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Proceeding Article

Determinations of Adaptation Level of Wine Grape Varieties in Terms of Climatic Data in Aegean Region

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Abstract

Wine grapes are adapted to a wide range of climate; the best production occurs in regions that meet certain specific climatic conditions. Temperatures during the growing season can affect grape quality and viability. Beneficial climatic conditions will improve the wine's quality. In this study it was aimed that to determine suitable wine grape varieties for the cultivation in some areas of Aegean Region with related to climate requirements. For this reason, long-term climatic data were collected by meteorological stations including Güney, Çal, Menderes, Seferihisar and Urla. In this study heliotermic and hdyrothermic indices were calculated and evaluated for appropriate viticultural practice in this region. It was found that Alicante Bouschet, Carignan, Cabernet Sauvignon in İzmir and Çalkarası, Öküzgözü, Boğazkere, Kalecik Karası, Syrah, Merlot, Cabernet Sauvignon, Chardonay can be adapted and grown well in terms of climatic conditions in Denizli respectively.

Keywords: Wine grape, Growing, Adaptation, Climatic data

Introduction

Viticulture is one of the important agricultural branches regarding to area that it covers and the income that it provides to the national economy in Turkey. Turkey is among the important viticulturist countries with its 478.000 ton of viticulture field and 4, 26 millions of ton of grape production. (5th one for the area and 6th one in the production) 52.9 % of table grape, 36.3% to be dried, 10.8 % for wort and wine (Anonym, 2010).

Güney and Çal counties in Denizli provinces; Menderes, Seferihisar and Urla counties in İzmir provinces of the Aegean region, being the study area has 329 km2 of total area. Wine grape area of the examined study area is 8720 ha and total wine grape production amount is
48750 tons. (Table 1) Çal county has the largest viticulture field (4000 ha) and it is Güney county that has the furthest production amount (21250 tons). Average yield of the study area is 56.34 kg / ha (Table 1)

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Geographic features of the countries

Urla

Urla county is surrounded by Güzelbahçe in the east, Alaçatı and Çeşme in the west, İzmir Bay in the North andAegean Sea and Seferihisar county in the South. County lands, being consist of undulating plateaus, take place in the west of İzmir, in the middle of Karaburun peninsula. There is Karan Mountain in the southwestern part of the country. The height increases by going towards west and east from Urla. The highest point is Akdağ in the Karaburun Peninsule (1,218 m). The height passes 1,000 m in Kızıldağ, known as Çatalkaya, in the east of Urla.

Seferihisar

Having a coast to the Aegean seas, Centrum of the Seferihisar County is 5 km inland. Seferihisar is situated in the southeastern coasts of Urla Peninsula (1695 km) which is the biggest peninsula reaches towards Aegean Sea.

Menderes

There is İzmir in the southwest, Gaziemir County in the North, Torbalı county in the east, Aegean sea in the South and Seferihisar county in the west of the Menderes county. The county generally consists of plateaus. There are mountains in the North and west. The highest point in the North is Çatalkaya. It is Efemçukuru plain that lies from here to the west.

Çal

There is Uşak city and Bekilli County in the north, Çivril in the northern east, Baklan in the east, Honaz in the South and Güney County in the west of Çal County, being in the northern west of Denizli.

Güney

Güney County is surrounded by Çal in the east, Buldan in the west, Uşak-Eşme and the villages of the Centrum in the north. Menderes River passes by the middle of the county being mountainous from place to place; it is partially covered by forests.

Turkey has a very rich genetic potential as it is the gene center of grapevine. The climatic conditions have a very important role in the constitution of the maturity, yield and quality values of the grape variety. The criterias determining the relations between the Vitis vinifera and the climate and if the substrate is convenient for the grape vine farming cultivation have been presented in the studies (Branas, 1974; Constantinescu, 1967; Huglin, 1986; Işık, 1988)

Specific temperature data is the basic information for any grape variety. Reaching to the phonologic phases, key for any varietys, is possible when 10 °C heat accumulation is used as base. (Van Leeuwen et all, 2008). Each variety of grapes needs a specific heat accumulation starting from the beginning of the vegetation period until the maturity period. (Winkler et all., 1974). Maturity period of grapes is closely connected to the local climate conditions and phenological growth of the variety. Phenological growth is a genetic feature varies from variety to variety (Van Leeuwen et all, 2008).

It has been detected that effective heat summation demand is between 1210 0C (Cardinal) and 1500 0C (Müşküle in Ankara conditions; 1033 0C (Uslu) and 1538 0C (Alphonse L.) in Mediterranean conditions (Uzun, 19969). If a grape variety cannot mature its grape in the demanded level in ecology, it means that it cannot be recommended to be cultivated for hat region

Oraman (1970), has emphasized in the study that he has performed that regular sunshine duration is important as well as the temperature and that the annual sunshine duration of a grape wine should not be less than 1300 hours. According to Çelik et all (1998a) this value should not be less that 1500-1600 hours in an economical grape wine cultivation and that the vegetation duration must be more that 180 days.

Other conditions apart from the vegetation are also important in the grape variety choice of regions (especially in the regions with frost risk). The resistances of the grape varieties to the lower temperatures are very different. Accordingly, it has been detected in the studies held that if the temperature is lower than-20,5 oC in 3 or less times 10 years, that region is convenient for the grape wine cultivation (Çelik et all. 1998a)

Not only the heat accumulation but also sunshine and amount of precipitation should also be taken into the consideration for the convenience to the environment during the vegetation period of a grape variety. According to (Branas, 1974;

Constantinescu, 1967; Huglin, 1986; Karantonis, 1978). Karantonis (1978) the temperature values of the environment is not the unique important factors for the grape cultivation; what is really important is the balance between the temperature and sunshine. It is stated that the heliothermic proportion (X*12-
3/H*10-3) value 1 or higher environments are convenient for the grape cultivation.
The method of detecting the varieties that might be convenient in a specific area by studying the relations between Grape varieties and environmental conditions (climate, land) has been applied in many countries of the world. The grape varieties that might be cultivated according to the climate data of the Aegean Region and Marmara Region have been detected with the studies that have been held in our country. To improve the wine grape cultivation in Aegean Region, the climate factors of the region have seen to have accorded with the region. The studies regarding the detection not only the domestic wine grape but also qualified wine grapes of foreign origins have gained a lot importance in the recent years.

MATERIAL AND METHOD Material

In this study was the first group material was provided wine grape growers in Denizli (Güney and Çal) and İzmir (Menderes, Seferihisar, Urla) provinces of the Aegean Region. Other materials consist of the climatic data (temperature, rain etc) of long years provided from the meteorological stations of the counties.

Method

Denizli and İzmir, two of the provinces having an important place and varieties in the wine grape production in the Aegean Region, have been the sampling area. The samples had been taken from Seferihisar and Urla in İzmir city and Güney and Çal in Denizli. The counties have been chosen so as to provide 50% of the wine grape production. 40 Wine grape growers from each county have been interviewed with telic sampling method.

'Effective heat summation (EHS)', being one of the efficient parameters to determine the needs of the wine grape varieties in the specific region, has been calculated. In the calculation of this value expressed as Day-Temperature, 10°C (threshold temperature), which is accepted as the average temperature when the grape wine growth starts, has been selected as baseline (Çelik and, 1998). The assessments have been formulated as the date and day when the average of many years in several stations for 10°C, threshold of the grape vine growth, reaches to threshold temperature (end date and day of the vegetation) and the accumulation of the temperatures that the average temperature for each day in this period is higher that the threshold temperature.
EHS =∑(T-Te)

EHS = accumulation of the effective temperature (°C-day)

T= daily average temperature (°C) Te: threshold temperature (°C)
Hydrothermic indices was calculated to determine the possibility of supplying the water need of the grape vine from the natural ways. In this calculation it will be determined that if the water consummation related to the temperature change of the varieties in the May-July period and rain, can be provided from the natural ways.

Hydrothermic indices: (∑P*10)/ ∑T°
∑P = Total rain (mm),

Heliothermic indices have been calculated to determine the balance between the temperature and sunshine for the grape production.
Heliothermic indices: X*12-3/H*10-3

X: accumulation of the effective heat temperature during the vegetation period

H: total hours of days (daytime)

RESULT AND DISCUSSION

Denizli (Güney and Çal) and İzmir (Menderes, Seferihisar, Urla) two of the cities where important wine grapes are being produced in the Aegean Region, have been the study area. topographic conditions of the study area. The effects of the variety of the terrestial level, annual total rain and altitude difference have been observed. Average temperature value of the study are for many years have been measured between 7.8 0C (Menderes) and 14.5 0C in Çal (Table 2). Extremely high temperature values are between 42.4 0C (Seferihisar) and 39.4 0C (Çal). Peak value of the low temperatures varies between -10 0C (Çal) and -4.3 0C (Urla) (Table 2)

When we assess the bio climatic values in the climatic surface in the regard of productions of the wine grape varieties (Table 3) it has been detected that the vegetation period starts between 7 March (Menderes) and 6 April (Çal). It has been understood that the potential vegetation duration was between 205 days (Çal) and 255 (Seferihisar); and the total temperature was between 4154 (Çal) and 6425 (Seferihisar). Heliothermic indices, presenting the combination of the vegetation days and temperature factor, were high in all counties examined in the scope of the wine grape cultivation and that there were important differences between counties. The heliothermic indices values are between 5.79 (Çal) and 9.15 (Seferihisar) and these values are appropriate for the cultivation of the varieties of the wine grape cultivation in the examined area (according to the vegetation duration and Effective temperature). A parallelism has been found between the counties in terms of precipitation amount and dispersion in the vegetation period. It is seen that wine grape cultivation is possible in the examined regions without watering in the wine grape growing.

As a result of the assessment made in Aegean region it was seen that the EHS was 3875 0C (Table 3) and the temperature need of Alicante B grape variety was 1398 0C (Table 4) and temperature need of Carignan grape variety was 1547 0C . Total efficient temperature in Urla county was 3605 and the needs of grape varieties were as follows: Cabernet Sauvignon 1382 0C, Syrah 1399 0C and Alicante B. 1398 0C (Table 4). EHS of Güney county in Denizli was 2390 0C and the temperature needs of the varieties are as follows : Syrah (1399 0C), Kalecik Karası (14210C), Boğazkere (1525 0C), Merlot (1402 0C), Öküzgözü (1542 0C), Cabernet Sauvignon (1382 0C), Çalkarası (1395 0C) and Sultani Çekirdeksiz (1380 0C) and the temperature need of these grape varieties demand a lower total temperature than these values. The total efficient temperature of Çal county was 2104 0C and the total temperature needs of the varieties were as follows: Öküzgözü 1542 0C, Çal Karası (1395 0C), Boğazkere 1525 0C, Merlot1402 0C and Sultani Çekirdeksiz (1380 0C)(Table 4)

According to the climatic data of the meteorology station and to the assessment made with the wine grape growers it has been detected that was found that Alicante Bouschet, Carignan, Cabernet Sauvignon in İzmir and Çalkarası, Öküzgözü, Boğazkere, Kalecik Karası, Syrah, Merlot, Cabernet Sauvignon, Chardonay can be adapted and grown well in terms of climatic conditions in Denizli respectively.

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Table 1: Surface area of the counties (km2), viticulture area (ha), production (ton) and yield (kg/da) values (Anonym, 2010)

Counties	Surface area of the counties (km^2)	Viticulture area (ha)	Production (ton)	Yield (kgh.a)
Menderes - İzmir	775	965	7720	80
Seferihisar - İzmir	371	325	2600	80
Urla - İzmir	728	80	2200	15
Güney - Denizli	534	2900	21250	69.8
Çal - Denizli	1521	4000	14800	37
TOTAL	3929	8270	48570	281.8

Table 2: Climatic data in the Study Area

STATIONS	LATITUDE (^{0} N)	LONGITUDE (^{0} E)	ALTITUDE (m)	AVERAGE ANNUA TEMPERATURE (^{0}C)	AVERAGE ANNUAL RAINFALL (kg/m^2)	TERRESTIAL LEVEL (^{0}C)	MAX. TEMPERATURE (^{0}C)	MIX. TEMPERATURE (^{0}C)
SEFERIHISAR - İZMİR	38°11'	26° 50'	28 (CENTRAL) 145 (AVERAGE OF VILLAGES)	16.3	582	18.3	42.4	-6.2
MENDERES - İZMİR	38°16'	27°08'	53 (CENTRAL) 143 (AVERAGE OF VILLAGES)	17.8	590	18.6	40	-5.4
URLA- İZMİR	38°19'	26° 45' '	75 (CENTRAL) 177 (AVERAGE OF VILLAGES)	17.2	535	18.1	41.1	4.3
GÜNEY-DENİZLİ	38° 09'	29° 04'	847(CENTRAL) 795 (AVERAGE OF VILLAGES)	15.3	514	21.7	37.7	-8.7
ÇAL - DENİZLİ	38° 05'	29° 23'	911 (MERKEZ) 858 (AVERAGE OF VILLAGES)	14.5	477	22.4	39.4	-10.4

Table 3: Potential bioclimatic values of the study area in terms of wine grape cultivation (Daily average temperature ≥10 0C Period) Hydrothermal

STATIONS	BUDBURST (DATE)	TIME (DAYS)	∑T (C)		AVERAGE TEMPERATURE (C)	RAINFALL (mm)	HELIOTERMIC INDICE	HYDROTERMIC INDICE (May-July)
			TOTAL	EFFICIENT				
SEFERIHISAR-İZMİR	11.3	255	6425	3875	25.2	207.9	9.15	0.85
MENDERES-İZMİR	7.30	254	6042	3502	23.7	245.2	8.40	0.72
URLA - İZMİR	10.3	252	6125	3605	24.3	227.3	7.53	0.83
GÜNEY-DENİZLİ	2.40	207	4460	2390	21.5	210.7	6.49	0.50
ÇAL-DENİZLİ	6.40	205	4154	2104	20.2	212.0	5.79	0.45
DIFFERANCE	22	50	2271	1771	50	34.5	3.36	0.40

Table 4: Features of some grape wine varieties and their temperature needs (Çelik at all, 1988 a)

Grape Varieties	Temperature Needs C)
Boğazkere	1525
Öküzgözü	1542
Wine Kalecik Karası	1421
Sultani Çekirdeksiz	1380
Cabernet Sauvignon	1382
Merlot	1402
Syrah	1399
Carignan	1547
Alicante B.	1398
Bornova Misketi	1250
Çal Karası	1395