

A Study on the Adaptation of Some Anise (*Pimpinella anisum* L.) Population to Ankara Conditions

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Abstract: This study was carried out at the Field Crops Department, Faculty of Agriculture, University of Ankara during the years of 2000-2001. The aim of this research was to adapt some anise populations (Göhlisar, Karamanlı, Tefenni, Yeşilova) to the Ankara conditions the four different anise populations and sowing times were studied. The field trials were arranged in split plot design with four replications, anise populations were main plots while sowing times were sub plots. According to the results of this research, average value were as follows, plant height 44.7-50.2 cm, seed yield 48.5-81.8 kg/da, biological yield 190.3-352.7 kg/da, branch number 5.61-7.20, 1000 seed weight 4.01-5.46 g and essential oil ratio 2.09-3.11 %. Regarding the seed yield, the highest values were obtained from Karamanlı and Göhlisar populations.

Key Words : anise, *Pimpinella anisum*, sowing time, population, seed yield

Bazı Anason (*Pimpinella anisum* L.) Populasyonlarının Ankara Koşullarına Adaptasyonu Üzerine Bir Araştırma

Özet: Bu araştırma Ankara Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü deneme tarlası ve laboratuvarlarında 2000-2001 yıllarında yürütülmüştür. Bu çalışmada bazı anason populasyonlarının (Göhlisar, Karamanlı, Tefenni, Yeşilova) Ankara koşullarına adaptasyonu amaçlanmıştır. Çalışmada 4 anason populasyonu (*Pimpinella anisum*) ve 4 farklı ekim zamanı kullanılmıştır. Her iki yılda da denemeler tesadüf bloklarında bölünmüş parseller deneme desenine göre dört tekrarlanmalı olarak kurulmuştur. Ana parsellere anason populasyonları, alt parsellere ekim zamanları yerleştirilmiştir. Araştırma sonuçlarına göre ortalama değerler şu şekilde bulunmuştur: Bitki boyu 44.7-50.2 cm, tohum verimi 48.5-81.8 kg/da, biyolojik verim 190.3-352.7 kg/da, dal sayısı 5.61-7.20 adet, bin tohum ağırlığı 4.01-5.46 g ve uçucu yağ oranı % 2.09-3.11. En yüksek tohum verimi değerleri Karamanlı ve Göhlisar populasyonlarından elde edilmiştir.

Anahtar Kelimeler: anason, *Pimpinella anisum*, ekim zamanı, populasyon, tohum verimi

Introduction

Anise (*Pimpinella anisum* L.) is an annual aromatic crop, belonging to the Apiaceae (*Umbelliferae*) family. Genus *Pimpinella* contains 23 species and 8 of them are endemic in Turkey. *Pimpinella anisum* is one of the most important species, which grows in different regions of Turkey (Davis 1972). Anise is native to the Middle East and it was known in ancient Egypt (Hemphill and Hemphill 1988).

Anise is cultivated in Turkey for domestic consumption and export with planting area of about 21.000 ha and annual seed production 11.000 tons in 2001 (Anonymous 2001). In the world, important producer countries of anise are India, Mexico, Egypt, China, Spain, Italy, Germany, France, Syria, Bulgaria and Tunisia (Reineccius 1994).

The Romans discovered that the anise seeds and other aromatic spices helped the digestion and they used it an ingredient of a special cake. The people of Asia Minor Greek found it for many medicinal applications (Owyer and Rattray 1997). *Pimpinella anisum* is primarily grown for its seeds that are currently used for flavoring. The essential oil of anise seeds also valuable in perfumery and in medicine. In Turkish folk medicine, this plant, especially its

seeds have been used as appetizer, diuretic and tranquillizer. Especially, this plant is extensively used in beverage production in Turkey (Baytop 1984, Gülçin et al. 2003).

Anise is cultivated mostly in the provinces of Burdur, Denizli, Afyon, Antalya and Bursa in Turkey (Anonymous 2000). The purpose of the present study was to adapt some anise populations to Ankara conditions and similar ecologies.

Materials and Methods

This research was carried out in the experimental field and laboratories of the Field Crops Department, Faculty of Agriculture, University of Ankara in the growing seasons of 2000 and 2001. Seed materials were collected from Göhlisar, Karamanlı, Tefenni and Yeşilova districts belong to Burdur province. Burdur is the most important province in which anise is cultivated in Turkey.

The experiments were designed on the basis of split plot of randomized blocks design with four replications in this study, four anise populations (Göhlisar, Karamanlı,

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Tefenni and Yeşilova) and four different sowing times were used as experimental factors. Sowing times were arranged at intervals of two weeks and first sowing was performed at the beginning of March. Experiments were watered two times in both years but no fertilizer was applied. Planting rate was 2 kg/da. Each populations were planted in a five-row plot that was 3 m long with 30 cm between rows. At the harvesting time, the following traits were observed: plant height, seed yield, biological yield, branch number, 1000 seed weight and essential oil ratio. Essential oil content was determined by using the water distillation method. All results by characters were subjected to analysis of variance and Duncan's Multiple Range Test was performed in order to find differences among the factors (Yurtsever 1984).

Results and Discussion

The results of plant height, seed yield, biological yield, branch number, 1000 seed weight and essential oil ratio were presented in Table 1 and Table 2.

Plant height: The average plant height values ranged between 44.7-50.2 cm. The highest value was measured in combination of ST₁ x P₄ while the lowest was ST₄ x P₄ (Table 1). There was no significant difference among average sowing times and populations. However, the maximum plant height was recorded in first sowing time (49.3 cm) and in both populations of Gölhisar and Karamanlı. Hemphill and Hemphill (1988) and Dwyer and Rattray (1997), reported similar data as between 45-60 cm and 30-60 cm, respectively.

Seed yield: There were significant differences among the seed yields of populations and sowing times. Also an interaction between two factors was statically important. Regarding interaction, the highest value with 81.8 kg/da was obtained in ST₁ x P₂ combination whereas the lowest seed yield was in ST₄ x P₃ (48.5 kg/da) (Table 1). The nine different groups were obtained statically. Seed yield values varied between 52.9 kg/da (ST₄) and 72.1 kg/da (ST₁) in sowing times while it was changed between 56.3 kg/da (P₃) and 67.4 kg/da (P₂) in populations. The results showed that delaying the sowing time decreased the seed yield. The results showed similarities with the data of Maheshwari et al. (1984) and Gangrade et al. (1989), reported 50.1 kg/da and 80.4 kg/da seed yield, respectively.

Biological yield: The average biological yield changed between 190.3-352.7 kg/da (Table 1). The highest value was in ST₁ x P₄ and the lowest was in ST₄ x P₁. There was only significant difference among the sowing times. Maximum biological yield was determined in the first sowing time with 342.5 kg/da whereas the minimum value was recorded in the fourth sowing time with 201.5 kg/da. There was no significant difference among the populations. Arslan et al. (1999) reported the average values of 169.8-237.5 kg/da lower than our data.

Branch number: The highest branch number with 7.20 was measured in the combination of ST₄ x P₂ while the lowest value was 5.61 in ST₂ x P₄ (Table 2). Significant differences were observed in terms of branch number among the sowing times and three groups were formed.

Table 1. Comparison of plant height, seed yield and biological yield values

Sowing time x population	Plant height (cm)			Seed yield (kg/da)			Biological yield (kg/da)			
	2000	2001	average	2000	2001	average	2000	2001	average	
ST ₁ *	P ₁	51.2	47.7	49.5	71.3	61.6	66.4 cde**	350.6	317.6	334.1
	P ₂	51.5	46.5	49.0	87.0	76.5	81.8 a	345.6	341.8	343.7
	P ₃	51.5	46.0	48.7	72.0	66.5	69.3 bcd	334.4	344.6	339.5
	P ₄	52.7	47.5	50.2	80.7	61.5	71.1 bcd	315.0	390.4	352.7
ST ₂	P ₁	50.7	43.1	46.9	96.7	56.0	76.3 ab	296.7	250.1	273.4
	P ₂	51.7	44.9	48.3	78.7	66.2	72.4 bc	253.3	250.1	251.7
	P ₃	52.2	41.2	47.0	63.3	51.2	57.3 fgh	257.2	230.0	243.6
	P ₄	52.7	39.7	46.2	75.3	51.1	63.3 def	248.3	235.1	241.7
ST ₃	P ₁	50.7	46.2	48.5	65.3	52.2	58.7 efgh	258.9	205.3	232.1
	P ₂	50.7	46.8	48.8	68.3	52.2	60.3 efg	271.1	235.7	253.4
	P ₃	50.5	46.1	48.3	58.0	42.2	50.1 hl	243.9	283.7	263.8
	P ₄	52.2	43.9	48.1	48.8	62.1	55.5 fghl	253.9	241.7	247.8
ST ₄	P ₁	48.7	46.4	47.6	59.7	52.0	55.9 fghl	190.6	190.0	190.3
	P ₂	49.2	43.7	46.5	63.3	47.1	55.2 fghl	218.3	210.1	214.2
	P ₃	49.5	43.3	46.4	50.1	47.0	48.5 l	200.6	200.0	200.3
	P ₄	48.5	41.0	44.7	58.1	46.0	52.0 ghl	201.1	201.1	201.1
Average of sowing times	ST ₁	51.7	46.9	49.3	77.8	66.5	72.1 a	336.4	348.6	342.5 a
	ST ₂	51.9	42.4	47.1	78.5	56.2	67.3 a	263.9	241.3	252.6 b
	ST ₃	51.1	45.8	48.4	60.1	52.2	56.1 b	256.9	241.7	249.3 b
	ST ₄	49.0	43.6	46.3	57.8	48.0	52.9 b	202.6	200.4	201.5 b
Average of population	P ₁	50.4	45.9	48.1	73.3	55.4	64.3 a	274.2	240.6	257.4
	P ₂	50.8	45.5	48.1	74.3	60.5	67.4 a	272.1	257.2	265.7
	P ₃	50.9	44.3	47.6	60.9	51.7	56.3 c	259.0	264.6	261.8
	P ₄	51.6	43.1	47.3	65.7	55.2	60.5 b	254.6	267.0	260.8

* ST: Sowing time, P₁: Gölhisar, P₂: Karamanlı, P₃: Tefenni, P₄: Yeşilova

** Mean value followed by the difference letters are significant at the 0.05 level

Table 2. Comparison of branch number, 1000 seed weight and essential oil ratio values

Sowing time x population		Branch number			1000 seed weight (g)			Essential oil ratio (%)		
		2000	2001	average	2000	2001	average	2000	2001	average
ST ₁ *	P ₁	6.00	7.04	6.52	5.03	4.89	4.96 a	2.33	2.47	2.40
	P ₂	5.75	6.69	6.22	5.56	5.30	5.43 a	2.53	2.51	2.52
	P ₃	5.25	7.25	6.25	5.62	5.30	5.46 a	2.65	2.63	2.64
	P ₄	6.50	6.50	6.50	5.50	4.50	5.00 b	2.83	2.71	2.77
ST ₂	P ₁	6.25	5.57	5.91	4.75	3.99	4.37 cd	3.20	2.18	2.69
	P ₂	6.50	6.22	6.36	4.96	4.20	4.58 c	3.78	2.44	3.11
	P ₃	6.25	6.71	6.48	4.81	3.99	4.40 cd	3.75	2.17	2.96
	P ₄	6.25	4.97	5.61	4.75	4.21	4.48 c	3.68	2.52	3.10
ST ₃	P ₁	7.00	7.10	7.05	5.01	3.79	4.40 cd	3.08	2.50	2.79
	P ₂	6.50	6.40	6.45	4.68	4.00	4.34 cde	3.58	2.44	3.01
	P ₃	6.00	6.68	6.34	4.71	3.59	4.15 def	3.10	2.54	2.82
	P ₄	6.50	6.50	6.50	4.22	3.80	4.01 f	3.75	2.35	3.05
ST ₄	P ₁	7.50	6.64	7.07	4.87	3.69	4.28 cdef	2.08	2.10	2.09
	P ₂	7.50	6.90	7.20	4.80	4.06	4.43 cd	2.55	2.09	2.32
	P ₃	7.75	6.09	6.92	4.43	3.69	4.06 ef	2.10	2.70	2.40
	P ₄	6.75	6.79	6.77	4.96	3.60	4.28 cdef	2.40	2.12	2.26
Average of sowing times	1	5.88	6.86	637bc**	5.43	4.99	5.21 a	2.58	2.58	2.58 b
	2	6.31	5.87	6.09 c	4.82	4.10	4.46 b	3.60	2.34	2.97 a
	3	6.50	6.66	6.58 ab	4.65	3.81	4.23 b	3.38	2.46	2.92 a
	4	7.38	6.66	6.99 a	4.76	3.76	4.26 b	2.28	2.26	2.27 c
Average of population	1	6.69	5.59	6.64	4.91	4.11	4.51 b	2.67	2.31	2.49 b
	2	6.56	6.56	6.56	5.00	4.38	4.69 a	3.11	2.37	2.74 a
	3	6.31	6.69	6.50	4.89	4.15	4.52 b	2.90	2.51	2.71 a
	4	6.50	6.20	6.35	4.86	4.02	4.44 b	3.16	2.44	2.80 a

* ST: Sowing time, P₁: Gölhisar, P₂: Karamanlı, P₃: Tefenni, P₄: Yeşilova

** Mean value followed by the difference letters are significant at the 0.05 level

However, differences among the populations values were low. Our results showed similarities with the data of Bayram (1992), recorded 6.51-7.90 branch number per plant.

1000 seed weight: Statistically, there were significant differences among the sowing times, population and interaction of sowing times x populations (ST x P). The average values changed between 4.01-5.46 g. The maximum data was in ST₁ x P₃ while the minimum value was in ST₃ x P₄ (Table 2). First sowing time had the highest 1000 seed weight with 5.21 g while population 2 had the highest value with 4.69 g. These results were higher than the data of Otan et al. (1991) (3.18-3.75 g) and Bayram (1992) (2.37-2.65 g).

Essential oil ratio: There were significant difference among the sowing times and populations. The interaction between sowing times and populations was not found important, statically. Essential oil ratios ranged between 2.09-3.11 %. The highest ratio was recorded in ST₂ x P₂ when the lowest ratio was in ST₄ x P₁ (Table 2). In sowing times, it was between 2.27-2.97 % and in populations, it was between 2.49-2.80 %. Similarly with our results Gangrade et al. (1989) reported that essential oil ratio was higher in earlier sowing. Melchion and Kastner (1974) and Kevseroğlu (1982) recorded similar data with 2.3 % and 2.10-2.83 %, respectively.

In conclusion, anise is cultivated mostly in the provinces of Burdur, Denizli, Afyon, Antalya and Bursa. The results of this results showed that anise can be cultivated in Ankara and similar conditions with irrigation application. Average anise seed yield is about 60 kg/da in

Turkey. In this study, especially earlier sowing time, seed yield was obtained more than average of Turkey.

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