة على المحصول الكلي وجودته، وكما وجد أن معاملة التبريد حسنت من المحصـول الكلـي للفدان و المحصـول الكلـي للنبات اما بالنسبة للوزن الطازج للتخت فقد زاد معنويا باستخدام معـاملات البنزيـل أمينـو بيـورين

أوالنقع في مركب إندول بيوتريك اسيد والميكروهيزا بينما تأثر قطر التخت باستخدام معاملة التبريد ، وجد أن الزراعة فى ١٥ أغسطس زادت محتوى التخت معنويا من المادة الجافة و الانيولين في المحصول الكلي، لوحظ أن معاملات المشتل الثلاثه الرش بالبنزيل أمينو بيورين, النقع في مركب إندول بيوتريك اسيد,والمعامله بالميكروهيزا زودت محتوى التخت من المادة الجافة و الانيولين في المحصول المبكر بينما معاملة التبريد زودت معنويا محتوى التخت من المادة الجافة والانيولين في المحصول الكلي. ولذا يمكن أن نوصي بزراعة قطع الخرشوف في ١ يونية بالمشتل ومعاملاتها بالرش بمركب البيوروتنج أو الرش بالبنزيل أمينو بيورين أو تبريد القطع قبل الزراعه حيث يؤدي ذالك الى زيادة المجموع الخضري في المشتل و نسبه البقاء فى كلا من المشتل والأرض وكذالك أدت هذه المعاملات بالاضافه معامله النقع فى الأندول بيوتريك أسيد الى زيادة المحصول المبكر والكلي وتحسين صفات الجودة لهما وكذلك زيادة محتوي المادة الجافة و الانيولين في كلا المحصولين المبكر والكلي.

Table (6):Effect of planting dates and treatments on quality parameters of globe artichoke in two seasons (2012 and 2013)

Treatments	F.H. FW (g)/ head		F.H. DM(cm)/head		Receptacle FW (g)		Receptacle DM (cm)	
P.d.	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
July15th	٢٤٤.٦٦a	٣٧١.٧٣a	٧.٤٥a	٧.٩٠a	٨٢.٨٦a	١١٩.١١a	٦.٢٩a	٦.٤٥a
August15th	٢٤٣.٩٤a	٣١٧.٨٠a	٧.٤٧a	٧.٣٥b	٦٩.٨٥a	٩٨.٤٦a	٦.٥٦a	٥.٧٢a
Treat. Of nursery								
Control	٢٣١.١٧bc	٣٣٠.٢٩a	٨.١٨a	٧.٤٤a	٩٠.٥٩a	٩٥.٧٢c	٦.٩٠a	٦.٤٥a
B. rooting	٢٣٩.١٢abc	٣٣٠.٤٠a	٧.٢٧b	٧.٥٩a	٦٥.٨٩b	١٢٥.١٩a	٥.٩٤c	٥.٦٨b
BA	٢٧٤.٢٣ab	٣٣٠.٩٥a	٧.٤١b	٧.٥٨a	٧٨.٧٥ab	١١٧.٨٧ab	٦.٧٥ab	٦.٢٤b
IBA	٢٧٧.٣٥a	٣٤٢.٤٣a	٧.٤٣b	٧.٨٠a	٧٤.٠٠ab	١٠٣.٢٥bc	٦.٦٥abc	٦.١٢ab
Mycorrhiza	٢٣٩.٢٠abc	٣٧٨.٩٣a	٧.٥٠b	٧.٧٤a	٨١.٨٥ab	١١٣.٤٠abc	٦.١٦bc	٥.٩٠ab
Cooling	٢٠٤.٧٤c	٣٥٥.٤٧a	٦.٩٦b	٧.٦٢a	٦٧.٠٥b	٩٧.٢٧bc	٦.١٧bc	٥.٦٢b
The interactions								
July15th								
Control	٢٣٣.٢٢bcd	٣٩١.٢٢a	٧.٦٣bc	٧.٧٧abc	٩٢.٧٨ab	١١١.٢٨ab	٦.٤٦ab	٧.٠٤a
B. rooting	٢٦٠.٤١abc	٣٧٣.٤٥ab	٧.٤٣bcd	٧.٩٠abc	٧٨.٧٢abc	١٣٣.٧٢a	٥.٨٣b	٥.٤٧bc
BA	٢٨٣.١٠ab	٣٣٥.٤٦abc	٧.٨٣b	٧.٦٨abc	١٠١.٣٣a	١٢٠.٤٦ab	٦.٧٠ab	٦.٢٤ab
IBA	٢٦١.٤٥abc	٣٧١.٠٤ab	٧.٧٦bc	٨.١١ab	٨٠.٣٥abc	١٣٣.٨٩a	٦.٦٠ab	٦.١٢b
Mycorrhiza	٢٤٦.١٩abcd	٣٨٩.٢١ab	٧.٤٣bcd	٨.٢٦a	٧٨.٧٤abc	١١٩.٥٣ab	٥.٩٦b	٥.٩٠bc
Cooling	١٩٣.٦٠d	٣٧٠.٠٠ab	٦.٦٢d	٧.٧١abc	٦٥.٢٣bc	٩٥.٧٧bcd	٦.٢٠b	٥.٦٢bc
August15th								
Control	٢٣٩.١١abcd	٢٦٩.٣٧c	٨.٧٣a	٧.١٢c	٨٨.٤٠ab	٨٠.١٦cd	٧.٣٣a	٥.٨٦bc
B. rooting	٢١٧.٨٤cd	٣٨٧.٣٤c	٧.١١bcd	٧.٢٨bc	٥٣.٠٧c	١١٦.٦٦ab	٦.٠٥b	٥.٨٨bc
BA	265.37abc	٣٢٦.٤٤abc	٧.٠٠cd	٧.٤٩abc	٥٦.١٦c	١١٥.٢٨ab	٦.٨٠ab	٥.٢٣c
IBA	٢٩٣.٢٥a	٣١٣.٨٣bc	٧.١٠bcd	٧.٤٩abc	٦٧.٦٥bc	٧٢.٦١d	٦.٧٠ab	٥.٦٥bc
Mycorrhiza	٢٣٢.٢١abcd	٣٦٨.٧ab	٧.٥٦bc	٧.٢٢bc	٨٤.٩٦abc	١٠٧.٢٨abc	٦.٣٦ab	٥.٧٩bc
Cooling	٢١٥.٨٩cd	٣٤٠.٩abc	٧.٣٠bcd	٧.٥٣abc	٦٨.٨٧bc	٩٨.٧٨bcd	٦.١٥b	٥.٩٢bc

FH=flower Heads, FW= Fresh Weight, DM= diameter, P. d.= planting dates

Means having the same letter (s) in the same column are not significantly differ from each other according to Duncan ' s multiple tests at 5% level.

Table (4):Effect of planting dates of nursery and treatment of nursery on early yield and flower head parameters of globe artichoke plants in two seasons

Treat.	Early yield		Flower head				Receptacle			
	No. of heads/Fed.		Fresh weight(g)		Diameter(cm)		Fresh weight(g)		Diameter(cm)	
P.d.nursery	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
July 15th	٦١١٦b	٧٣٦٦a	٢١٨.٥٢a	٢٤٠.٨a	7.06a	٧.١٩a	٥٣.٩٧a	٥٩.١٢a	٥.٤٢a	٥.٦٩a
August 15th	٨٤٢١a	٨٠٤٩a	١٨٨.٨٣a	١٩٧.٩٦a	6.55a	٦.٥٩a	٣٩.٧٧a	٤٦.٠٤b	٥.٠١a	٥.٢٢b
Treat. Of nursery										
Control	٤٩١٣e	٥٨٩٩d	١٥١.٢٥c	٢٠٦.٠٢ab	٧.٠٥a	٦.٧٣a	٤٤.٤٢ab	٤٦.٠٢ab	٥.١٢ab	٥.٤٠ab
P. rooting	٦٢٨٤d	٦٧٩٩c	٢٤٥.٥٠a	٢٤٨.٩٨a	٧.١٥a	٧.١٢a	٥٣.١١a	٦٤.٢٩a	٥.٥٨a	٦.١٨a
BA	٨٨١٥a	٩٠٩٩ab	٢١٠.٩٧ab	٢٢١.٤٢ab	٦.٨٧a	٦.٩١a	٥٤.١٩a	٥٣.٥٤ab	٥.٣١ab	٥.٥٩ab
IBA	٧٠٤٨c	٧٨٩٩b	٢١٠.٦٧ab	٢٢٦.٤٢ab	٦.٢٨a	٦.٨٨a	٤٧.٩٨ab	٥٤.٨٩ab	٥.٠٣ab	٥.٥٠ab
Microhyz	٨٢٧٥ b	٩٤٠٠a	١٨٨.٧٤bc	٢٠١.٥٢b	٦.٤٠a	٦.٥٤a	٣٦.٨٩b	٤٤.٨٩b	٤.٨١b	٤.٧٨c
Cooling	٨٢٧٥b	٧١٥٠c	٢١٤.٩٣ab	٢١٢.١١ab	٧.٠٨a	٧.١٤a	٤٤.٦٥ab	٥١.٨٤ab	٥.٤٥ab	٥.٢٧bc
The interactions										
July 15th										
Control	٤٣٢٦f	٥٨٠٠g	١٥٠.٩٣e	١٨٦.٩٦def	٦.٥٥ab	٦.٩٦abc	٤٧.٢٢b	٥١.٢٦ab	٤.٩٠bcd	٥.٦٠abcd
P. rooting	٥٣٧٥e	٦٤٠٠ef	٢٥٥.٠٥ab	٢٦٢.٩١ab	٦.٩٦ab	٦.٩٤abcd	٥٥.٣٩ab	٦٦.٦٧a	٥.٧٣ab	٦.٤١a
BA	٧٨٣٠c	٩٨٠٠b	٢٢٤.٧٠abc	٢٤٧.٢٩abcd	٧.١٥ab	٧.٢١abc	٧٠.٢٢a	٦٤.٣٣ab	٥.٧٠ab	٥.٨٣abc
IBA	٤٥٦٦f	٦٩٠٠de	٢٧٨.٣٦a	٢٨١.٧٦a	٧.٥٠a	٧.٧٠a	٥٣.١٢ab	٦٦.٣٥ab	٥.٩١a	٥.٩٢abc
Microhyz	٧٦٠٠cd	٨١٠٠c	٢١٠.٧٦bcd	٢١٥.٩١bcdef	٦.٩٠ab	٦.٩١abcde	٤٦.٥٠b	٤٩.٩٢ab	٤.٩٣bcd	٤.٨١d
Cooling	٧٠٠٠d	٧٢٠٠d	١٩١.٣٤cde	٢٥٠.٣٤abc	٧.٣٠ab	٧.٤١ab	٥١.٣٦b	٥٦.١٧ab	٥.٤٠abc	٥.٥٦abcd
August 15th										
Control	٥٥٠٠e	٦٠٠٠fg	١٥١.٥٦e	٢٢٥.٠٨abcdef	٧.٥٥a	٦.٥٠cde	٤١.٦٢bc	٤٠.٧٨ab	٥.٣٥abc	٥.٢١bcd
P. rooting	٧١٩٣cd	٧٢٠٠d	٢٣٥.٩٦abc	٢٣٥.٠٥abcdef	٧.٣٣a	٧.٣١abc	٥٠.٨٣b	٦١.٩٢ab	٥.٤٣abc	٥.٩٦ab
BA	٩٨٠٠ a	٨٤٠٠c	١٩٧.٢٤cde	١٩٥.٥٥cdef	٦.٦٠ab	٦.٦٢bcde	٣٨.١٦bc	٤٢.٧٥ab	٤.٩٣bcd	٥.٣٥bcd
IBA	٩٥٣٠ab	١٠٩٠٠a	١٤٢.٩٨e	١٧١.٠٩f	٥.٠٦c	٦.٠٦e	٤٢.٨٤bc	٤٣.٤٢ab	٤.١٦d	٥.٠٩bcd
Microhyza	٨٩٥٠b	١٠٧٠٠a	١٦٦.٧٣de	١٨٧.١٣def	٥.٩٠bc	٦.١٨de	٢٧.٢٧c	٣٩.٨٧b	٤.٦٨cd	٤.٧٦d
Cooling	٩٥٥٠ab	٧١٠٠d	٢٣٨.٥٢abc	١٧٣.٨٨ef	٦.٨٦ab	٦.٨٧abcde	٣٧.٩٣bc	٤٧.٥١ab	٥.٥٠abc	٤.٩٩cd

677 - 678 679