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PRODUCTION AND EXPORT MARKETING OF VEGETABLES
IN TURKEY

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ABSTRACT

Vegetable production in Turkey has become increasingly important during the last two decades. Acreage devoted to vegetables, total production and exports have all expanded. This paper gathers available data on vegetables and investigates the growth pattern that this industry has demonstrated. Issues for further study are also identified.

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I. INTRODUCTION

Agriculture is still the dominant sector in the Turkish economy in spite of an emphasis on industrialization by the policy makers since 1960. Agriculture's share of the gross national product has declined from 37.5 percent in 1960 to 26.7 percent in 1970, and to 22.6 percent in 1980. During this period, the share of industry has increased from 15.6 percent in 1960 to 22.6 percent in 1970, and to 25.3 percent in 1980[1]. However, when one considers agriculture-related industries as a component of agriculture, this sector still provides the greatest share of the gross national product.

Agriculture has played four main roles in the economic development of Turkey. First, it has been able to feed the rapidly growing population; the country has stayed self-sufficient in most agricultural products with the exception of spices, coffee and, in some years, rice. Second, it has provided the necessary raw materials for the expanding food processing industry and other industries, such as textiles, cigarettes and leather. Third, it currently provides employment for about two-thirds of the economically active population. Fourth, agriculture constitutes the major portion of the foreign exchange earnings of the country. In 1981, the export value of raw agricultural products amounted to 47.2 percent of all exports[2]. It is estimated that the above figure exceeds 70 percent when one includes the value of other exports with an agricultural base.

The production of cereals has dominated Turkish agriculture for a long time. However, the production pattern has changed somewhat during the last ten years and vegetable production has become increasingly important. The value of vegetable crops has increased from 8.3 percent of the total crop value in 1970 to 19.7 percent in 1981[3]. Area devoted to vegetables has also increased during this period.

Several reasons can be given to explain the expansion of vegetable production in Turkey. First, the dietary habits of the population have changed through time; there has been a gradual shift from cereal consumption to vegetable consumption. Increasing income levels and the urbanization process have also substantially contributed to this shift. These changes have created a market demand for vegetables throughout the year, thus supporting specialization in these crops. Some farmers have started producing for the market as opposed to producing for mere self-consumption as in earlier years. Second, the development of a relatively efficient transportation network in the last two decades has enabled farmers to ship

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1/ Devlet Planlama Teskilati. Ataturk'un Dogumunun 100. Yildonumunde Rakamlarla ve Fotograflarla Kalkinan Turkiye. Ankara, 1981, p.3.

2/ Obtained from State Institute of Statistics files. See also Agricultural Bank of the Turkish Republic. Agricultural Production Value of Turkey. Ankara, 1970-81, p. 10.

3/ Agricultural Bank of the Turkish Republic. Agricultural Production Value of Turkey. Ankara, 1970-81, p. 10.

their surplus vegetables to regional and/or national markets. A strong demand in these markets and the resulting high profits compared to other crops have encouraged farmers to expand production. Third, the fact that vegetables are "cash crops" has given added incentives to the farmers to produce more vegetables. The growing season is normally shorter than for other crops and a return on investment in production inputs is realized sooner. An additional reason for a quick investment turnover is that government agencies are not involved in the marketing of vegetables; therefore, resulting delays in payment are avoided. Fourth, the recent changes in government policies have encouraged vegetable production and exports. These policies have included:

1) Major investments in irrigation projects.
2) The provision of long-term credits at low interest rates using the resources of the World Bank and the European Investment Bank (especially for vegetable production in greenhouses).
3) Subsidized production inputs such as fertilizers and seeds.
4) The provision of export credits.
5) Farmer education in vegetable production through the extension service of the Ministry of Agriculture.

Finally, one should mention that the favorable climate and soil conditions in Turkey for vegetable production have enabled farmers to respond to the changing demand and supply conditions and government policies outlined above. Most of the above policies would have been ineffective without the right climate and soil environment.

As was briefly explained above, vegetables have gained in importance in terms of production, consumption and exports during the last ten years. It is expected that this trend will continue in the coming decades. Nevertheless, very little economic research has been conducted to deal with the production and marketing problems of vegetable crops. Vegetables have always been combined with other products (such as fruits) in analysis. Even the State Institute of Statistics lumped vegetables with fruits until 1968. Likewise, the 5-Year Development Plans have treated vegetables in conjunction with fruits. Other institutions, such as the Center for Export Promotion (IGEME), the Turkish Economic Development Foundation and the Union of Turkish Agricultural Chambers have treated the subject the same manner. Finally, the Second Economic Development Congress (this is a major series of conferences held to plan long-term structural changes in the economy; the first one was held in 1937) held in 1981 devoted very little time to vegetables. Out of 55 papers presented on the agricultural sector, only one covered vegetables and again in conjunction with fruits[4].

It is difficult to understand why vegetables are always studied together with fruits or other products, especially when one considers the different climatic and soil requirements, production techniques, marketing practices

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4/ Both domestic and international agencies have tended to treat fruits and vegetables as one class. See references 7,11,12,16,20,21,22,24 and 25.

and consumption patterns. It is believed that vegetables have become too important in Turkish agriculture to be treated as a stepchild. They should receive more attention in terms of support and research if Turkey is to become a major exporting country. More researchers should focus on the problems of vegetable producers and marketers.

The main reason for undertaking this particular study is to summarize the available data on vegetable crops, to describe past trends, to analyze the current situation and to identify areas that need further research. It is hoped that this will raise interest among policy-makers, researchers and private institutions to start a dialogue giving more thought to the problems of vegetable producers, consumers and marketers. The time has come for vegetables to get the attention that they deserve.

The general objective of this study will be to analyze trends in vegetable acreage, production and marketing during the last two decades. More specific objectives will be:

1) To examine trends at the national levels.
2) To identify regional production shifts and/or specialization in vegetable crops.
3) To study the export trends and identify specific crops that have export potential.
4) To identify issues for further study.

The data to be used in analysis were gathered from published sources as well as from files of related government agencies. Analysis will be mostly descriptive in nature due to the limited availability of information; some correlation and regression analysis will be introduced when appropriate.

To the best of the authors' knowledge, this is a pioneering study on this topic. It is hoped that it will serve as a basis for more comprehensive research in the future.

II. ANALYSIS OF TOTAL AND REGIONAL VEGETABLE ACREAGE

A. Analysis of Total Vegetable Acreage Trends

From 1960 to 1981, total cultivated land in Turkey increased from about 25 million hectares to 28 million hectares or 11 percent. However, it should be noted that about 10 million hectares (mainly in Central Turkey) lie fallow in any given year due to dry weather conditions. Therefore, the increase in total acreage sown is actually closer to 9 percent.

The total area devoted to vegetable production also increased; for the twenty-two years for which data is given (Table 1), vegetable acreage more than doubled. Analysis of this information indicated a sudden leap in the growth rate between 1967 and 1968, with slower rates of growth during the years preceeding and following this interval. In searching for an explanation for this dramatic shift, it was discovered that the State Institute of Statistics had started a new classification system in 1968; prior to this reclassification, vegetables and fruits were treated as one category. During this transition, it is possible that an upward adjustment might have been made to the figures for vegetable acreage. However, as previously noted, the acreage devoted to vegetable production continued to grow after 1968. The total increased from 467 thousand hectares to 568 thousand hectares in the 1968-81 period. This is still much higher than the rate of increase for the total cultivated land.

The changes in vegetable acreage were analyzed using simple regression; the following equations were estimated for both the 1960-81 and the 1970-81 time periods to study long and short-term trends:

$$A = 211 + 20T \qquad R^2 = 0.85 \qquad (1960-81)$$
$$A = 299 + 15T \qquad R^2 = 0.59 \qquad (1970-81)$$

where A = Total vegetable acreage (in thousand hectares)
T = Time period (1960 = 1......1981=22)

The slope coefficient was found to be statistically significant in both equations. The higher coefficient of determination (R^2) for the longer time period indicates a gradual increase in area; however, the 1968 reclassification may have affected the magnitude of the coefficient. The lower R^2 statistic for the 1970-81 interval reflects wider acreage fluctuations (Table 2) from year to year.

The steady long-term growth can be attributed to several factors. These include rising population and per capita income figures, and a change in consumer buying habits. Moreover, the high rate of rural to urban migration in the 1960s and 1970s transformed the former producers to consumers. An improved transportation network, developed at the same time, enabled the farmers to ship their products to these new markets on a cost-effective basis. This strong demand resulted in higher prices and provided incentives for the farmers to increase their vegetable acreage and production.

The short-term fluctuations can be attributed mainly to changes in the export demand for fresh and processed vegetables. Adverse conditions in the international markets in a given year normally resulted in a decrease in

Table 1:   Total Area Sown, Total Vegetable Area and Total
Vegetable Production in Turkey (1960-81)

Year	Area Sown (1000 ha)	Vegetable Area (1000 ha)	Area* Index (1960=100)	Vegetable Production (1000 tons)	Production* Index (1960=100)
1960	15075	279	100	3390	100
1961	15128	293	105	3274	97
1962	15167	276	99	3427	101
1963	15276	265	95	3540	104
1964	16367	270	97	3848	114
1965	15294	251	90	3785	112
1966	15454	267	96	4008	118
1967	15515	278	99	4072	120
1968	15400	467	167	7572	223
1969	15848	501	179	7974	235
1970	15591	448	160	8439	249
1971	15924	451	161	8608	254
1972	16047	530	190	8946	264
1973	16062	530	190	8219	242
1974	16154	501	179	8908	263
1975	16241	490	175	9561	282
1976	16343	614	221	10605	313
1977	16531	592	212	10150	299
1978	16349	571	204	11070	327
1979	16607	686	246	12576	371
1980	16379	596	213	11990	354
1981	16445	568	203	12173	359

Source: State Institute of Statistics Publications and Files
* computed by the authors.

vegetable acreage sown the following year. In addition, several new types of vegetable crops were tried in this period, resulting in an increase in area sown. Failure of some of these crops adversely affected the area sown in succeeding years. One can observe "The Cobweb Theorem"[5] in action by examining the acreage statistics for the 1970-81 period (Table 2). Finally, one may argue that the way the third (1973-77) and the fourth (1978-82) Five-Year Development Plans were implemented might have caused some of the above fluctuations. Incentives provided in a given year were withdrawn during succeeding years, resulting in farmer dissatisfaction and a shift to other crops.

B. Analysis of Regional Vegetable Acreage Trends

Turkey has been divided into nine agricultural regions, or land use zones, since the 1950 agricultural census. These zones will be used for regional analysis in the remaining sections of this report; Names of the regions and their numeric codes are listed below. The name of a major province in each regions is also provided as a reference aid to the reader(see Map):

Region No.	Region Name	Major Province
1	Central North	Ankara
2	Aegean	Izmir
3	Marmara	Istanbul
4	Mediterranean	Antalya
5	Northeast	Erzurum
6	Southeast	Diyarbakir
7	Black Sea	Samsun
8	Central East	Sivas
9	Central South	Konya

The distribution of vegetable acreage among the nine agricultural regions has shown variations during the 1960-81 period. With the exception of region 9 (Konya), vegetable acreage has increased in each region. The largest increases have been observed in regions 2 (Izmir) and 4 (Antalya), followed by regions 1 (Ankara) and 3 (Istanbul) (Table 3).

The main reason for the growth of vegetable area in region 2 is probably due to its favorable geographic location and the suitability of its climate and soils for a wide selection of vegetables. The proximity of this region to major urban markets is an advantage, both in terms of selling products and obtaining market information. Also, the farmers in this region are generally better educated and they follow modern production technology. It is not uncommon for them to grow multiple crops in a given year. These advantages, on both the supply and demand sides, have made vegetable production in this region very profitable, leading to a substntial increase in acreage.

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[5] See references 10 and 15 for a discussion of the Cobweb Theorem.

AGRICULTURAL REGIONS OF TURKEY
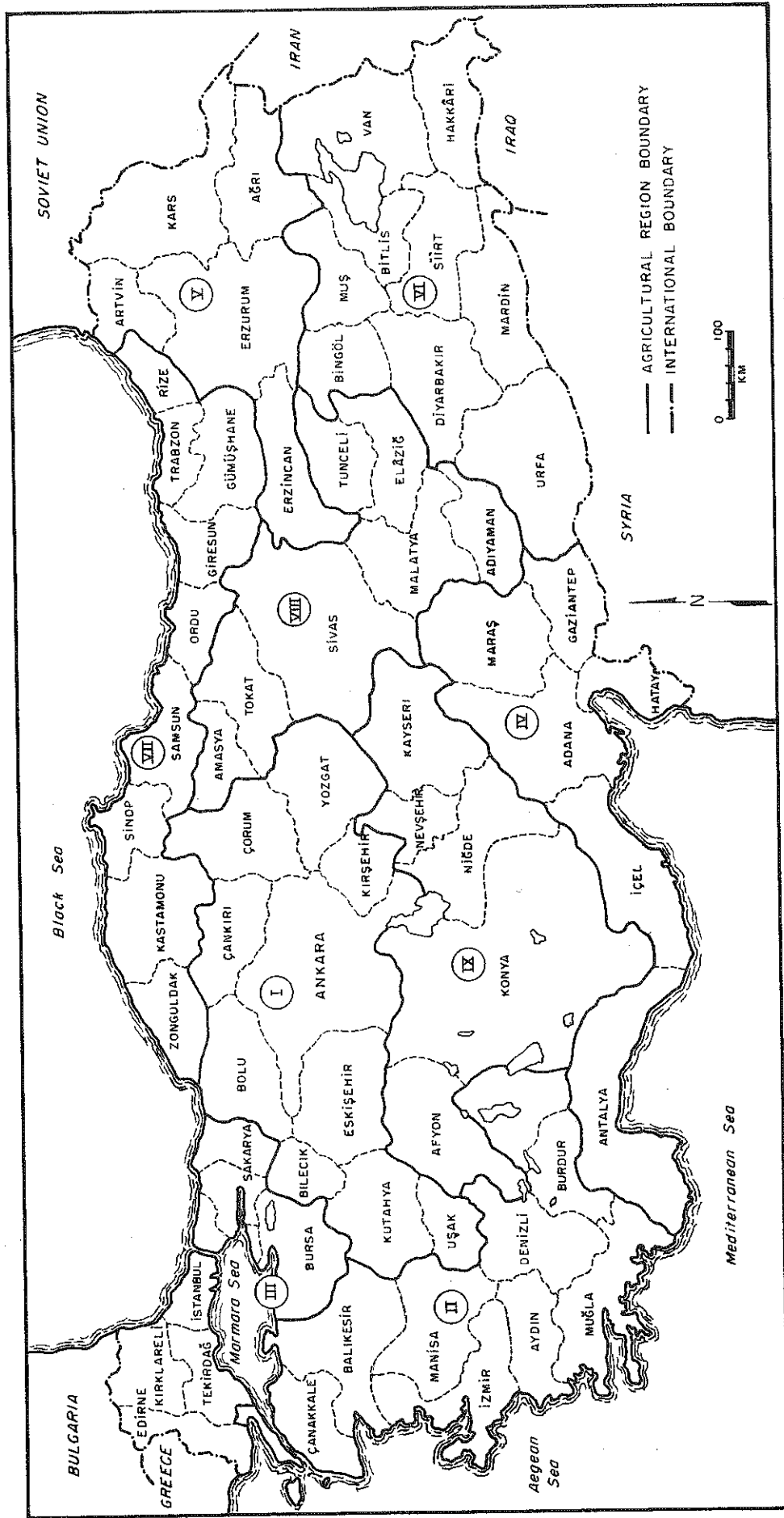
Table 2:   Regression Coefficients Between Vegetable Area and Time

Region		Time Period					
		1960-81			1970-81		
		a	b	r	a	b	r
Central North	(R1)	34	2	0.82	56	0.7	0.32
Aegean	(R2)	42	4	0.93	45	4	0.88
Marmara	(R3)	41	2	0.67	33	3	0.45
Mediterranean	(R4)	17	7	0.91	82	3	0.65
Northeast	(R5)	6	0.3	0.62	10	0.05	0.07
Southeast	(R6)	7	3	0.86	-0.4	4	0.67
Black Sea	(R7)	5	2	0.84	-0.4	2	0.76
Central East	(R8)	10	1	0.79	28	-0.0007	-0.0006
Central South	(R9)	46	-0.3	-0.37	46	-0.3	-0.29
Total		211	20	0.92	299	15	0.77

Source: Computed by Authors.
Area Units are Thousands of Hectares; Time is in years.
a=Intercept
b=Slope
r=Correlation Coefficient
Vegetable Area=Dependent Variable
Time=Independent Variable

The expansion in region 4 is also mainly due to climatic and soil factors. Off-season production (both late Fall and early Spring) has enabled the farmers to receive reasonably high and steady returns from vegetable production throughout the year. Production under a controlled environment (greenhouse and plastic house) is also well established here, making winter production possible. Finally, irrigation projects completed in the late 1960s have had a significant effect on the growth of vegetable farming.

Region 3 has devoted more land to vegetable production in large part because most of the food processing plants in Turkey are located there. In addition, a very strong demand in the Istanbul market was another factor in influencing the increases in vegetable acreage.

It is believed the main reason for the acreage increase in region 1 is due to its proximity to the major markets in Central Anatolia, such as Ankara.

In region 9, where wheat is the dominant crop, farmers produced vegetables for the local markets in the earlier years covered by this study. However, in later years, when other regions (especially the Mediterranean) started shipping vegetables to this area, the farmers could not compete anymore. Thus most of them shifted to wheat production, resulting in a decrease in vegetable acreage.

When one examines the long-term trend (1960-81), the correlation coefficients (r) between regional vegetable area and time were rather high (ranging from 0.79 to 0.93), with the exception of regions 3, 5 and 9. The short-term (1970-81) coefficients have been significantly lower, again indicating fluctuations in area from year to year. Only regions 2 and 7 had correlation coefficients that were higher than 0.75 for this period. Regression coefficients (intercept and slope) were obtained for each region using area as the dependent and time as the independent variable. These coefficients, as well as the correlation coefficients, are provided for each region in Table 2.

Table 3:   Regional Distribution of Vegetable Area in
Turkey (1960-81)

Year	Region 1	Region 2	Region 3	Region 4	Other* Regions	Total
1960	42	49	47	30	111	279
1961	41	54	71	28	100	294
1962	37	65	46	34	94	276
1963	40	54	45	36	91	266
1964	40	55	51	33	92	271
1965	36	53	48	36	79	252
1966	36	53	48	39	91	267
1967	36	58	50	40	93	277
1968	63	89	55	108	152	467
1969	63	101	71	119	148	502
1970	59	82	65	105	137	448
1971	63	80	58	112	138	451
1972	65	102	67	128	169	531
1973	76	105	78	120	151	530
1974	62	95	72	122	149	500
1975	60	87	72	136	136	491
1976	72	104	80	158	205	619
1977	74	106	74	131	207	592
1978	62	118	75	124	196	575
1979	79	119	144	158	187	687
1980	78	119	73	142	184	596
1981	58	130	74	130	176	568

Source: State Institute of Statistics Publications and Files.
Units are Thousand hectares.
* computed by the authors by summing the acreage figures
for regions 5 through 9.

III. ANALYSIS OF TOTAL AND REGIONAL VEGETABLE PRODUCTION

A. Analysis of Total Production Trends

Total vegetable production in Turkey expanded from 3.4 million metric tons in 1960 to 12 million metric tons in 1981. This represents a 3.6 fold increase. As in vegetable acreage, a sudden jump in production was observed between 1967 and 1968. The production index changed from 120 to 223 between these two years (Table 1). This dramatic growth can again be attributed to the new classification that was initiated in 1968. After this year, an increase in production continued at a more gradual rate.

Production increased by 61 percent between 1968 and 1981, as opposed to a 22 percent increase in vegetable acreage. This suggests that there were substantial yield improvements during this period. An examination of the data indicates that the fluctuations in vegetable acreage are reflected on the production side; in years of substantial decreases in area, production has also gone down. However, the fluctuations in production were less severe since the greater increases in yield smoothed out the effect of the acreage variation.

There were several factors which influenced the yield during the above period. Some of these were:

1) Improvements in the quality of production inputs (seeds, fertilizers).
2) The transformation of vegetable farming from subsistence production to production for regional and national markets. This change in the character of the market, and the fact that vegetables are "cash crops", led farmers to reserve their prime land for vegetable production.
3) The increase in irrigated land. As more acreage was irrigated, the tendency has been to utilize this "new" land for vegetable production.
4) Improved knowledge of production, land management and marketing techniques.

In addition to yield increases, there were several other factors which contributed to the substantial growth in overall vegetable production. Growing demand (local, regional and international) for fresh vegetables and an increased demand from the food processing industry can be given as examples.

The changes in vegetable production were analyzed using simple regression; the following equations were estimated for both the 1960-81 and the 1970-81 time periods to study the long and short-term trends (Table 4):

$$P = 1931 + 489\ T \qquad R^2 = 0.94 \qquad (1960\text{--}81)$$
$$P = 3415 + 405\ T \qquad R^2 = 0.88 \qquad (1970\text{--}81)$$

where P = total vegetable production (in thousand tons),
T = time period (1960 = 1.....1981=22).

The slope coefficient was found to statistically significant for both

equations; the high R^2 figures for both periods show the gradual increase in production through time. The two coefficients do not differ much, indicating narrower fluctuations in production during recent years as opposed to wider fluctuation in acreage. This should be viewed as a positive factor, reflecting better management skills.

The relationship between vegetable production and vegetable acreage was also investigated. The equations estimated are reported below (Table 5):

$$P = -2338 + 22 \ A \qquad R^2 = 0.94 \qquad (1960-81)$$
$$P = 237 + 18 \ A \qquad R^2 = 0.66 \qquad (1970-81)$$

where P = total vegetable production (in thousand tons),
A = total vegetable acreage (in thousand hectares).

As can be observed, there is a strong correlation between vegetable production and acreage in the long-run. However, the relationship is weaker for the 1970-81 period. This is expected because the main increase in production during recent years has been achieved through yield increases rather than increases in acreage.

B. Analysis of Regional Vegetable Production Trends

As with acreage, there have been substantial changes in regional production during the last two decades. The four regions (regions 1, 2, 3 and 4) which showed the greatest increase in area have also accounted for most of the production; three of these are coastal regions with mild climates. Region 2 (Aegean) and region 4 (Mediterranean) accounted for about 26 and 23 percent of the total production respectively, for a total of 49 percent. These are followed by region 3 (Marmara) with 15 percent of the production and region 1 (Central North) with 12 percent. Thus, these four regions have accounted for more than three-fourths of the total production. The production share of other regions varied from 1 percent (Northeast) to 7.2 percent (Black Sea) (Table 6).

Vegetable production increased (both in relative and absolute terms) most in the Mediterranean and Aegean regions during the 1960-81 period. The rate of increase in production of these regions was almost three times as large as the national average. For example, overall production in Turkey increased 3.6 times while the corresponding statistics were 6.9 and 6.4 for the Mediterranean and Aegean regions respectively. The main reasons for this rapid growth were:

1) Favorable climatic conditions that permitted the production of various crop types throughout the year.
2) An extensive transportation network that linked these regions to highly populated urban centers and other markets.
3) Completion of irrigation projects (Seyhan Project in the Mediterranean region and Gediz project in the Aegean) and resulting increases in vegetable acreage and yields.
4) A well developed extension service and the resulting improvement in production technology.
5) Specialization in off-season vegetable production.
6) High demand for off-season vegetable crops and the resulting high prices paid to farmers.

Table 4: Regression Coefficients Between Vegetable Production and Time

| Region | | Time Period | | | | | |
| | | 1960-81 | | | 1970-81 | | |
		a	b	r	a	b	r
Central North	(R1)	251	499	0.94	250	50	0.89
Aegean	(R2)	161	133	0.98	414	120	0.98
Marmara	(R3)	308	73	0.97	585	58	0.96
Mediterranean	(R4)	89	133	0.92	1071	76	0.73
Northeast	(R5)	67	3	0.64	71	2	0.82
Southeast	(R6)	90	38	0.83	-494	72	0.85
Black Sea	(R7)	-13	47	0.91	563	15	0.68
Central East	(R8)	145	15	0.84	268	8	0.77
Central South	(R9)	832	-2	-0.14	687	5	0.34
Total		1931	489	0.97	3415	405	0.94

Source: Computed by Authors.
Production Units are in Thousand Metric Tons; Time is in Years
a=Intercept
b=Slope
r=Correlation Coefficient
Vegetable Production=Dependent Variable
Time=Independent Variable

Table 5: Regression Coefficients between Vegetable Production
and Vegetable Acreage

Region		Time Period					
		1960-81			1970-81		
		a	b	r	a	b	r
Central North	(R1)	-289	20	0.87	590	7	0.28
Aegean	(R2)	-1055	32	0.96	-240	25	0.85
Marmara	(R3)	62	16	0.70	1186	.5	0.46
Mediterranean	(R4)	-166	19	0.97	506	14	0.61
Northeast	(R5)	49	5	0.62	109	-0.2	-0.07
Southeast	(R6)	24	12	0.87	-62	13	0.81
Black Sea	(R7)	-16	23	0.84	671	4	0.51
Central East	(R8)	53	12	0.89	351	2	0.20
Central South	(R9)	744	1.6	0.07	671	2	0.18
Total		-2338	22	0.97	237	18	0.81

Source: Computed by Authors.
Production Units are in Thousand Metric Tons; Acreage Units are in Thousand Hectares.
a=Intercept
b=Slope
r=Correlation Coefficient
Vegetable Production=Dependent Variable
Vegetable Acreage=Independent Variable

7) Efficient use of land (especially in the Aegean region) by small family farms which harvest up to four crops in a given year.[6].
8) Ease of obtaining agricultural credit. For example, long-term credits at low interest to promote greenhouse vegetable production. The farmers in these regions are more willing to use and more able to get credit compared to farmers in other regions[7].

Region 3 (Marmara) normally supplements the other two coastal regions during the regular growing season. The surplus output is marketed in Istanbul and other regional markets. Many farmers in the region are under contract to the food processors; so most of their produce goes directly to the processing plants.

Region 1 (Central North) has a typical continental climate; winters are generally cold and summers are hot, without much rainfall. Precipitation normally falls during the spring and fall months; therefore, the growing season is short and production is mainly for local and regional markets. Interregional shipments are almost nonexistent.

The farmers in the remaining five regions normally produce for self-consumption and/or local markets. The selection of vegetable types and/or varieties is quite limited due to climatic conditions.

A strong positive correlation between vegetable production and time was computed for all regions, with the exception of region 9, South Central. This was true for both the long-term (1960-81) and the short-term (1970-81). Details of the analysis are presented in Table 4.

Total vegetable production in region 9 (South Central) has remained more or less constant through time mainly because of a reduction in vegetable area, offsetting improvements in yield. However, its relative share of the national total has declined from 25.5 percent in 1960 to 6.4 percent in 1981. Most of this share was picked up by the Mediterranean region. This could have been partially due to the new land classification system. Another reason could have been the completion of the Seyhan Irrigation project in the Mediterranean region and the resulting emphasis on vegetable production there.

The relationship between vegetable production and vegetable acreage was also investigated at a regional level. The long-term correlation

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6/ See Fethi Acil. Tarim Ekonomisi. A.U. Ziraat Fakultesi Yayinlari No. 721. Ankara, 1980.

7/ For further discussion on the role of credit, see Mehmet Bulbul. "Tarimsal Kredi ve Kullanimi", Verimlilik Dergisi (pp. 121-138). Milli Produktivite Merkezi. Ankara, 1980/1 and Mehmet Bulbul. "Tarimda Kredi Politikasi, Sorunlari ve Cozum Yollari". DPT 2. Turkiye Iktisat Kongresi Tarim Komisyonu Tebligleri (pp. 825-846). Izmir, 1981.

Table 6: Regional Distribution of Vegetable Production
in Turkey (1960–81)

Year	Region 1	Region 2	Region 3	Region 4	Other* Regions	Total
1960	447	491	577	403	1472	3390
1961	406	584	629	424	1232	3275
1962	388	698	542	417	1381	3426
1963	484	740	510	453	1354	3541
1964	489	703	660	402	1594	3848
1965	424	717	554	419	1672	3786
1966	379	748	573	656	2052	4408
1967	421	782	652	579	1639	4073
1968	868	1424	908	1943	2429	7572
1969	847	1631	1079	1954	2463	7974
1970	886	1843	1282	2120	2308	8439
1971	944	1879	1246	2157	2383	8609
1972	961	1921	1346	2290	2428	8946
1973	903	1997	1346	1783	2190	8219
1974	905	2140	1480	1947	2436	8908
1975	903	2393	1524	2139	2604	9563
1976	988	2494	1629	2283	3210	10604
1977	1069	2459	1536	2225	2862	10151
1978	1127	2740	1692	2410	3102	11071
1979	1336	2845	1778	3135	3483	12577
1980	1348	2838	1940	2655	3210	11991
1981	1452	3154	1775	2781	3011	12173

Source: State Institute of Statistics Publications and Files.
Units are Thousand Metric tons
* computed by the authors by summing the production
figures for regions 5 through 9.

coefficients were high for all regions, again with the exception of region 9 (South Central). No correlation was found between production and acreage in this region. The correlation coefficients were much lower for the short-term (Table 5). This suggests that production increases during the last decade have been achieved mainly through yield improvements rather than expansion of vegetable acreage.

IV. PRODUCTION AND CONSUMPTION OF SPECIFIC VEGETABLES IN TURKEY

A. Production

Several climatic conditions coexist in Turkey due to its geographic location and topography. This results in the possibility of producing a wide range of vegetables. In terms of quantity, tomatoes, cabbage, eggplants, green peppers and cucumbers are most important. The following table summarizes production figures for 1980 and 1981:

Table 7:   Production of Specific Vegetable Crops in Turkey

Vegetable Crop	1980		1981	
	Total Production (1000 tons)	%	Total Production (1000 tons)	%
Tomatoes	3550	45.2	3600	46.9
Cabbage	863	11.0	565	7.4
Eggplant	650	8.3	700	9.1
Green peppers	600	7.6	600	7.8
Cucumber	500	6.4	510	6.6
Others	1692	21.5	1698	22.2
Total	7855	100.0	7673	100.0

Source: SIS files. Percentages computed by authors.

As can be observed tomatoes dominate all vegetable production. Although they are grown in every region, the Mediterranean, Marmara, Aegean and North Central regions are most important. Tomato consumption per capita is very high in Turkey due to dietary habits. This strong domestic demand, coupled with substantial export demand, has contributed to the popularity of this crop. Growing domestic and international demand for processed tomatoes (sauce, puree, paste, juice, etc.) may also have affected production.

Regional distribution of the main vegetable crops is summarized on the following page. It should be noted that cabbage production is the specialty of the Black Sea Region. That is why the share of "other" regions is so high.

Table 8: Regional Production of Selected Vegetables (percent)

Region	Tomatoes	Cabbage	Eggplant	Green Peppers	Cucumber
Central North	8.8	8.1	9.0	7.2	9.8
Aegean	25.4	17.3	35.7	34.8	13.1
Marmara	21.3	11.9	9.0	15.7	13.1
Mediterranean	24.6	12.0	27.3	26.2	27.3
Other	19.9	50.7	19.0	16.1	36.7

Source: Computed by authors using 1981 data from Table 7.

B. Consumption

It is very difficult to obtain reliable consumption estimates for vege-
table crops, due to the fact that a substantial amount of production is for
self-consumption and this output does not go through the regular marketing
channels. Therefore, consumption figures are generally derived by taking
the difference between production and export estimates. This difference is
then divided by population to obtain per capita consumption figures. The
following table summarizes the per capita consumption estimates of the State
Planning Organization.

Table 9: Per Capita Consumption of Plant-Based Products and
Vegetables in Turkey (selected years)

Year	Plant-Based Products (Kg)	Vegetable Crops (Kg)	Proportion of Vegetable Crops (Percent)
1962	532	77	14.5
1963	520	79	15.2
1964	717	90	12.6
1967	1080	88	8.1
1972	1075	91	8.5
1977	792	92	11.6
1983*	912	123	13.5

Source: State Planning Organization publications.
* estimate.

An examination of the above data indicates that per capita consumption of food items of plant origin has about doubled during the 1962-67 period. Cereals and pulses accounted for most of this increase. Only a moderate increase (14 percent) was observed in vegetable consumption. However, per capita consumption figures for total plant-based products have shown a general decline since 1967; the main reason for this is a shift to the consumption of animal protein and fruits. During these years, however, the share of vegetables has grown substantially. An increase of 35 Kg per capita in vegetable consumption was estimated between 1967 and 1983; this was a 40 percent increase[8].

The increase in per capita vegetable consumption can be partially explained by an increase in per capita disposable income. However, domestic consumption is not well distributed among regions; there are regions in the country where some vegetable varieties are completely unknown. As a result, consumption of some vegetables (such as cauliflower, artichokes, asparagus, spinach and okra), are well below world averages. On the other hand, consumption of other vegetables is substantially higher than in many other developed and/or developing countries. For example, per capita consumption for tomatoes was estimated to be 38 Kg in Turkey by OECD. Comparable statistics for the United States, France, West Germany, United Kingdom and Japan were 28, 15, 8, 12 and 7, respectively[9].

The faster rate of increase in vegetable consumption during recent years is probably due to higher incomes and the shift of the population from rural areas to the urban centers. Urbanization not only affects the consumption of fresh vegetables, but it also increases the demand for processed vegetables. Per capita consumption of processed vegetables, although still very low, has shown substantial growth during the last decade, especially in large urban centers.

Another characteristic of vegetable consumption in Turkey is that it is rather seasonal. Consumption peaks in certain months and then declines to almost zero in other months. This is mainly due to the unavailability of cold storage facilities and the relative infancy of the food processing industry.

8/ Devlet Planlama Teskilati. 4. Bes Yillik Kalkinma Plani, Ozel Ihtisas Komisyonu Raporu: Sebze ve Meyva Isleme Sanayi. Ankara, 1977.

9/ OECD. Production, Consumption and Foreign Trade of Fruit and Vegetables in OECD Member Countries. AGR/WP5, (67)5, Paris, 1976.

V. VEGETABLE EXPORTS

As was mentioned earlier, agriculture is the dominant sector in the Turkish economy. This is also reflected on the export side. In 1960, 83.8 percent of Turkish exports were derived from the agricultural sector. This figure has steadily decreased, falling to 47.2 percent in 1981, through deliberate efforts of the policy makers[10/]. The policy emphasis in the development plans has generally been to reduce the dependence of the economy on agriculture and to push towards industrialization. As a result, industry's share of GNP has increased from 10.7 percent in 1960 to 48.7 percent in 1981.

In spite of a fall in relative share of total exports, both the quantity exported and the gross value of agricultural exports have increased through time. Exports of vegetable products have also increased both in terms of quantity and value since the beginning of the planned development era (Table 10).

An analysis of the data provided in Table 10 indicates that agricultural exports have quintupled between 1970 and 1981; this is a rather remarkable achievement. However, the main thrust of the increase came in 1976. Following the oil crisis of 1973, the country depleted all of its foreign exchange reserves in about 2 years, facing a very severe balance of payment problem. This necessitated an urgent push to promote exports; but due to the dependence of the domestic industry on imported parts and machinery, substantial increases in production and/or exports could not be achieved immediately. Agriculture, on the other hand, showed a very speedy response and the value of agricultural exports was increased by about 58 percent between 1975 and 1976. Exports have settled down at this higher level during subsequent years, with sudden upward shifts in some years.

Vegetable exports have shown a gradual increase during the 1970-81 period. The export value has increased from 114 thousand dollars in 1971 to more than 27 million dollars in 1981, though the growth rate was faster after 1977 (Table 10).

Specific vegetable crops that were important in the export mix included tomatoes, leeks, green peppers and eggplants. Other vegetables (such as cabbage, beans, carrots, etc.) have also been involved in export trade; the export growth pattern of these crops is summarized in Table 11. An examination of these figures indicates that neither the specific crop nor total vegetable export values amounts to a significant sum. However, observing the export pattern and the general trend through time brings out some interesting factors. Some of these are briefly stated on the following page:

10/ Sedat Dogan ve Hurman Ocakli. "Turk Tariminda Bag-Bahce Urunleri".
Ikinci Turkiye Iktisat Kongresi Tarim Komisyonu Tebligleri (pp. 891-900),
Izmir, 1981.

1) Total export value was rather small and showed great variation from year to year until 1978.

2) Tomato exports picked up in 1978 and showed a steady increase after that year. Dollars earned from tomato exports exceeded dollars earned from all other vegetables combined every year after 1979.

3) Leek exports were the most erratic of all. The value of these exports jumped from 2 thousand dollars in 1970 to more than a million dollars in 1979. In 1980, the value fell to 30 thousand dollars. This kind of fluctuation probably reflects the existence of serious marketing problems. Holding on to a certain market and meeting its requirements should be a major concern of all exporters.

4) In 1970, total export earnings from vegetables amounted to 623 thousand dollars. Most of this amount was derived from crops other than the specific crops listed. However, the value fell to 114 thousand dollars during the following year. What were the reasons for this decline? Why were these markets lost? How does a country keep a given market when it is established? These are some of the questions that need to be answered if Turkey is to stay competitive in the world markets.

The growth pattern of vegetable exports (both in terms of quantity and dollar value) were investigated using simple regression analysis. Three different time periods (1970-81, 1974-81 and 1977-81) were used to analyze the developments of recent years. Because of the small number of observations in each time period, the results may be rather unreliable; the computed statistics are provided below to demonstrate growth trends in general. These statistics should not be used for projections:

$$X \text{ Tons} = -20625 + 5654 \ T \qquad R^2 = 0.56 \qquad (1970-81)$$
$$X \text{ Tons} = -26151 + 11014 \ T \qquad R^2 = 0.74 \qquad (1974-81)$$
$$X \text{ Tons} = -22651 + 19742 \ T \qquad R^2 = 0.85 \qquad (1977-81)$$

$$X \text{ Dollars} = -6285 + 1674 \ T \qquad R^2 = 0.56 \qquad (1970-81)$$
$$X \text{ Dollars} = -7840 + 3245 \ T \qquad R^2 = 0.72 \qquad (1974-81)$$
$$X \text{ Dollars} = -7605 + 6045 \ T \qquad R^2 = 0.86 \qquad (1977-81)$$

where X Tons = Total amount of vegetables exported (1000 tons),
    X Dollars = Total value of vegetables exported (1000 dollars),
    T = time period (1970 = 1.....1981 = 12)

A quick glance at the above equations indicate that the coefficient of determination (R^2) increases if shorter but more recent time periods are selected. This is an indication that exports (both quantity and dollars obtained) have become more stable during the recent years.

Table 10:   Total Agricultural and Vegetable Exports of Turkey (1970-81)

Year	Agricultural Exports (nom.) ($ Mill)	Agricultural Exports (real) ($ Mill)	Vegetable Exports (nom.) ($ Mill)	Vegetable Exports (real) ($1000)*
1970	443	381	623	536
1971	491	405	114	94
1972	607	484	176	140
1973	892	670	182	137
1974	852	577	273	185
1975	793	492	469	291
1976	1254	736	691	405
1977	1047	577	767	423
1978	1543	790	4436	2271
1979	1344	617	8305	3815
1980	1672	682	11872	4842
1981	2219	815	27276	10017

Source: Ministry of Commerce files.
* Real figures were obtained using United States Consumer Price Index (1967 = 100) as a deflator.

Table 11: Export Value of Specific Vegetable Crops for
the 1970-81 Time Period (in thousand dollars)

Year	Tomatoes	Leek	Peppers	Eggplant	Other*	Total
1970	11	19	9	5	579	623
1971	---	13	---	3	98	114
1972	2	---	22	19	133	176
1973	3	---	26	27	126	182
1974	4	---	115	15	139	273
1975	34	8	75	10	342	469
1976	22	1	123	22	523	691
1977	73	182	153	28	331	767
1978	1047	2	241	117	3029	4436
1979	4639	1161	307	137	2061	8305
1980	7073	30	325	112	4332	11872
1981	19233	343	452	430	6818	27276

Source: Ministry of Commerce files.
* Does not include onion, garlic, melon and watermelon.

VI. CONCLUSION

A. Summary

It has been established that vegetable production is becoming increasingly important as time passes. Acreage devoted to vegetables, total production and exports of vegetable crops have all shown fast growth during the last decade. In the 1950s and 1960s, most vegetables were grown for self-consumption and/or for local markets. However, in the 1970s, the structure changed and lots of farmers started to produce for the market. Shipments of vegetables between regions have become rather common. International marketing of these crops also started in the early 1970s and growth of exports became substantial by the end of the decade.

The main reasons for the increase in vegetable acreage included a shift in domestic demand pattern due to urbanization and higher per capita income, the newly discovered international markets and the availability of more irrigated land suitable for vegetable production. Moreover, changes on the supply side such as introduction of modern production technology and the availability of production inputs (better seeds, fertilizers, etc.) at subsidized prices made vegetable production attractive. Yields have also improved during this period, resulting in substantial production increases. Most of the above changes were also supported by government policy. For example, the Third Five-Year-Plan (1972-77) has provided lots of incentives for vegetable production. As production increased in the 1970s, there was substantial change in regional distribution of output. Coastal regions (Mediterranean, Aegean and Marmara), as well as the Central North, provided about 75 percent of the output by the late 1970s. Off-season production has also gained in importance, especially in the Mediterranean region. The growth of the food processing industry has been another factor in encouraging production expansion. Both off-season production in greenhouses and investment in processing plants have been supported by long-term and subsidized credit.

Turkey has suitable climatic and soil types for the production of a wide variety of vegetable crops. The recent growth in production and exports should be considered as the tip of the iceberg; a huge potential still exists for growth. The country could become a significant supplier in the international markets. Its geographic proximity to both the near Eastern markets (e.g. Arab countries, Iran) and West European countries provides a location advantage which perhaps could be exploited. It should be noted that, especially in the near Eastern markets, Turkey would face little competition from other countries in the region, if it were to specialize in exporting to these countries.

B. Issues for Further Study

Data analysis and other investigation indicate that there is lots of room for further research in regard to vegetable production and marketing. Studies focusing on the following topics will prove especially beneficial if expansion of vegetable production and exports is to continue:

1) Determination of optimal vegetable growing patterns in different geographic regions, considering net returns by crop and farm size.

2) Investigation of credit use and its effects on vegetable production. Specific questions to be addressed could include:

- Production response to increased credit
- Cost and Terms of credit
- Timing of credit extension
- Credit priorities for specific vegetable crops
- Special credits for alternative production techniques
- Credit for vegetable processing
- Marketing and export credit
- Regional distribution of credit

3) Investigation of issues related to domestic marketing of vegetables. Specific topics could include:

- An evaluation of marketing channels
- Pricing practices and problems
- Collection and dissemination of marketing information
- Feasibility of horizontal/vertical marketing systems
- Standardization and grading problems
- Determination of storage and transportation requirements.

4) Very little research has been done on international marketing of vegetables. All of the above issues mentioned with regard to domestic marketing are also applicable to the export sector. In addition, the following topics should be studied:

- Determination of demand by crop/variety in major importing countries
- Determination of effective promotion methods to sustain and/or expand the export demand
- Determination of optimal organizational structure for export marketing of vegetables

5) The role of government in promotion and marketing of vegetables should be investigated to determine the extent of public involvement in:

- Supply of production credit
- Collection, analysis and dissemination of information
- Pricing
- Developing necessary infrastructure
- Education, extension and research
- The support of production/marketing cooperatives
- Provision of export credit
- Export promotion

The above is not an exhaustive list of research topics. As was mentioned in the introduction to this paper, the intent was to summarize the data available on vegetable crops in order to provide a basis for future research. It is clear that there has been substantial growth in this industry over the last 20 years and the potential exists for future expansion. It is hoped that this pioneering study stimulates enough interest for this segment of the Turkish economy to encourage further research, so that the full potential may be realized.

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