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YIELD AND SOME MORPHOLOGICAL CHARACTERISTICS OF CAPER (*CAPPARIS SPINOSA* L.) POPULATION CULTIVATED AT VARIOUS SLOPES IN AEGEAN ECOLOGICAL CONDITIONS*

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Abstract

This study was carried out to determine the relationship between ecological conditions and caper bud production and the percentage distribution in calibre classes of caper buds to get information about caper bud yields and some morphological characteristics like number of branches and branch lenghts of caper (*Capparis spinosa* L.) population cultivated in Menemen ecological conditions on various slopy area (3.5% and 8%) for two years.

Upto 79% of total production of caper bud was obtained when maximum temperatures (40.8°C and 41.1°C) occur and rainfall is absent (0 mm). The calibre classes of 0-7 mm were 38.64% in Menemen and a five-day average picking interval helped to obtain bud diameters below 11 mm. Upto 96% of the plants at first (3.5%) and 88% plants at second slope (8%) produced buds. The stem lenghts increased steadily upto 180 cm in second year at 3.5% slopy area. Upto 16% of the plants at the first slope (3.5%) and 4% of the plants at second slope (8%) had more than 7 branches per plant.

Introduction

Caper, a perennial, winter-deciduous shrub native to Mediterranean region, grows widely at various regions of the world. Its immature flower buds, semi-mature fruits and young tender shoots with small leaves are pickled for pharmacological and cosmetic fields but especially are used as a condiment (Kara *et al*., 1996; Anonim, 1997; Alkire, 1998; Riviera *et al*., 2003). In order to use it as a condiment, caper buds are sorted into different sizes, based on diameter, ranging from 7 to 17 mm. Best quality buds are the smallest ones and these are especially preferred. Barbera & Lorenzo (1991) observed in Mazara, Italy that 15.83% of caper buds were obtained from 0-7 mm calibre class and from picking intervals of 7 days. The length of picking intervals are strongly associated with quality and depend greatly on the weather conditions.

Caper favours a rainy spring and a dry, hot summer with intense sunlight where temperature exceeds 40°C and average rainfall is 350 mm during spring and winter season (Barbera & Lorenzo, 1984). Moreover, Trewartha & Trewartha (2005), found a positive correlation between high temperatures and caper bud yields. Caper is also effective at controlling soil erosion with its thick, deep root system and dense canopy. These features makes caper suitable to grow on arid, degraded, steep rocky areas, slopy hills and on sandy, loamy soils with nutrient deficiency (Pugnaire & Esteban., 1991; Özgüven *et al*., 2004). Ölmez (2001) cultivated caper on a 3% slopy area and found maximum 38.2 cm branch lenght from one-year old plants and 56.1 cm from two-year old ones. In addition, he reported maximum 3 branches from individual plants.

*This study is part of Zehra Aytac's M.Sc. Thesis

Certain species and varieties of caper have been cultivated in Mediterranean region (Luna & Perez, 1985; Barbera & Lorenzo, 1991) but most of the traditional and commercial uses in the world depend on wild caper populations (Riviera *et al*., 2003). Caper yields within the first year but economic production starts at third year (Barbera & Lorenzo, 1984). In the study of Barbera & Lorenzo (1991), caper buds per plant varied from 600 g to 1300 g. Meanwhile, Trewartha & Trewartha (2005), achieved approximately on average 28 g buds from one-year old plants and 185 g per plant from two-year old ones. Branch lengths of caper plants were reported between 147-211 cm (Barbera & Lorenzo, 1991).

This study was carried out to determine the relationship between ecological conditions and caper bud production; to get information about caper bud yields and some morphological characteristics i.e., number of branches and branch lengths of caper (*Capparis spinosa* L.) population cultivated in Menemen, Izmir, Turkey on various slopy area (3.5% and 8%) for two years. The percentage distribution in calibre classes of caper buds with an average picking interval of five days was also observed.

Materials and Methods

Caper seedlings were produced from seeds of the population of *Capparis spinosa* in Menemen and transplanted fallowing year to the experimental field of Aegean Agricultural Research Institute, Menemen, Izmir, Turkey in April 1997. The observations were carried out in 1997 and 1998 in two growing seasons. The study was set up on a slopy area. The slope ratio of the first block was 3.50% (first slope) whereas the second was 8% (second slope). The experimental plot was fertilized before transplanting and plants were irrigated three times each year during the growing season.

Menemen, where sub-arid Mediterranean climate conditions occur, is around the sea level at an altitute of 10 m and is located in Aegean region. The yearly average air temperature is 16.9^{o}C. Summers are warm and dry while winters are mild and rainy. Yearly rainfall average is 550 mm. The monthly rainfall and average temperatures in 1997 and 1998 of the growing season are presented in Table 1.

The soil structure of the research area was clay-loamy, low in organic matter (1.203%) and moderate for $CaCO_3$ (8.213%). Total salt was 0.123%, N, P, K content in soil was 0.103, 2.313 and 493.3 ppm respectively.

Data was collected for flower bud yields per plant, the branch length (cm) and the number of branches of 80 individual plants at first year (1997) and 50 plants at the second year (1998) beginning each year at the second week of June untill the end of August. After each harvest, caper buds were sorted into the different sizes based on bud diameter. From the data above weekly production of capers as percentage of total production and the percentage distribution of caper buds in calibre classes at the end of the harvest season has also been examined. Percentage distribution of caper bud yields, branch lenghts and number of branches per plant have been observed and compared between one (first year) and two year-old plants (second year) and between the plants cultivated on 3.5% (first slope) and 8% (second slope) slopy areas.

Table 1. Monthly temperature and rainfall datas of caper in Menemen during growing season.

Months	Temperature (^{o}C)			Rainfall (mm)		
	Normal*	1997	1998	Normal*	1997	1998
May	19.9	20.3	18.2	27.8	20.00	79.5
June	24.6	23.1	24.4	6.4	-	28.5
July	26.8	26.9	27.3	3.0	-	14.5
August	26.1	23.6	27.1	3.6	1.75	-
September	22.2	20.0	22.1	9.7	-	47.25
October	17.1	16.9	17.3	31.9	64.50	39.5

*Long-term average, (1954-1998).

Table 2. Percentage distrubition in calibre classes at the end of the harvest season.

Calibre class (mm)	Percentage distribution of caper buds (%)
0-7	38.64
7-8	19.30
8-9	27.90
9-11	16.13

Average picking interval: 5 days

Results and Discussion

Understanding the relationships between ecological conditions (temperature, rainfall) and caper bud production helps to figure out suitable picking intervals to obtain smaller and more valuable buds. The results of weekly bud production are shown in figure 1 as percantages of the final production. Maximum temperature and rainfall distribution during the growing seasons are also presented at the same figure. Bud production begun at the first week (second week of June) and reached to peak point at the sixth week (mid-July) with 23% and seventh week (end of July) with 24% of the total production and decreased gradually after seventh week. Most of bud production was obtained between 5 th. (second week of July) and 9 th. week (first week of August) with 79% of total production. Barbera & Lorenzo (1984) and Rhiopoulou & Psaras (2003) reported that caper plants continue to develop during the prolonged summer drought. As it is seen on Figure 1, bud production increased when maximum temperatures (40.8^{o}C and 41.1^{o}C) occur and rainfall was absent (0 mm). Barbera & Lorenzo (1991) and Trawartha & Trawartha (2005) also stated that there is an increase of bud production at the beginning of the growing season and greatest fertility during hottest periods.

The shorter the picking intervals the smaller the caper buds. The smallest bud size refers to the best quality group. In this study the average picking intervals were 5 day in order to obtain smaller caper buds. Table 2 shows the percentage distribution of caper buds which divided into classes by diameter of total production. As it can be seen in the Table, the calibre classes of 0-7 mm were mostly present 38.64% in Menemen and a five-day average picking interval helped to obtain bud diameters below 11 mm. The results were higher than the results of Barbera & Lorenzo (1991), because their average picking interval was longer i.e., 7 days.

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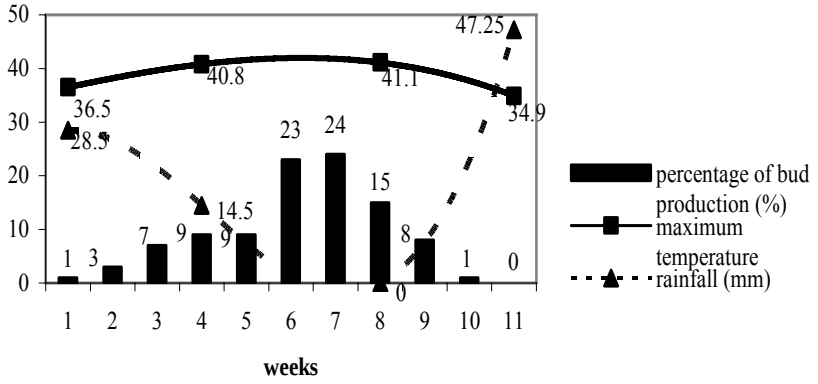
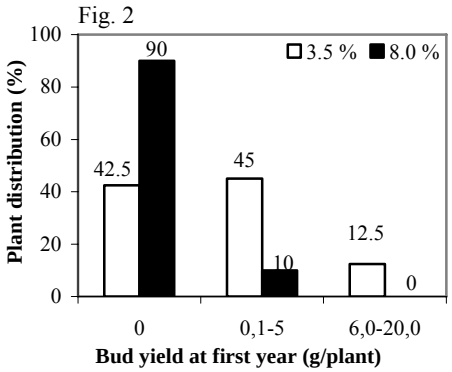
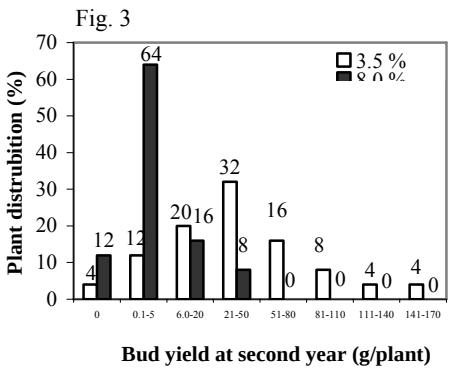


Fig. 1. Weekly production of caper buds as percentage of total production.





Figs. 2. and 3. Distribution of caper bud yields at various slopes (3.5 % and 8 %) at first year (1997) and second year (1998).

Figs. 2 and 3 show the distribution of bud yield between slopes in the first and the second year. In the second year (1998), bud production increased steadily, as compared to the first year (1997) due to its perennial habit, 96% of the plants at the first (3.5%) and 88% plants at the second slope (8%) produce caper buds (Fig. 3). Bud yields were higher at first slope (3.5%) than the second (8%), 32% of the plants at the first slope and 8% of the plants at the second slope produced between 21-50 g buds per plant (Fig. 3). Normally, as the slope increases, water runoff occurs more quickly and infiltration decreases, so the plants at the top can not receive enough water than the plants at the bottom. In addition to that, the nutritional uptake becomes limited. But as it was stated above 88% of the plants at the second slope (8%) produce caper buds, thus this is a very important data to control erosion on slopy areas. Pugnaire & Esteban (1991) and Özgüven *et al*., (2004) also stated that caper grows and yields on slopy hills and steep areas.

Branch lengths are related to bud production. Buds form while branches continue to develop. Branch lengths at two slopes are shown in Figure 4 and 5 in first and second year. Branch lengths increased steadily up to 180 cm in second year especially at the first slope. The second year 64% of the plants at the first slope and 34% of plants at the second slope varied between 91-150 cm.

Fig. 4

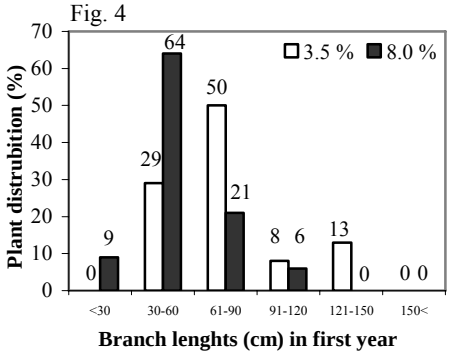
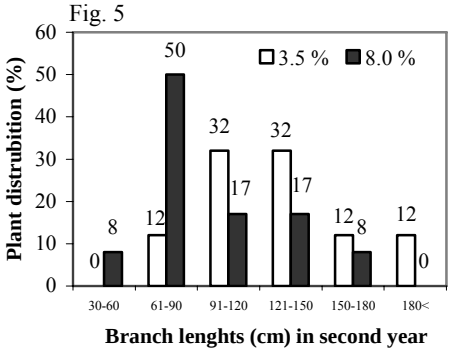


Fig. 5



Figs. 4. and 5. Distribution of caper branch lenghts at two different slopes (3.5% and 8%) at first year (1997) and second year (1998).

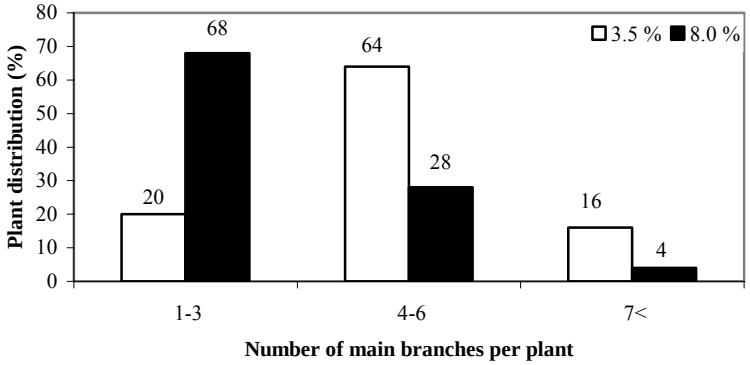


Fig. 6. Distribution of the number of main branches in the population in the second year (1998).

The number of main branches in the population varied mainly between 1-7. As it can be seen in Figure 6, 16% of the plants at the first slope and 4% of the plants at second slope (8%) has more than 7 main branches per plant. Both results given above were higher than the results of Ölmez (2001).

The results stated above will be very helpful to understand the vegetative and productive characteristics of one-year and two-year old caper plants on slopy areas. The length and the number of branches increases when slope rate decreases. But it is obvious that cultivating caper on slopy hills will help to prevent soil erosion because as it was stated above, branch lengths reached up to 180 cm and more than 7 branches per plant develop at the second year on 8% slopy area. Furthermore a 5 day average picking interval helped to obtain the smallest sized caper buds. In adition to this, most of bud production was obtained between the second week of July and the first week of August with 79% of total production when maximum air temperatures occurs. This and further studies will help researchers to collect more information about the vegetative and productive characteristics of *Capparis spinosa* L., and to identify biotypes from local populations.

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References

Alkire, B; 1998. Capers. http:\\www.newcrop.hort.purdue.edu/newcrop/cropfactsheets/caper.html.

Anonymous. 1997. Kapari T.C. Orman Bakanlığı Ağaçlandırma ve Erozyon Kontrol Müdürlüğü, Çeşitli Yayınlar Serisi No:2, Ankara.

Barbera, G. and R. Di Lorenzo. 1984. The caper culture in Italy. *Acta Horticulturae*, 144:167-171.

Barbera, G. and R. Di Lorenzo. 1991. Observations on *Capparis* populations cultivated in Sicily and on their Vegetative and productive behavior. *Agr. Med*., 121: 32-39.

Kara, Z., F. Ecevit and S. Karakaplan. 1996. Toprak Koruma Elemanı ve Yeni bir Tarımsal Ürün Olarak Kapari (*Capparis* spp.). *Tarım İlişkileri Sempozyumu Bildir Kitabı*, 919-921 s.

Luna, F. and M. Perez. 1985. La Taperena Alcappara Cultivo y Appovechamiento Publ.de Ext.Agraria Coro Zon de Maria. 8. 28002 Madrid.

Ölmez, Z. 2001. *Capparis ovata* Desf (Kapari)'nin fidanlık tekniği ve Artvin yöresinde plantasyon denemeleri. Karadeniz Teknik Üniversitesi. Doktora Tezi.

Özgüven, M., S. Sekin, B. Gürbüz, N. Şekeroğlu, F. Ayanoğlu and S. Erken. 2004. Tütün, Tıbbi ve Aromatik Bitkiler Üretimi ve Ticareti. Türkiye Ziraat Mühendisliği Teknik Kongresi. 3-7 Ocak 2005.TMMOB Ziraat Mühendisleri Odası.s: 492-494.

Pugnaire, F.I. and E. Esteban. 1991. Nutritional adaptations of caper shrub (*C. ovata* Desf.) to environmental stress. *Journal of Plant Nutrition*, 14(2): 151-161, Abstr. Vol 63(2):

Rhizopoulou, S. and G.K. Psaras. 2003. Development and structure of drought-tolerant leaves of the mediterranean shrub *Capparis spinosa* L. *Annals of Botany*, 92: 377-383.

Riviera, D., C. Inocencioa, C. Obon and F. Alcaraz. 2003. Review of Food and Medicinal Uses of *Capparis* L. Subgenus *Capparis (Capparidaceae*). *Economic Botany*, 57(4): 2003 s: 515-534.

Trewartha, J. and S. Trewartha. 2005. Producing Capers in Australia. Viability study. RIRDC Publication No: 05/132.

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