Citrus production and its future in Turkey.

I - Orange production.

Ö. TUZCU, O. ERKAN and H.Ç. BEDESTENCİ*

PRODUCTION DES AGRUMES ET SON AVENIR EN TURQUIE
I.- PRODUCTION D'ORANGES.
Ö. TUZCU, O. ERKAN et H.Ç. BEDESTENCİ
Fruits, Oct. 1983, vol. 38, nº 10, p. 683-689.

RESUME - Au cours des dernières années l'augmentation rapide de la production d'oranges indique le potentiel de la Turquie. En quatorze ans, elle s'est accrue considérablement, de 300.000 tonnes en 1965 à 679.795 tonnes en 1979. Une grande partie est réalisée dans la région méditerranéenne et on estime qu'elle gardera son importance dans l'avenir. On prévoit un accroissement régulier de production d'environ 25.000 tonnes par an dont 23.000 tonnes seraient dues à la région méditerranéenne. Dans la région d'Egée, l'augmentation serait de l'ordre de 1.600 tonnes par an. En revanche, la production de la région de la Mer Noire se dégraderait rapidement et se réduirait à un niveau négligeable dans le pays.

INTRODUCTION

Orange is a subtropical fruit and therefore, it can only be grown in suitable climatical areas of the world. The utmost limiting factor of its production is low temperatures. However, Citrus production has shown an important increase in the areas where suitable to grow and orange has the biggest share among the citrus fruits. The share of oranges in 1977-1979 period was about 69 % of the world citrus production (FAO, 1980).

The world production of oranges in 1961 was 15 688 000 tons and it reached to 37 883 000 tons in 1979 (WOLF, 1977 ; FAO, 1980). This shows that the orange production has a very rapid increase in a short period.

Altough the citrus fruits have been known for a long time in Turkey, the production became important since 1940's. In the last few years it has shown a rapid increase and the orange production reached to 57 295 tons, 300 000 tons and 679 795 tons in 1951, 1955, 1979 respectively (SIS, 1971 and 1980).

There are some studies on the area used, number of trees and the amount of production of Turkish oranges. However, these studies have not analyzed the orange production by production regions and have not done forecasts for the future. The purpose of this study is to analyze the present situation on the amount of orange production, the land use and the number of orange trees by regions in Turkey. And also, to determine and make predictions on the amount of orange production, land use and the number of orange trees for the years 1985, 1990 and 2000.

* Ö. TUZCU - Department of Horticulture, Faculty of Agriculture, University of Çukurova, Adana, Turkey.
O. ERKAN et H.Ç. BEDESTENCİ - Department of Agricultural Economics, Faculty of Agriculture, University of Çukurova, Adana, Turkey.

MATERIAL AND METHOD

The orange producing areas of Turkey are divided into regions and subregions according to the structure and the ecology of the area as explained below (figure 1) :

Mediterranean Region : It is the region between Samandağ (Hatay) and Kaş (Antalya). This region is bordered by the shores of Hatay, Adana, İçel, Antalya provinces and by the Kozan and Kadirli inland (Adana) citrus areas.

The Mediterranean region is divided into two subregions by the Kaledran stream ; East Mediterranean and West Mediterranean.

Aegean Region : This region is bordered by the shores of Muğla, Aydın, İzmir, Balıkesir provinces and by the Büyük Menderes Valley and surroundings of Ödemiş county.

Black Sea Region : It is the narrow shore from Sürmene (Trabzon) to USSR border in the East.

The publications such as FAO Production Year Book, (FAO, 1980) and the Turkish Agricultural Structure and Production Book by the State Institute of Statistics (SIS) are used as sources for the data used in this study (SIS, 1971, 1975, 1978 a, 1978 b, 1981). The present situation of the orange production have been analyzed with the data obtained from these sources.

As econometry suggest, a trend analysis was used to determine and predict the amount of orange production, land use and the number of trees by region and subregions for the years 1985, 1990 and 2000.

However, as can be seen from the tables 1, 3 and 5, the share of the Black Sea region in orange production in Turkey's total is negligibly low. And, in fact, in recent years the competition between the tea and orange production in this citrus growing areas resulted recession in orange plantation. Because of the very low share and fluctuations in the data for Black Sea region, this region was omitted from the analyses in order not to effect the results in the total study.

As suggested by most econometricians, different mathematical forms of trend have been tried such as linear, logarithmic, semi-logarithmic, hyperbolic and exponential (DRAPER and SMITH, 1966 ; KMENTA, 1971 ; SCHMALENSEE, 1973).

After applying regression technique to different trend forms, the one's with the highest R^2's and with the lowest Standard Errors (S.E.) have been chosen for predictions.

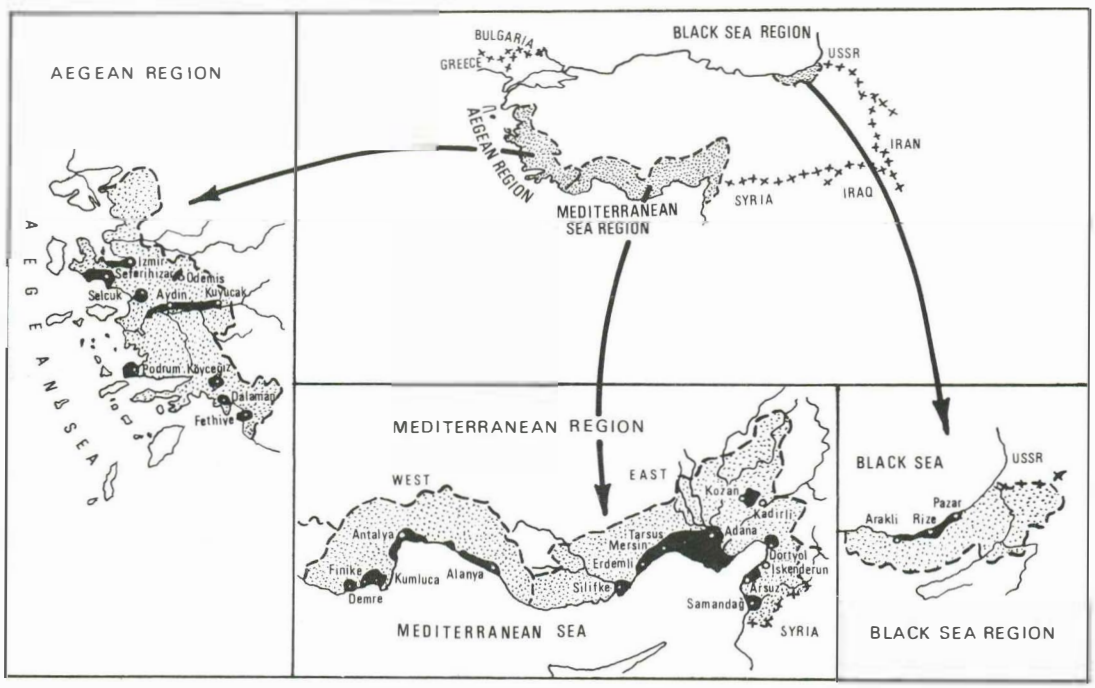

Figure 1 - CITRUS GROWING REGIONS IN TURKEY.

At the same time the validity of regression coefficients have been tested by r-test (LAMONT et al., 1977). The formula for the r-test is :

$$r_{test} = \left[\frac{t^2}{t^2 + d.f.} \right] 1/2$$

In some cases a «Dummy» variable was used to eliminate the disturbances in the observations to get a representative fit. In East Mediterranean region the «Dummy» value for 1977 was zero «O» ; and for Aegean region it was one «l» for the same year.

After several trials of the different models in general, two forms of the mathematical models were selected to be the representative models for the research, and they are as follows :

a) Linear $Y_{ij} = a + bx_{ij} + E_{ij}$

b) Linear with «D» $Y_{ij} = a + bx_{ij} + bD + E_{ij}$

Y = Dependent Variable (Amount of Production, Land Use, Number of Trees).

Where : i = 1,2 .....5 (Regions)
1 : Turkey
2 : East Mediterranean Sub Region
3 : West Mediterranean Sud Region
4 : Mediterranean Region
5 : Aegean Region
x : Trend Variable (Time)

Where : j = 0,1 14
0 : 1964
1 : 1965

36 : 2000
D : Dummy Variable

In order to standardize the region's shares to the Turkey's total, each region's forecast was corrected by the formule given below :

$$\hat{Y}_{id} = \hat{Y}_{ij} \mp \left[(TT - \sum \hat{Y}_{ij}) \frac{\hat{Y}_{ij}}{\sum \hat{Y}_{ij}} \right]$$

$\hat{Y}id$: Corrected forecast value
$\hat{Y}ij$: Forecast value
TT : Turkey's total forecast.

ANALYSES AND THE RESULTS

Land use of orange production by regions in Turkey.

The area used for oranges by regions are given in Table 1. The area was 25 000 hectares in 1965 and it reached to 29 962 hectares in 1979. About 90 % of the orange producing land is in the Mediterranean region. The East Mediterranean is the most important region of all. On the other hand, the Aegean and Black Sea regions has only about 10 % of the total share. During 1965-1979 period the increase in orange growing areas, regions kept the ratios (share) about the same, as can be seen from Table 1. The Mediterranean region kept 89 % share where as Aegean region had 10 % share and Black Sea region had a only 1 % share.

The forecasted values of orange areas upto year 2 000 are given in Table 2. The total area is expected to reach 31.3, 32.8 and 36.1 thousand hectares by 1985, 1990 and 2000 respectively.

When the increase is indexed by 1965, the index for the forecasted values are 125, 132 and 144 for 1985, 1990 and 2000 respectively.

TABLE 1 - The area of orange production (hectares) by regions in Turkey.

Years	Turkey's Total	Regions				
		East Mediterranean	West Mediterranean	Total Mediterranean	Aegean	Black Sea
1965	25 000	15 473	6 860	22 333	2 397	270
		(61.9)*	(27.4)	(89.3)	(9.6)	(1.1)
1970	26 229	16 250	7 253	23 503	2 483	243
		(61.9)	(27.7)	(89.6)	(9.5)	(0.9)
1975	27 749	16 253	8 650	24 903	2 563	283
		(58.5)	(31.2)	(89.7)	(9.2)	(1.1)
1979	29 962	19 210	7 496	26 706	3 013	243
		(64.1)	(25.0)	(89.1)	(10.1)	(0.8)

* - The amount of share (%).

TABLE 2 - The forecasted orange production areas (hectares) by year 2000 in Turkey.

Years	Turkey's Total	East Mediterranean **	West Mediterranean	Total Mediterranean	Aegean **
1980	29 641	17 267	9 180	26 457	2 878
	(119)*	(112)	(135)	(118)	(120)
1985	31 259	17 871	10 083	27 954	2 978
	(125)	(116)	(147)	(125)	(124)
1990	32 877	18 516	10 906	29 422	3 110
	(132)	(120)	(159)	(132)	(130)
2000	36 115	19 791	12 537	32 328	3 415
	(144)	(128)	(183)	(145)	(143)

* - The rate of increase : 1965 = 100.

** - «Dummy» variable is used.

Mediterranean region, especially West Mediterranean region is the fastest growing subregion among all in terms of orange growing areas. A moderate increase in the Aegean region is expected in the near future.

The estimated regression equations are given below for orange producing regions, by Turkey's total, regions and subregions :

Turkey's Total

$\hat{Y}_1 = 24463.0 + 323.6X_1$ $R^2 = 90^{xxx}$

East Mediterranean Region

$\hat{Y}_2 = 12369.7 + 141.0X_2 + 28797D$ $R^2 = 84^{xxx}$

West Mediterranean Region

$\hat{Y}_3 = 6632.9 + 173.4X_3$ $R^2 = 74^{xxx}$

Mediterranean Region

$\hat{Y}_4 = 21906.8 + 283.6X_4$ $R^2 = 85^{xxx}$

Aegean Region

$\hat{Y}_5 = 2319.3 + 29.8X_5 + 595.7D$ $R^2 = 96^{xxx}$

The outlook for the number of orange trees in Turkey.

The number of orange trees by regions in Turkey are given in Tabla 3. The number of orange trees were 7.5 millions in 1965 and increased close to 9 millions in 1979. Around 90 % of orange trees are grown in Mediterranean region. East Mediterranean has the biggest share when analyzed within the regions. Aegean and Black Sea regions, share about 9 % and 1 % respectively.

The forecasted values for the number of the orange trees in Turkey are given in Table 4. The forecasted results are very similar to the one's made for the orange producing areas, and the equations used for forecasts are given below :

Turkey's Total

$\hat{Y}_1 = 7338.5 + 96.9\ X_1$ $R^2 = 90^{xxx}$

East Mediterranean Region

$\hat{Y}_2 = 3713.1 + 42.1\ X_2 + 862.4D$ $R^2 = 84^{xxx}$

West Mediterranean Region

$\hat{Y}_3 = 1989.9 + 52.0\ X_3$ $R^2 = 74^{xxx}$

Mediterranean Region

$\hat{Y}_4 = 6572.7 + 84.9\ X_4$ $R^2 = 85^{xxx}$

Aegean Region

$\hat{Y}_5 = 694.7 + 8.9\ X_5 + 117.3D$ $R^2 = 96^{xxx}$

TABLE 3 - The number of orange trees by regions in Turkey (1000 units).

Years	Turkey's Total	East Mediterranean	West Mediterranean	Total Mediterranean	Aegean	Black Sea
1965	7 500	4 642	2 048	6 700	719	81
		(61.9)*	(27.4)	(89.3)	(9.6)	(1.1)
1970	7 869	4 875	2 176	7 051	745	73
		(61.9)	(27.7)	(89.6)	(9.5)	(0.9)
1975	8 325	4 874	2 593	7 467	768	90
		(58.5)	(31.2)	(89.7)	(9.2)	(1.1)
1979	8 989	5 763	2 249	8 012	904	73
		(64.1)	(25.0)	(89.1)	(10.1)	(0.8)

* - The amount of share (%).

TABLE 4 - The forecasted number of orange trees by regions in Turkey by year 2000 (1 000 units).

Years	Turkey's Total	East Mediterranean **	West Mediterranean	Total Mediterranean	Aegean **
1980	8 889	5 184	2 787	7 971	826
	(120)*	(112)	(135)	(119)	(115)
1985	9 373	5 373	3 034	8 407	869
	(127)	(116)	(147)	(125)	(121)
1990	9 858	5 566	3 280	8 846	909
	(131)	(120)	(159)	(132)	(126)
2000	10 827	5 948	3 772	9 720	997
	(148)	(128)	(183)	(145)	(139)

* - The rate of increase: 1965 = 100.
** - «Dummy» variable is used.

The outlook for the amount of orange production by regions in Turkey.

The amount of orange production in Turkey by regions for the 1965-1979 period is given in Table 5. The orange production was 300 thousand tons in 1965 and it increased to 697 795 tons in 1979.

An important portion of the oranges produced in Turkey are grown in Mediterranean region. In 1979, around 95 % of the oranges were produced in this region. The biggest share of the production was in the East Mediterranean subregion and about 64.53 % of the Turkish total production was produced in this subregion.

The share of the orange production in the Aegean and Black Sea regions are negligible. In 1965-1974 period about 5 % of the total oranges are produced in Aegean region and less then 1 % of the oranges were produced in Black Sea region.

The forecasted orange production by year 2000 are given in Table 6. According to the forecasts, the amount of production is expected to reach 680 845, 928 778 and 1 176 710 tons for the years 1980, 1990 and 2000 respectively. This means that the amount of production that will be produced in year 2000 is about 4 times more than the amount of orange produced in 1965. The forecasted values are very close to the realized values ; the forecast for 1980 was 680 845 and the production realized in 1979 was 680 000 tons (SIS, 1980).

The projection studies on Turkish orange production was done also by WOLF (1977) and BUCH (1981). According to their study the expected orange production in Turkey for 1980 was 550 000 tons. In fact, the calculated projection values seem to be closer to the realized production value in comparison to the expected values of the other experts. However, they indicate that among the Mediterranean countries, Turkey has a bigger potential in orange production with Italy and Egypt (WOLF, 1977).

When the orange production is analyzed by regions, as in the previous cases, the Mediterranean region is expected to have the largest orange production share. The growth rate in the subregions ; East Mediterranean has the largest

TABLE 5 - The amount of orange production (tons) by regions in Turkey.

Years	Turkey's Total	East Mediterranean	West Mediterranean	Total Mediterranean	Aegean	Black Sea
1965	300 000	216 230	70 265	286 495	11 730	1 775
		(72.1)*	(23.4)	(95.5)	(4.0)	(0.5)
1970	445 000	294 194	122 219	416 413	26 377	2 110
		(66.1)	(27.7)	(93.6)	(6.0)	(0.5)
1975	540 000	340 346	165 578	506 924	32 549	617
		(63.0)	(30.8)	(93.8)	(6.1)	(0.1)
1979	679 795	438 358	205 000	643 358	35 959	478
		(64.5)	(30.1)	(94.6)	(5.2)	(0.1)

* - The amount of share (%).

TABLE 6 - The forecasted orange production (tons) by regions in Turkey by year 2000.

Years	Turkey's Total	East Mediterranean	West Mediterranean	Total Mediterranean	Aegean
1980	680 845	417 258	222 432	639 690	40 656
	(227)*	(193)	(317)	(223)	(347)
1985	804 812	489 390	268 516	757 916	46 628
	(268)	(226)	(382)	(265)	(398)
1990	928 778	558 916	315 225	874 141	54 483
	(310)	(258)	(449)	(305)	(464)
2000	1 176 710	699 194	407 556	1 106 450	70 213
	(392)	(323)	(580)	(386)	(599)

* - Rate of increase ; 1965 = 100.

share when the Mediterranean sub-regions are analyzed (figure 2).

Although the ecological condition for citrus in the West Mediterranean is suitable, the orange is being produced for a long time. The most important areas of orange production in the regions are Finike-Kumluca and Demre valleys.

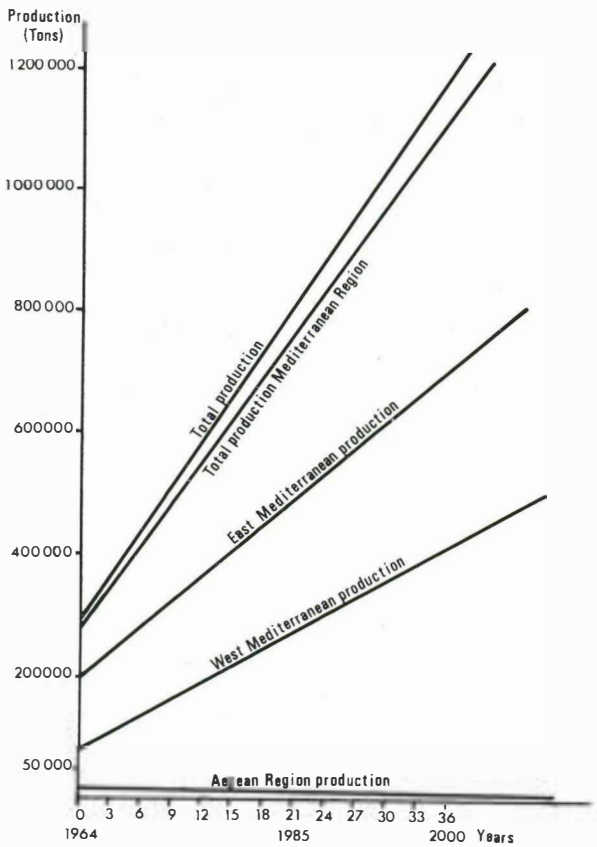

Figure 2 - ORANGE PRODUCTION PROJECTIONS IN TURKEY BY YEAR 2000.

The potential area for orange production is not completely used, therefore, an increase of orange plantation in these areas is naturally expected. Although the East Mediterranean region is also suitable for citrus production, the lemons seem to be increasing its share more rapidly (SIS, 1980). With the above explanations the forecasted values are expected to be realized.

It also can be said that the East Mediterranean will keep its importance and its share in the Turkish orange production.

A similar trend is expected in the Aegean region. The biggest increase is expected to take place in the Büyük Menderes valley and the southern part of the region where the land is suitable for citrus growing. It could be said that the Black Sea region is going to lose its share in orange production.

The reason for this, is the rapid increase in tea production which is in competition with citrus in this region.

The estimated functional relations used to forecast the amount of orange production by regions are given below :

Turkey's Total
$\hat{Y}_1 = 284\,154.2 + 24\,793.2X_1$ $\quad R^2 = 91^{xxx}$

East Mediterranean Region
$\hat{Y}_2 = 192\,797.7 + 14\,107.7X_2$ $\quad R^2 = 80^{xxx}$

West Mediterranean Region
$\hat{Y}_3 = 75\,101.1 + 9\,250.3X_3$ $\quad R^2 = 88^{xxx}$

Total Mediterranean Region
$\hat{Y}_4 = 267\,898.8 + 23\,358.0X_4$ $\quad R^2 = 90^{xxx}$

Aegean Region
$\hat{Y}_5 = 213\,513.6 + 1\,579.1X_5$ $\quad R^2 = 80^{xxx}$

In general, according to the results obtained from the analysis, it could be said that the orange production will increase rapidly in the future and Turkey will take a better place among the orange producing countries.

LITERATURE CITED

BUCH (I.). 1981.
The FAO Citrus projections : A new view of the results.
Citrograph, 66, 237-239.

DRAPER (N.R.) and SMITH (H.). 1966.
Applied regression analysis.
John Wiley and Sons, Inc., New York.

FAO. 1980.
1979 FAO production yearbook.
FAO Statistics, Series nº 28, FAO,Rome.

KMENTA (I.). 1971.
Elements of Econometrics.
The Macmillan Company, New York.

LA MONT (M.D.), OLIVA (R.A.), HOFFMAN (R.I.), ZASTROCKY (M.), REED (J.F.) and BATTAGLA (S.). 1977.
Calculating better decisions.
Texas Instruments Inc. Learning Center, Dallas, Texas.

SCHMALENSEE (R.). 1973.
Applied microeconomics.
Holden-Day Inc., San Francisco, California.

SIS. 1971.
Summary of agricultural statistics.
Printing Division of State Institute of Statistics, Pub. nº 632, Ankara.

SIS. 1975.
Agricultural structure and production 1971-73.
Printing Division of State Institute of Statistics, Pub. nº 740, Ankara.

SIS. 1978 a.
Agricultural structure and production 1974-76.
Printing Division of State Institute of Statistics, Pub. nº 858, Ankara

SIS. 1978 b.
Agricultural structure and production 1973-1975.
Printing Division of State Institute of Statistics, Pub. nº 827, Ankara.

SIS. 1980.
Summary of agricultural statistics.
Printing Division of State Institute of Statistics, Pub. nº 913, Ankara.

SIS. 1981.
Agricultural structure and production 1977-1979.
Printing Division of State Institute of Statistics, Pub. nº 941, Ankara.

WOLFF (I.B.). 1977.
Medium-term prospects for world Citrus production.
Proc. Int. Soc. Citriculture, 2, 328-332.