

Effect of Gibberellic Acid Application Times on Earliness and Production of A-106 Artichoke Cultivar in Antalya Ecologic Conditions

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Abstract: Artichoke is one of the important vegetable crops in Mediterranean countries including Turkey. In our country, while artichoke production was undertaken in İzmir, Bursa and Yalova until 10 years ago, its area of production has broadened to include southern cities such as Antalya and Muğla. As early artichoke production, especially in Antalya region, is profitable for farmers, demand for growing this crop has increased. The present study investigated the effect of gibberellic acid application times (0, 1, 2, 3 and 4) on earliness and production of A-106 artichoke cultivar. The plants were grown in West Mediterranean Agricultural Research Institute in 2007-2008. The results show that GA₃ applications are very effective to promote earliness in A-106 cultivar. it

Keywords: GA₃ application, time, artichoke, A-106 and earliness.

Introduction

Artichoke is a vegetable whose forebear is thistle and is included in *Cynara* genus in botanical classifying, which belongs to the Asteraceae family, and it is perennal, in rosetta shape. It is declared in literature that the home of this vegetable, which can be seen in Mediterranean basin, is middle and west Mediterranean and has firstly been consumed by the Romans in 1979 B. C. (Anonymous a 2008; Graifeirberg ve ark. 1995; Lanteri ve ark. 2001; Stamigna 2001; Hill 2001).

In our country artichoke is grown by vegetative propagation and especially in Aegean and Mediterranean regions with our standard types for a long time. However, taking more and early products from unit area has been the main objective, as the other branches of agriculture where the production cost increases day by day. In this context, our region, especially Antalya and neighbours, has many advantages in earliness as in many other kinds of fruit and vegetables. Until a few years ago, it wasn't possible to see other plantations that were established by other types than Sakız and Bayrampaşa. In the last years, the number of plantations that are established with hybrid artichoke cultivars that are produced by seed have increased. Production by seed has an important disadvantage, lateness, besides many important advantages like productivity, resistance to diseases (especially *Verticillium* spp. ve *Fusarium* spp.) and profitability (Macua ve ark. 2000; Gil ve ark. 2003; Calabrese ve ark. 2004; Bianco 2000).

The elimination of lateness has an importance in production by seed if artichoke is going to be grown in Mediterranean region of our country, especially in Antalya where earliness is of importance.

Artichoke needs vernalization 250 hours under 7 C to form a head (although changing from cultivar to cultivar). Foury ve Pecaut 1988; Welbaum 1994; Basnizki ve Goldschmidt 1994; Hill 2001). The effects of GA₃ applications in artichoke on earliness and productivity has been known and applied for a long time. It has been declared in many scientific works that GA₃ applications has taken the place of colding need for head forming in many cultivars (Gerakis ve ark., 1969; Snyder ve ark. 1971; Kocer ve Eser 1999; Miguel ve ark., 1997; Miguel ve ark., 2004; Ercan ve ark. 2004).

The effects of hormone applications on seed propagated artichoke cultivars depend on date of plantation, time of application, number of application, dosage of application, and cultivar. (Welbaum 1994; Schrader, 1992; Elia ve ark., 1994; Mauromicale ve Ierna 1995; Miguel ve ark., 1997; Calabrese ve Bianco 2000; Mauromicale ve Ierna 2000; Goreta ve ark., 2004; Eldin ve ark., 2007).

Mauromicale ve Ierna (2000) has decided that the head characteristics of Orlando and Sicilia artichoke cultivars change by hormon applications.

Calabrese (2000) examined the early productivity of 8 hybrid artichoke types which are produced by seed in Southern Italy. It has been decided that the period between seeding and harvest is 97-120 days. It is declared in the studies of these investigators that productivity changes according to cultivars between 1.75/2.20 ton/ha. These results show that artichoke types that are produced by seed can be grown in October-May like other types which are grown in early classical ways.

Material

In this study A-106 artichoke cultivar, which is included in *Cynara* genus which belongs to Asteraceae family, has been used as plant material. A-106 artichoke cultivar is a type which is early, has a low vernalization need, with much productivity, which form qualified heads, and has many purple bracte leaves.

This study was conducted between the years 2007-2008 in a artichoke plantation situated in West Mediterranean Agricultural Research Institute in Antalya-Turkey (36° 56' N, 30° 51' E).

Metod

In this research it is aimed to determine the most suitable GA₃ application time for A-106 artichoke for earliness. In this research 4th, 6th and 8th weeks after transferring to soil is selected as the first application time for vegetable development regulatory. 25 ppm GA₃ applications were made to the plants by spraying. Only water is sprayed to the plants that have been selected as the control group. In this study following criteria have been examined:

1. Number of days from transfer to soil until harvest (earliness)

Number of days from transferring the vegetables to soil until harvest is an important criteria in determining the effectiveness of the applications on earliness.

2. Head weight (g)

Differences among the applications are determined by weighing the heads at time of harvest.

3. Head length (mm)

Differences among the applications are determined by measuring the length of heads at time of harvest.

4. Head diameter (mm)

Differences among the application are determined by measuring the diameter of heads at time of harvest.

5. Productivity (kg/da)

Productivity in da is calculated in kg by the productivity per vegetable.

All application groups were laid out with four replications and 10 plants in each replicants in the randomized block experimental design. Data were subject to analysis of variance by SAS statistical program (SAS Institute, Version 7) and means were compared by LSD's (Least Significant Differences) test at 0.05 significance levels.

Results and Discussion

In this research, where the affects of GA₃ application times on A-106 artichoke cultivar on earliness, productivity and head quality is examined, it is determined that hormone applications have important affects on all criteria that have been examined, compared to the control vegetables with no applications.

Although depending on the application time of hormone, average 1,5 months of earliness is provided at the vegetables with applications. The earliest harvest at the GA₃ application made at the 4th week happened at the 98. day after transferring to soil. The latest harvest happened at 140. day at the control group with the plants with no hormone application. At other application times these periods were very close, between 100-110 days.

The effects of hormon application times on productivity is shown at Figure 1. As it can be seen in Figure 1, the effects of the applications are found statistically significant. The effects of application times on productivity changed between 1.12-1.88 t/da; the highest productivity was determined at the GA₃ application on the 4. week as 1.88 t/da, and it is followed by the application at 6. week and the control application at the 8. week. The effects of applications on productivity is found to be more successful in all applications than control. Our trial results are in accordance with many other investigators. In many studies where the effects of hormone application times on artichoke are examined, it is reported that hormone application times increase productivity significantly. (Esteva ve Ayala, 2004; Ercan ve ark. 2004; Gil ve ark. 1998; Goreta ve ark. 2004)

Besides, the effects of hormone application times on head quality (head weight, head width and length) are examined and the results are presented in Figure 2. The effects of the applications on the head quality are

different. As a result of the statistical evaluations it is determined that the all hormone application times have important effects on all quality criteria that are examined, compared to the control group. Furthermore, the effects of hormone application times on head quality (head weight, head width and length) are examined in this study and the results are presented at Figure 2. The effects of the applications made on head quality are different. For example, the highest head weight is found to be 423 g at the 4th week, the lowest head weight is 410 g at the heads at the control group. Head weight values determined at other hormone application times took place in the same group statistically with the 4th week applications. The highest value of head width was found in the heads with hormone applications on 4th week. The highest head height is found at the vegetables with hormone applications on 8th week. The effect of GA₃ applications on head length can be explained by the fostering of the GA's to the cells for growing.

In this study, where the effects of GA₃ application times on earliness, productivity and head quality of A-106 artichoke cultivar is examined, considering all the criteria investigated it can be said that the optimum GA₃ application time is the 4th week after transferring the vegetables to soil.

Application Time	Yield(tonnes/da)
Control	1.12 C
4.th	1.88 A
6. th	1.64 B
8. th	1.58 B
LSD ₅	0.18

Table 1. Effect of GA₃ Application Times on Yield (tonnes/da) of A-106 Artichoke Cultivar

Application Time	Head Weight (g)	Head Diameter (mm)	Head Length (mm)
Control	382 B	98.98 C	89.48 C
4.th	423 A	130.28 A	98.74 B
6. th	418 A	122.48 B	112.46 B
8. th	420 A	120.22 B	118.34 A
LSD ₅	22	8.42	6.32

Table 2. Effect of GA₃ Application Times on Head Quality of A-106 Artichoke Cultivar

References

- Anonymous, 2008. Artichoke-Spring Season. <http://www.mmdtkw.org>
- Basnızki Y. and E.E. Goldschmidt, 1994. Further Examination of Gibberelline A₃ Effects on Flowering of Globe Artichokes (*Cynara scolymus* L.) Under Controlled Environment and Field Conditions. *Isr. J. Plant Sci.* (42):159-166.
- Bianco V.V., 2000. Present situation and future potentials at artichoke in the Mediterranean basin. <http://www.area.ba.cnr.it>
- Calabrese N. And V.V. Bianca, 2000. Effect of Gibberellic Acid on Yield and Quality of Seed Grown Artichoke (*Cynara cardunculus* var. *Scolymus* (L.) Fiori). *Acta Hort.* 514:25-32.
- Calabrese N., E. De Palma and V.V. Bianca, 2000. Gibberellic acid and earliness of new seed propagated artichoke cultivars grown for four years (Abstract). IV. International Congress on Artichoke, October 17-21. Valenzani-Bari, Italy.
- Calabrese N., E. DE Palma and V.V. Bianca, 2004. Yields and quality of new commercial seed grown artichoke hybrids (Abstract). V. International Congress on Artichoke 5-8 may, 2003. Tudela-Navarra, Spain.
- Eldin A.S., W.H. Schnitzler, G. Nitz, A.M. Razin and I.I. El-Oksh, 2007. The Effect of Gibberellic Acid (GA₃) on Some Phenolic Substances in Globe Artichoke (*Cynara cardunculus* var. *scolymus* (L.) Fiori). *Scientia Horticulturae Volume 111, Issue 4*, 16 February 2007, Pages 326-329.
- Elia A., N. Calabrese and V.V. Bianco, 1994. Sowing Time, Gibberellic Acid Treatments and Cultivars of "Seed" Propagated Artichoke. *Acta.Hort.* 371:347-354.
- Ercan N., A.N. Onus, F. Ayar, M. Temirkaynak, A.S. Şensoy and E. Polat, 2004. Determination of optimum GA₃ concentrations and awaking irrigation time for globe artichoke (*Cynara scolymus* L. Cv. Sakız) grown in mediterranean region of Turkey. V. International Congress on Artichoke 5-8 may, 2003. Tudela-Navarra, Spain.197-203.

- Foury C., 2003. Common vegetables for seed and fruit. Chapter: Artichoke or globe artichoke and cardoon. <http://gears.tucson.ars.ag.gov>. (03.05.2008)
- Gerakis P.A., D. Markain and S. Honma, 1969. Vernalization of Globe Artichoke, *Cynara scolymus*. J. Amer. Hort. Sci. 94:254-258.
- Gil O.R., J.J. Macua and P. Arce, 1993. Diferentes ciclos de produccion en variedades de alcachofa de multiplicacion por semilla. Agricola Vergel 139 :379-380.
- Goreta S., L. Bucan and G. Duminic, 2004. Effect of Environment and Gibberellic Acid (GA₃) on Earliness and Yield of Globe Artichoke. V. International Congress on Artichoke 5-8 may, 2003. Tudela-Navarra, Spain.155-159.
- Graifeirberg A., L. Giustiniani, O. Temperini and M. Lipucci Di Paola, 1995. Allocation of Na, Cl, K and Ca within plant tissues in globe artichoke (*Cynara scolymus* L.) under saline-sodic conditions. Scientia Horticulturae 63 (1995) 1-10.
- Hill, D.E, 2001. Globe artichoke trials 1998, 2000 Management of yield using induced or natural vernalization. The Connecticut Agricultural Experiment Station, New Haven Bulletin 975, may 2001. 7 pages.
- Koçer, G. ve B. Eser, 1999. Köklü Dip Sürgünü Özellikleri ve GA₃ Uygulamalarının Enginarıda Verim Dağılımına Etkileri. Turkish Journal of Agriculture&Forestry. Türk Tarım ve Ormancılık Dergisi. 23(2): 325-332.
- Lanteri S., I. D. Leo, L. Ledda, M.G. Mameli and E. PORTIS, 2001. Rapd variation within and among populations of globe artichoke cultivar 'Spinosa Sardo'. Plant Breeding 120, 243-246.
- Macua J. I, L. Lahoz, A. Malumbres, J. Garnica, I. Urmeneta and A. Arrondo, 2000. Agricultural Behavior of Two Cardoon Varieties at Different Planting Dates in Navarra. V International Congress on Artichoke (abst.)
- Mauromicale G. and A. Ierna, 1995. Effects of Gibberellic acid and Sowing Date on Harvest Time and Yields of Seed-Grown Globe Artichoke (*Cynara scolymus* L.). Agronomie. 15:527-538.
- Mauromicale G. and A. Ierna, 2000. Characteristics of Head of Seed-Grown Globe Artichoke (*Cynara cardunculus* L. var. *scolymus* (L.) Fiori) as effected by Harvest Period, Sowing Date and Gibberellic Acid
- Miguel A., J.V. Maroto, B. Iranzo and S. Lopez, 1997. Acido Giberelico en alcachofa. Horticultura, 120:111-113. Agronomie 20: 197-204.
- Miguel A., C. Baixauli, J.M. Aguilar, A. Giner, J.V. Maroto, S. Lopez, A San Bautista and B. PASCUAL, 2004. Gibberellic Acid Concentrations in Seed Propagated Artichoke. V. International Congress on Artichoke 5-8 may, 2003. Tudela-Navarra, Spain.167-172.
- Schrader W.L., 1992. Growth Regulator Effects on Earliness and Yield in Artichokes Grown as Annuals from Seed. HortScience. 27:643.
- Snyder M.J, N.C. Welch and V.E. Rubatzky, 1971. Influence of Gibberellin on Time of Bud Development in Globe Artichoke. HortScience, 6 (5):484-485.
- Stamigna C., G. Pandozy, P. Crino and F. Saccardo, 2001. Male-sterility in Artichoke (*Cynara scolymus* L.) (Abstract). Proceedings of the XLV Italian society of Agricultural Genetics SIGA Annual Congress. Salsomaggiore Terme, Italy-26/29 September 2001.
- Welbaum, G.E., 1994. Annual Culture of Globe Artichoke from Seed in Virginia. HortTechnology. 4 (2):147-150.