

Vegetable Production Potential of Turkey

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Authors' contributions

This work was carried out in collaboration between both authors. Author HB designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors HB and MD collected the data. Author HB reviewed all drafts of the manuscript. Authors HB and MD read and approved the final manuscript.

Article Information

DOI: 10.9734/AJEA/2016/25778

Editor(s):

(1) Anita Biesiada, Department of Horticulture, Wroclaw University of Environmental and Life Sciences, Poland.

Reviewers:

(1) Sait Engindeniz, Ege University, Turkey.

(2) Magdalena Valsikova, Slovak University of Agriculture in Nitra, Slovakia.
Complete Peer review History: <http://sciencedomain.org/review-history/14616>

Review Article

Received 19th March 2016

Accepted 5th May 2016

Published 13th May 2016

ABSTRACT

The ecological diversity in Turkey has a great role on formation agricultural systems. Turkey has been the fourth largest vegetable producer after China, India, and the United States, with 29.522.290 million tons of production over an 809.000 ha agricultural area. Even though production has been based on traditional methods, it ranks in the first in the World in terms of vegetable production capacity per km² and per capita with being among the top five in the production of most types of vegetables. Vegetable production activity has been spread over many parts of the country, but production for trading purposes has been especially focused on the Mediterranean Region (MTR), Aegean Region (AR), Marmara Region (MR), and the Black Sea Region (BSR). There has been a marked increase in vegetable production in the Inner Anatolia Region (IAR). Vegetable production is limited by the local climate and an insufficient supply of water in Southeastern Anatolia Region (SAR), and by highlands and rough local climate in the Eastern Anatolia Region (EAR). The purpose of the current study was to provide information on the vegetable production potential of Turkey in order to present to the international community. Vegetable production and its farming areas in seven geographical regions of Turkey were presented in the tables and discussed.

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Keywords: Regions of Turkey; vegetable types; vegetable areas; vegetable production.

1. INTRODUCTION

Agricultural production has been a major source for sustaining huge world population. It has a prominent and privileged place in the national economy. Turkey has been a self-sufficient country with respect to agricultural production, crop diversity and abundance with having the capacity to aid poor countries. Also, its agricultural resources provide raw materials for many industrial branches [1]. Vegetables, the greatest portion of plant based nutrition, contain 1.7-15.7 g of carbohydrates, 0.6-4.7 g protein and 0.1- 0.7 g plant oil per 100 g fresh vegetables, including cellulose, minerals, vitamins, hormones and aromatic compounds as well [2]. Their main mineral contents are iron, calcium, phosphorus, magnesium, sodium, sulfur, silica, and iodide, which control water concentration and osmotic pressure of the body, and join the structure of hemoglobin and hormones [3].

In Turkey, 28.053.500 hectares of land (36% of the surface area) are suitable for agriculture with showing different properties. Inner Anatolia Region (IAR), Southeastern Anatolia Region (SAR), Marmara Region (MR), and the plains of the Aegean Region (AR) possess wide and plane agricultural lands while Black Sea Region (BSR) and Mediterranean Region (MTR) have lands with narrower and high-low altitude together. The Eastern Anatolian Region (EAR) has very harsh surface features and climate [4].

The genetic diversity allows Turkey to be a prominent region for vegetable production. This richness has been projected on production with number of products, gross production size, total size of cultivated lands, and productivity increasing every year. The average vegetable yield in Turkey is 284,987 kg/ha, whereas the global average is 241,559 kg/ha [5].

Out of all plant production area in Turkey, 66.5% (15.7 million ha) has been used for field crops, 16.9% (4 million ha) for fallow land, 5% for fruit production (1.5 million ha), 3.7% (809.000 ha) for vegetable production, 2% (600.000 ha) for olive production, and 2% (500.000 ha) for vineyards. Greenhouse cultivation has become very important for horticulture and floriculture in recent years, applied on more than 66.362 ha, with 38.943 ha modern greenhouses and 27.422 ha low and high tunnels. The total share of

greenhouse in vegetable production is 12.24% [6]. A 41% of Turkish population has been involved in agriculture and 12% of total agricultural lands has been used for horticulture, engaging nearly 2.5-3 million people have been worked on horticulture in Turkey [7].

In Turkey, about 50 types of vegetables have been cultivated in 87% in the open fields and 13% in greenhouses, being the fourth largest vegetable producer in the world, while 20 types of plants have been obtained from nature for consumption. Fruits and vegetables make up 86% of total vegetable production, whereas leaf vegetables make up 7%, and root vegetables make up 3% [8].

Generally, Turkey's share in global vegetable production is 3.1%. Only 7-8% of local production is exported, the buyers being Russia (21%), Germany (17%), Saudi Arabia (9%), Greece (8%), Romania (8%), and the Netherlands (5%). Central Asian Turkish republics, Balkan countries, England, Belgium, France, and Austria are among other important markets. The exported products consist of tomatoes, onions, pickled cucumbers, carrots, peppers, and watermelons. Turkey supplies the global demand at a rate of 12% for melons, 11% of global watermelons, 13.7% of global green beans, 9.6% of global peppers, and 8% of tomatoes [9].

Vegetables comprise 28% of total plant production in Turkey. Total vegetable production area is 809.000 ha, according to 2015 data. Annually, 29.5 million tons of vegetables are produced, supplying the national economy with 1 billion Turkish liras [10].

When looked consumption rate, average annual vegetable consumption per capita is 346 kg in Turkey but this is 107 kg in the World, 375 kg in China, 101 kg in EU Countries and especially between 94.6 and 106.1 kg in Slovak Republic [11].

The current study presents the average vegetable cultivation area and production data of 52 vegetables between 2006 and 2012. Moreover, production data over those years was reviewed for seven geographical regions of Turkey and presented in tables since there has not been any sufficient information on literature with respect to the current situation of vegetable

production of Turkey in detail. Therefore, the purpose of the current work was to provide information on the vegetable production potential of Turkey in order to present the international community.

2. CLIMATE OF TURKEY AND ITS INFLUENCE ON AGRICULTURE

Turkey is situated between 36-42° north latitude and between 26-45° east longitude. This country is divided into seven geographical regions: Mediterranean Region (MTR), Eastern Anatolian Region (EAR), Aegean Region (AR), Southeastern Anatolian Region (SAR), Inner Anatolian Region (IAR), Black Sea Region (BSR), and Marmara Region (MR). The ratio of regional over national surface area is 16% for MTR, 21% for EAR, 12% for AR, 7.5% for SAR, 18% for BSR, and 8.5% for MR (Fig. 1).

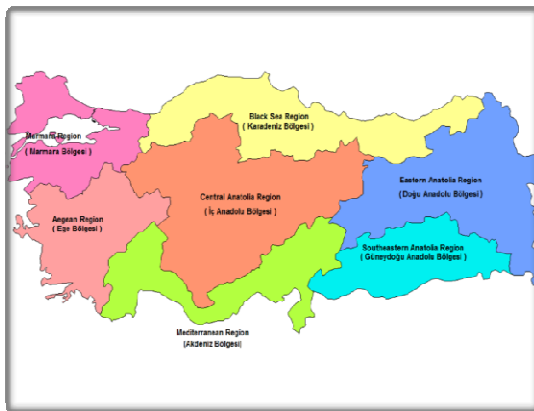


Fig. 1. Seven vegetable producing regions of Turkey

Various climate types with different properties have emerged in Turkey due to being surrounded by sea on three sides, and the arrangement of mountains and elevations. MTR, AR, and southern MR shores have a Mediterranean climate (hot and rainless summers, cold and rainy winters); the northern shores of BSR have a Black Sea Climate (hot and rainy summers, cold winters); IAR, EAR, SAR, and the Thrace region of MR have a continental climate (long, cold, and snowy winters, short and hot summers). MR, AR, and MTR have the greatest product diversity due to the transitional climate. Vast steppes in IAR together with short and cool summers in EAR are among the important factors limiting vegetable production [4].

Climate variability in Turkey makes it possible for many plant types with different edaphic and climatic requirements, including vegetables, to grow in different regions and seasons. This not only leads to increased production, but also lengthens the productive period in which different vegetables can be grown and supplied to the market [12].

3. PRODUCTION AREA AND YIELDS BY YEAR

There are 52 vegetable types grown at an economically relevant scale. Production areas and yields over the years are provided in Table 1. Vegetable production area was 829.413 ha in 2006, whereas it decreased in 2008 and 2010, and increased to 871.883 ha in 2012. In 2006, highly produced vegetables were tomatoes (6,83 million tons), watermelons (3,78 million tons), tomatoes for paste (2,92 million tons), melons (1.75 million tons), cucumbers (1,66 million tons), onions (1,30 million tons), eggplants (922.169 tons), peppers (773.050 tons), peppers for paste (672.872 tons), green beans (558.346 tons), and white head cabbage (2.93 million tons). The lower produced vegetables were arugula (2.675 tons), dill (2.403 tons), garden cress (2.104 tons), celery (1.975 tons), and asparagus (10 tons), in decreasing order. In 2008, tomatoes (7,39 million tons), watermelons (3,68 million tons), tomatoes for paste (3.56 million tons), onions (1.57 million tons), cucumbers (1.53 million tons), eggplants (762.580 tons), peppers for paste (733.278 tons), carrots (590.453 tons), peppers (564.645 tons), bell peppers (512.016), and green beans (502.794 tons) were the highly produced vegetables; whereas dill (2.777 tons), celery (2.720 tons), garden cress (2.400 tons), turnips (1.892 tons), and asparagus (10 tons) were the lower produced. In 2010, tomatoes (7.17 million tons), watermelons (3.67 million tons), tomatoes for paste (2.88 million tons), cucumbers (1.58 million tons), watermelons (815.597 tons), and peppers (585.809 tons) were more produced vegetables. In the same year, dill (2.974 tons), garden cress (2.567 tons), turnips (1.698 tons), celery (1.528 tons), and asparagus (25 tons) were lower in production. In 2012, the highly produced vegetables were tomatoes (7.69 million tons), watermelons (4.02 million tons), tomatoes for paste (3.65 million tons), onions (1.74 million tons), melons (1.69 million tons), cucumbers (1.60 million tons), peppers (907.478 tons), eggplants (799.288 tons), peppers for paste (748.422 tons), carrots (714.280 tons),

and green beans (619.313 tons) while the lower produced vegetables were dill (2.899 tons), celery (1.559 tons), turnips (1.537 tons), and asparagus (7 tons). Total vegetable production increased in 2006 (25.22 million tons) and 2008 (26.74 million tons), decreased in 2010 (25.44 million tons) in correlation with a decreased production area, but increased again in 2012 (27.82 million tons) (Table 1).

Between the years 2006 and 2012, most produced vegetables were tomatoes, watermelons, and tomatoes for paste. Tomato production increased over the years, except for a slight decrease in 2010 due to a decrease in production area. The decrease in watermelon production in 2006 and 2010 was parallel to the decrease in production area, although it increased again in 2012. The production of tomatoes for paste showed minor fluctuations. In 2008, the production of tomatoes for paste increased in spite of the decreased production area, decreased in 2010 and increased again in

2012. Between 2006 and 2012, there were some differences in terms of production values in the ranking between melon, cucumber, and onion production. Even though eggplant production was greater between 2006 and 2010, pepper production became greater in 2012. Carrots were among the highly produced vegetables in 2008 and 2012. Cabbage and bell peppers were listed among the highly produced products in 2006 and 2008, respectively. Green beans were produced at lower rate during the 2006-2012 term, except 2006 (Table 1). Between 2006 and 2012, arugula, dill, garden cress, celery, turnips, and asparagus were produced in lower rate.

There are significant fluctuations in vegetable production in Turkey among vegetable types and regions. With regard to vegetable types, (85 %) consists of vegetables grown for their fruit. Among these, tomatoes, watermelons, melons, cucumbers, and peppers are especially prominent [13].

Table 1. Yield and production areas of 52 vegetable types in Turkey between 2006 and 2012 [19-20-21-22]

Vegetable tonnage (ton) and production area (da) in Turkey by year				
Vegetable types*	2006	2008	2010	2012
Vegetable production area (da)	8.294.135	8.222.687	8.015.980	8.718.827
White head cabbage	506.768	479.537	490.138	481.501
Red cabbage	47.977	98.797	118.087	133.234
Collard greens	75.798	80.575	86.376	85.023
Brussel sprout	91.300	10.519	15.260	16.970
Artichoke	35.007	34.699	39.912	32.173
Celery	1.975	2.720	1.528	1.559
Curly lettuce	151.476	144.038	131.930	144.988
Head lettuce	240.091	228.828	224.245	205.463
Iceberg lettuce	50.616	60.408	50.371	68.134
Spinach	242.150	223.177	215.469	221.775
Chard	5.960	6.916	5.276	5.953
Pursley	4.232	3.716	4.917	6.945
Garden cress	2.104	2.400	2.567	4.476
Parsley	53.203	52.243	56.024	56.587
Dill	2.403	2.777	2.974	2.899
Mint	9.624	9.904	11.754	12.598
Arugula	2.675	3.814	4.390	7.689
Cauliflower	136.158	12.165	158.579	169.097
Broccoli	16.240	30.823	26.522	30.807
Asparagus	10	10	25	7
Mushroom	109.690	27.506	39.087	33.750
Tomato	6.830.502	7.388.325	7.169.322	7.693.266
Tomatoes for paste	2.925.153	3.564.084	2.882.678	3.652.039
Cucumber	1.664.024	1.525.902	1.583.864	1.603.083
Cucumber for pickles	131.494	158.476	145.112	138.768
Armenian cucumber	27.139	34.292	25.621	32.581
Pepper for paste	672.872	733.278	777.173	748.422
Bell pepper	391.700	512.016	386.951	383.213

Vegetable tonnage (ton) and production area (da) in Turkey by year				
Vegetable types*	2006	2008	2010	2012
Vegetable production area (da)	8.294.135	8.222.687	8.015.980	8.718.827
Pepper	773.050	564.645	815.597	907.478
Okra	36.813	150.944	35.878	35.728
Eggplant	922.169	762.580	846.241	799.288
Green bean	558.346	502.794	585.809	619.313
Green pea	89.867	140.490	90.341	101.959
Green fava	45.727	37.503	41.857	40.471
Green cowpea	16.060	20.379	16.591	20.566
Green pinto bean	55.617	154.687	69.292	84.134
Marrow	287.495	216.650	313.891	302.374
Pumpkin	76.988	79.099	88.854	93.612
Pumpkin for seed	17.374	19.802	26.682	32.110
Melon	1.747.705	1.960.046	1.582.852	1.688.687
Watermelon	3.775.448	3.684.792	3.671.935	4.022.296
Scallion	200.630	167.079	165.478	150.932
Onion	1.303.135	1.572.797	1.429.074	1.735.846
Green garlic	27.581	44.363	42.880	25.806
Garlic	41.273	51.560	47.878	79.385
Leek	319.845	255.743	244.086	231.082
Carrot	383.442	590.453	497.278	714.280
Turnip	5.697	1.892	1.698	1.537
Red beet	9.746	35.378	8.416	7.540
Celery root	15.593	16.537	14.758	17.049
Horseradish	19.091	16.893	16.110	15.107
Radish	149.086	144.813	139.370	131.375
Total vegetable production (ton)	25.215.732	226.740.864	25.435.493	27.815.682

* Production area and tonnage data represents the sum of field and greenhouse production. There are 52 types of vegetables in the table

4. PRODUCTION AREA AND YIELDS BY GEOGRAPHICAL REGIONS

In 2006, MTR ranked the first in terms of production area with 163.417 ha, followed by AR (154.997 ha), MR (152.694 ha), IAR (144.971 ha), BSR (106.963 ha), SAR (74.424 ha), and EAR (31.948 ha). For annual vegetable production, MTR ranked the first with 7.53 million tons, followed by AR (4.96 million tons), MR (4.47 million tons), IAR (2.97 million tons), BSR (2.57 million tons), SAR (1.96 million tons), and EAR (754.158 tons). There seems to be a correlation between vegetable production and production area in ranking the regions (Table 2). When looked the highly produced vegetables, tomatoes and watermelons are produced in every region. Melons and cucumbers are produced in greater quantities, except for in BSR and SAR, respectively. The regions of relatively low production are EAR and IAR for eggplants; EAR, AR, and SAR for onions; and MTR and EAR for tomatoes for paste. Peppers for paste are produced in smaller quantities in EAR, IAR, and BSR compared to other regions. The regions with the least pepper production were

EAR, SAR, and IAR; it was produced in substantial quantities in other regions. The regions with greatest white head cabbage production are BSR, IAR, MR, and AR; it is produced in small quantities in MTR, EAR, and SAR. Green beans are produced in BSR and MTR more at an economically relevant scale. It can be seen in Table 2 that the regions and the greater produced vegetables were followed as EAR for mushrooms, IAR for carrots, BSR for collard greens, AR for cucumbers for pickles, and MTR for marrow, red cabbage, head lettuce, bell peppers, and leeks. Pumpkin for seeds and red beets in MTR, artichokes in IAR, Armenian cucumbers in BSR, and celery and asparagus in MR are produced in low quantities. Green peas, green cowpeas, and dill were produced very little in SAR; red cabbage, collard greens, green peas, broccoli, iceberg lettuce, and dill were produced very little in EAR, where vegetable production area and yield is low (Table 2). Production data for some vegetables, for example asparagus, are not available for some regions, except MR. Celery root production data is not available for MT, EAR, SAR, and IAR; celery for EAR, SAR, IAR, and BSR; green

cowpea for EAR, IAR, and BSR; brussel sprouts, artichokes, arugula, cauliflower, and pumpkin for seeds for EAR and SAR; chard, parsley, and red beets for EAR; and red cabbage, iceberg, broccoli, mushrooms, and turnip for SAR (Table 2).

In 2008, MTR ranked in the first in terms of production area with 176.943 ha, followed by MR (150.254 ha), AR (148.474 ha), IAR (142.445 ha), BSR (107.640 ha), SAR (83.316 ha), and EAR (26.723 ha). For tonnage yield, MR ranked in the first (8.11 million tons), followed by AR (5.39 million tons), MR (4.56 million tons), IAR (3.26 million tons), BSR (2.73 million tons), SAR (2.04 million tons), and EAR (661.617 tons) (Table 3). The tomatoes were highly produced vegetable in MTR, EAR, and BSR; tomatoes for paste were the most produced vegetable in AR and MR, being an important vegetable produced in all regions (Table 3). Tomatoes for paste are grown at an economically relevant level in all regions, except EAR. Watermelons were the highest produced vegetable in SAR and one of highly produced vegetables in all regions. Similarly, melons and cucumbers are produced easily in all regions. Onions were produced the highest level in IAR and among the highly produced vegetables in all regions, except EAR and SAR. Regions of relatively higher production were MTR, AR, SAR, BSR, and MR for eggplants; MTR, AR, SAR, and MR for peppers for paste; and AR, IAR, BSR, and MR for white head cabbage. The region with highest carrot production was IAR. BSR was the leading region in green bean production, followed by MR and AR. As can be seen in Table 3, regions with relatively higher production were MTR and BSR for bell peppers, and MTR, AR, and BSR for peppers. Okra, head lettuce, green pinto beans, marrow, leeks, and radishes were produced in MTR; cucumbers for pickles were produced in AR, and red cabbage and collard greens were produced in BSR, all of which were not among the highly produced vegetables in other regions (Table 3). The lower produced vegetables were red beets in MTR, pumpkins for seeds, dill, cauliflower, broccoli, green cowpeas, green fava beans, and collard greens in EAR; purslane in AR, green peas, dill, and arugula in SAR; celery in BSR; and asparagus in MR. Production data for asparagus was not available for any region, except MR. No production data was available from TUIK due to climate conditions that are unsuitable for production or economically negligible scale of production for the following: Celery root in MTR; brussel sprouts, artichokes,

celery, iceberg, arugula, and celery root in EAR; red cabbage, brussel sprouts, artichokes, celery, cauliflower, mushrooms, green cowpeas, turnips, and celery root in SAR; celery root in IAR; and green cowpeas in BSR (Table 3).

In 2010, MTR (1.73 million tons) ranked in the first, followed by AR (146.147 ha), IAR (143.144 ha), MR (137.816 ha), BSR (103.428 ha), SAR (72.037 ha), and EAR (26.063 ha). With regard to tonnage yield, MTR (8.49 million tons) ranked first, followed by AR (4.87 million tons), MR (3.98 million tons), IAR (2.99 million tons), BSR (2.76 million tons), SAR (1.72 million tons), and EAR (629.961 tons). Even though the production area in IAR is greater than MR, IAR ranks in the fourth and MR ranks in the third in terms of production. For other regions, tonnage was correlated with production area (Table 4).

Tomatoes ranked in the first as the most produced vegetable in MTR, EAR, and BSR; it ranked in the second in AR and MR; and ranked in the third in SAR and IAR. Tomatoes for paste ranked in the first as the most produced vegetable in AR and MR, and ranked in the second in SAR. Moreover, tomatoes for paste were among the highly produced vegetables in MTR and BSR. Watermelons were the most produced vegetable in SAR and produced in almost all regions as cucumbers and melons. Onions are the most produced in IAR, followed by MTR and MR. Peppers was among highly produced vegetable in MTR, AR, and BSR; peppers for paste was the most produced vegetable in MTR, AR, MR, and SAR; and white head cabbage was the most produced vegetable in BSR, IAR, MR, and AR. Eggplants was produced extensively in MTR, AR, SAR, BSR, and MR. The most produced vegetable was green beans in BSR, MTR, AR, and MR; carrots in IAR; cucumbers for pickles in AR; red cabbage and collard greens in BSR; and marrow, bell peppers, head lettuce, red beets, and leeks in MTR (Table 4).

The least produced vegetable was pumpkins for seed in MTR; green peas and dill in EAR; green pinto beans, curly lettuce, and dill in SAR; green cowpeas in IAR; pumpkins for seeds and turnips in BSR; and Armenian cucumbers and asparagus in MR. There were no production data of asparagus for MTR, EAR, SAR, IAR, and BSR; celery root in EAR, SAR and IAR; celery in EAR, SAR, IAR, and BSR; green cowpeas in EAR, SAR, and BSR; collard greens for EAR and IAR; brussel sprouts, artichokes, cauliflower,

and red beets for EAR and SAR; green fava beans and broccoli for EAR; red cabbage, mushrooms, pumpkins for seeds, and turnips for SAR; and Armenian cucumbers for BSR. This situation does not imply that they are not produced at all. Their data was not collected because of their negligible production.

In 2012, MTR (180.881 ha) had the largest production area as those of previous years, followed by IAR (165.303 ha), AR (156.152 ha), MR (147.396 ha), BSR (122.434 ha), SAR (69.087 ha), and EAR (30.629 ha). For the amount of production, MTR (8.68 million tons) ranked first, followed by AR (5.25 million tons), MR (4.78 million tons), BSR (3.31 million tons), IAR (3.21 million tons), SAR (1.85 million tons), and EAR (735.818 tons). Even though IAR had the second largest production area in 2012, it ranked in the fifth after MTR, AR, MR, and BSR in terms of tonnage (Table 5). Tomatoes were the most produced vegetable in all regions. Tomatoes for paste were one of the highly produced vegetables in AR and MR (Table 5). Watermelon and melon were substantially produced in all regions, especially in SAR. The other substantial productions were seen in MTR, EAR, AR, BSR, and MR for cucumbers; in MTR, IAR, BSR, and MR for onions; in MTR, AR, SAR, and in MR for peppers for paste; in MTR, AR, BSR, and MR for peppers; and in MTR, AR,

SAR, and BSR for eggplants. Green beans was produced in relatively in larger quantities in MTR, AR, BSR, and MR. The region with highest white head cabbage production was BSR, followed by IAR, MR, and AR. Bell peppers were the most produced vegetable in MTR and BSR. Carrots were the most produced vegetable in IAR, even though it was not among the most produced vegetables in other regions in 2012. The most produced vegetable were cucumbers for pickles in AR; red cabbage and collard greens in BSR; and marrow, radishes, head lettuce, and leeks for MTR. Vegetable with the least production was red beets in MTR; green cowpeas in IAR; turnips in BSR; asparagus fin MR; green pinto beans, pumpkins for seeds, and dill in SAR; and broccoli, green peas, red cabbage, dill, and cauliflower in EAR. Asparagus was the least produced vegetable in MR, although the production data was not available for the other six regions. There were no production data regarding celery in EAR, SAR, IAR, and BSR; collard greens in EAR, AR, and SAR; celery root and red beets in EAR, SAR, and IAR; green cowpeas in EAR, SAR, and BSR; brussel sprouts, artichokes, iceberg, mushrooms, and green fava beans for EAR; red cabbage, cauliflower, broccoli, turnips, and horseradish in SAR; and Armenian cucumber and pumpkins for seeds in BSR (Table 5).

Table 2. Vegetable production (ton) and production areas (da) in 2006 [19]

Vegetable tonnage (tons) and production area (da) in Turkey in 2006								
Vegetable type*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.634.167	319.475	1.549.972	744.238	1.449.709	1.069.632	1.526.942	8.294.135
White head cabbage	46.722	34.281	98.789	1.463	108.244	118.171	99.098	506.768
Red cabbage	12.581	12	5.058	-	8.757	5.799	15.770	47.977
Collard greens	2.585	10	1.080	62	53	60.830	11.178	75.798
Brussel sprout	40	-	291	-	44	140	398	913
Artichoke	4.825	-	15.010	-	8	1.364	13.800	35.007
Celery	390	-	1.565	-	-	-	20	1.975
Curly lettuce	51.120	1.478	11.841	235	27.489	28.879	30.434	151.476
Head lettuce	116.361	1.004	38.070	8.199	48.601	14.553	13.303	240.091
Iceberg lettuce	11.745	3	1.719	-	36.550	228	371	50.616
Spinach	40.864	2.561	51.368	2.928	49.730	42.463	52.236	242.150
Chard	4.450	-	196	225	60	932	97	5.960
Purslane	377	-	98	17	2.266	234	1.240	4.232
Garden cress	701	29	212	164	484	182	332	2.104
Parsley	24.475	493	3.022	1.805	9.381	1.203	12.824	53.203
Dill	367	3	528	2	60	124	1.319	2.403

Vegetable tonnage (tons) and production area (da) in Turkey in 2006								
Vegetable type*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.634.167	319.475	1.549.972	744.238	1.449.709	1.069.632	1.526.942	8.294.135
Mint	4.337	71	163	4.495	212	241	105	9.624
Arugula	398	-	636	-	826	134	681	2.675
Cauliflower	41.931	-	39.666	-	2.900	9605	42.056	136.158
Broccoli	7.023	8	5.868	-	675	1.356	1.310	16.240
Asparagus	-	-	-	-	-	-	10	10
Mushroom	13.304	87.910	285	-	1.038	348	6.805	109.690
Tomato	3.014.594	183.314	1.066.498	242.394	637.163	911.503	775.036	6.830.502
Tomato for paste	85.620	11.053	1.160.288	91.410	148.411	79.464	1.348.907	2.925.153
Cucumber	835.170	55.275	240.031	68.477	96.966	245.908	122.197	1.664.024
Cucumber for pickles	3.849	761	97.270	1.264	6.305	4.609	17.436	131.494
Armenian cucumber	9.825	2.563	2.701	10.802	1.113	15	120	27.139
Pepper for paste	91.340	451	181.529	167.159	1.836	48.806	181.751	672.872
Bell pepper	100.394	14.100	60.765	63.013	9.834	67.313	76.281	391.700
Pepper	362.122	7.862	139.015	25.827	24.134	105.214	108.876	773.050
Okra	8.215	315	14.369	1.601	464	3.469	8.380	36.813
Eggplant	390.390	10.584	150.197	164.238	22.703	69.522	114.535	922.169
Green bean	119.505	16.351	82.674	15.178	57.255	178.375	89.008	558.346
Green pea	19.161	9	10.404	6	776	3.784	55.727	89.867
Green fava bean	1.998	148	14.163	97	217	4.293	12.811	45.727
Green cowpea	1.661	-	12.481	4	-	-	1.914	16.060
Green pinto bean	2.430	1.078	9.422	12	3.789	24.040	14.846	55.617
Marrow	143.699	6.174	34.144	3.505	46.296	23.697	29.980	287.495
Pumpkin	3.424	1.567	6.192	401	19.393	18.007	28.004	76.988
Pumpkin for seed	24	-	287	-	12.951	106	4.006	17.374
Melon	269.807	106.822	410.891	253.419	361.225	87.000	258.541	1.747.705
Watermelon	1.066.059	163.560	771.883	724.206	256.043	212.197	581.500	3.775.448
Scallion	36.963	16.462	27.050	25.637	51.816	13.853	28.849	200.630
Onion	273.048	23.564	70.921	65.080	569.207	129.368	171.947	1.303.135
Green garlic	8.439	486	4.662	8.590	1.255	749	3.400	27.581
Garlic	11.740	622	4.465	1.166	8.390	169	14.721	41.273
Leek	94.271	104	72.074	114	29.153	34.599	89.530	319.845
Carrot	50.729	601	15.758	2.835	298.912	4.335	10.272	383.442
Turnip	339	71	4.588	-	249	75	375	5.697
Red beet	10	-	4.036	47	266	3.124	2.263	9.746
Celery root	-	-	7.267	-	-	140	8.186	15.593
Horseradish	2.256	683	5.086	708	2.438	3.633	4.287	19.091
Radish	127.850	1.715	3.528	1.734	8.984	1.550	3.725	149.086
Total vegetable production (ton)	7.531.528	754.158	4.960.104	1.958.519	2.974.922	2.565.703	4.470.798	

* Production area and tonnage data represents the sum of field and greenhouse production. There are 52 types of vegetables in the table. MTR: Mediterranean Region, EAR: Eastern Anatolian Region, AR: Aegean Region, SAR: Southeastern Anatolian Region, IAB: Inner Anatolian Region, BSR: Black Sea Region, MR: Marmara Region

Table 3. Vegetable production (ton) and production areas (da) in 2008 [20]

Vegetable tonnage (ton) and production area (da) in Turkey in 2008								
Vegetable types*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.769.433	267.234	1.484.740	833.164	1.424.448	1.076.399	1.502.535	8.357.953
White Head	37.024	29.940	78.175	1.563	114.469	116.480	101.886	479.537
Cabbage								
Red cabbage	7.082	40	5.820	-	5.221	64.964	15.670	98.797
Collard greens	1.514	3	1.080	45	4	69.379	8.550	80.575
Brussel sprout	9.141	-	266	-	63	150	899	10.519
Artichoke	2.026	-	13.909	-	20	4.795	13.949	34.699
Celery	320	-	2.319	-	-	6	75	2.720
Curly lettuce	43.236	76	8.759	289	26.619	31.059	34.000	144.038
Head Lettuce	108.193	2.280	37.855	7.556	47.105	17.935	7.904	228.828
Iceberg lettuce	15.920	-	4.678	2.250	36.518	196	846	60.408
Spinach	36.770	1.834	50.824	2.596	44.587	37.742	48.824	223.177
Chard	4.670	433	294	271	45	989	214	6.916
Purslane	381	18	114	25	1.306	279	1.593	3.716
Garden cress	638	47	260	163	795	159	338	2.400
Parsley	23.057	608	3.506	1.812	8.703	1.376	13.181	52.243
Dill	542	9	594	4	182	113	1.333	2.777
Mint	4.697	63	365	4.114	273	259	133	9.904
Arugula	425	-	725	3	1.750	202	709	3.814
Cauliflower	18.865	8	42.551	-	1.927	24.599	41.215	129.165
Broccoli	18.308	8	7.167	-	971	2.331	2.038	30.823
Asparagus	-	-	-	-	-	-	10	10
Mushroom	13.424	60	804	-	113	517	12.588	27.506
Tomato	3.294.901	206.203	1.327.543	251.649	510.233	949.630	848.166	7.388.325
Tomato for paste	104.358	10.794	1.530.195	219.051	166.630	74.557	1.458.499	3.564.084
Cucumber	721.194	66.898	258.373	70.002	90.590	219.794	99.051	1.525.902
Cucumber for pickles	3.560	1.201	121.595	1.262	9.409	4.373	17.076	158.476
Armenian cucumber	8.183	1.198	2.388	21.135	1.118	65	205	34.292
Pepper for paste	135.974	311	178.770	173.627	2.221	88.247	154.128	733.278
Bell pepper	252.199	14.361	44.760	55.654	10.531	71.440	63.071	512.016

Vegetable tonnage (ton) and production area (da) in Turkey in 2008								
Vegetable types*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.769.433	267.234	1.484.740	833.164	1.424.448	1.076.399	1.502.535	8.357.953
Pepper	170.113	9.692	118.445	37.831	25.221	109.477	93.866	564.645
Okra	119.462	50	14.453	1.631	798	5.288	9.262	150.944
Eggplant	262.742	15.441	136.046	160.953	22.901	70.307	94.190	762.580
Green bean	60.419	17.244	88.192	9.374	51.851	188.947	86.767	502.794
Green pea	65.681	1.098	11.623	6	2.400	4.672	55.010	140.490
Green fava bean	14.659	6	9.986	100	201	2.571	9.980	37.503
Green cowpea	6.782	7	12.055	-	5	-	1.530	20.379
Green pinto bean	99.134	1.260	12.084	12	3.302	24.233	14.662	154.687
Marrow	97.105	6.211	29.079	3.137	40.075	17.647	23.396	216.650
Pumpkin	5.264	2.125	7.219	66	16.973	16.568	30.884	79.099
Pumpkin for seed	149	10	237	113	15.584	663	3.046	19.802
Melon	509.291	91.038	351.029	239.213	399.267	89.680	280.528	1.960.046
Watermelon	1.120.594	134.077	674.760	681.825	268.331	205.123	600.082	3.684.792
Scallion	35.126	12.810	23.875	21.813	33.689	12.827	26.939	167.079
Onion	368.382	20.252	73.935	45.436	757.697	115.747	191.348	1.572.797
Green garlic	5.188	364	4.937	7.993	1.497	21.066	3.318	44.363
Garlic	17.958	442	5.933	5.684	8.678	220	12.645	51.560
Leek	90.695	23	57.736	83	21.383	35.699	50.124	255.743
Carrot	64.451	361	15.042	2.357	496.798	3.820	7.624	590.453
Turnip	481	205	554	-	418	73	161	1.892
Red beet	10	11.034	3.257	4.012	220	15.194	1.651	35.378
Celery root	-	-	6.868	-	40	119	9.510	16.537
Horseradish	1.783	370	4.057	686	2.680	3.872	3.445	16.893
Radish	126.693	1.104	3.498	1.418	8.567	1.690	1.843	144.813
Total vegetable Production (ton)	8.108.764	661.617	5.388.589	2.036.814	3.259.979	2.727.139	4.557.962	

* Production area and tonnage data represents the sum of field and greenhouse production. There are 52 types of vegetables in the table. MTR: Mediterranean Region, EAR: Eastern Anatolian Region, AR: Aegean Region, SAR: Southeastern Anatolian Region, IAB: Inner Anatolian Region, BSR: Black Sea Region, MR: Marmara Region

Table 4. Vegetable production tonnage (ton) and production areas (da) in 2010 [21]

Vegetable tonnage (ton) and production area (da) in Turkey in 2010								
Vegetable types*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.729.635	260.631	1.461.466	720.370	1.431.443	1.034.280	1.378.155	8.015.980
White head cabbage	48.412	37.584	79.579	1.644	101.096	128.477	93.346	490.138
Red cabbage	12.926	15	8.089	-	5.195	78.618	13.244	118.087
Collard green	792	-	1.080	55	-	75.114	9.335	86.376
Brussel sprouts	112	-	358	-	53	150	853	1.526
Artichoke	14.096	-	16.644	-	320	675	8.177	39.912
Celery	216	-	1.243	-	-	-	69	1.528
Curly lettuce	30.145	108	10.531	6	25.000	30.972	35.168	131.930
Head lettuce	107.246	911	39.430	7.046	47.378	14.828	7.406	224.245
Iceberg lettuce	3.728	14	6.802	1.750	37.248	175	654	50.371
Spinach	29.711	1.103	52.180	2.375	41.853	43.430	44.817	215.469
Chard	3.389	14	281	232	45	1.051	264	5.276
Purslane	506	24	153	95	1.306	313	2.520	4.917
Garden cress	853	35	343	39	752	223	322	2.567
Parsley	26.867	420	4.017	2.296	8.098	1.418	12.908	56.024
Dill	673	3	643	2	166	203	1.284	2.974
Mint	4.972	128	450	5.651	202	241	110	11.754
Arugula	700	30	919	30	1.698	237	776	4.390
Cauliflower	40.488	-	44.279	-	3.041	24.473	46.298	158.579
Broccoli	12.530	-	9.701	29	920	1.419	1.923	26.522
Asparagus	-	-	246	-	-	-	8	254
Mushroom	14.808	17.528	802	-	2.032	266	3.651	39.087
Tomato	3.445.315	222.444	1.121.091	220.314	438.952	951.309	769.897	7.169.322
Tomato for paste	89.604	14.216	1.203.205	336.227	63.179	93.226	1.083.021	2.882.678
Cucumber	806.327	65.018	259.301	70.815	81.973	206.734	93.696	1.583.864
Cucumber for pickles	2.718	1.152	108.083	913	10.362	5.012	16.872	145.112
Armenian cucumber	6.451	1.127	2.466	14.620	947	-	10	25.621
Pepper for paste	114.116	534	235.954	138.462	2.243	85.933	199.931	777.173
Bell pepper	133.091	18.233	37.110	44.188	10.159	87.486	56.684	386.951

Vegetable tonnage (ton) and production area (da) in Turkey in 2010								
Vegetable types*	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.729.635	260.631	1.461.466	720.370	1.431.443	1.034.280	1.378.155	8.015.980
Pepper	412.244	11.322	124.265	18.174	26.110	130.368	93.114	815.597
Okra	6.481	61	16.174	1.028	661	3.111	8.362	35.878
Eggplant	369.019	18.241	134.679	122.173	24.178	97.077	80.874	846.241
Green bean	125.596	16.122	97.554	4.839	49.001	198.782	93.915	585.809
Green pea	23.291	9	14.412	791	222	4.144	47.472	90.341
Green fava bean	19.723	-	9.863	79	238	2.351	9.603	41.857
Green cowpea	1.758	-	13.506	-	4	-	1.323	16.591
Green pinto bean	4.822	985	24.645	13	3.432	23.369	12.026	69.292
Marrow	178.923	6.823	30.385	2.474	42.095	21.913	31.278	313.891
Pumpkin	6.709	2.249	8.811	46	20.712	19.228	31.099	88.854
Pumpkin for seed	36	46	464	-	23.878	5	2.253	26.682
Melon	279.793	41.662	326.809	173.633	399.115	101.802	260.038	1.582.852
Watermelon	1.467.986	124.388	623.800	493.890	279.052	169.689	513.130	3.671.935
Scallion	27.942	12.193	27.035	23.980	40.016	10.759	23.553	16.5478
Onion	366.843	12.578	74.408	20.622	698.601	74.265	181.757	1.429.074
Green garlic	5.105	175	4.860	6.215	1.180	22.168	3.177	42.880
Garlic	18.526	376	5.643	3.788	8.886	278	10.381	47.878
Leek	85.474	21	54.896	146	17.880	34.618	51.051	244.086
Carrot	10.828	871	11.596	1.319	466.221	1.211	5.232	497.278
Turnip	345	215	662	-	390	37	49	1.698
Red Beet	392	-	3.203	-	174	3.014	1.633	8.416
Celeriac	270	-	7.138	-	-	107	7.243	14.758
Horseradish	1.554	227	4.020	763	1.929	4.715	2.902	16.110
Radish	122.307	756	3.617	638	8.228	1.888	1.936	139.370
Total vegetable Production (ton)	8.486.759	629.961	4.867.425	1.721.400	2.996.421	2.756.882	3.976.645	

* Production area and tonnage data represents the sum of field and greenhouse production. There are 52 types of vegetables in the table. MTR: Mediterranean Region, EAR: Eastern Anatolian Region, AR: Aegean Region, SAR: Southeastern Anatolian Region, IAB: Inner Anatolian Region, BSR: Black Sea Region, MR: Marmara Region

Table 5. Vegetable production (ton) and production areas (da) in 2012 [22]

Vegetable tonnage (ton) and production area (da) in Turkey in 2012								
Vegetable types	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.808.806	306.291	1.561.524	690.874	1.653.029	1.224.342	1.473.961	8.718.827
White Head Cabbage	40.341	34.654	90.365	1.087	98.563	125.400	91.091	481.501
Red cabbage	19.024	3	8.527	-	13.189	79.385	13.106	133.234
Collard greens	471	-	-	-	30	74.542	9.980	85.023
Brussel sprout	128	-	294	-	73	60	1.142	1.697
Artichoke	3.913	-	17.812	-	1.440	1.603	7.405	32.173
Celery	192	-	1.298	-	-	-	69	1.559
Curly Lettuce	30.427	81	12.111	45	22.377	38.596	41.351	144.988
Head Lettuce	100.243	2.680	38.237	6.417	38.107	12.472	7.307	205.463
Iceberg lettuce	17.220	-	5.994	-	43.879	108	933	68.134
Spinach	30.656	3.552	5.074	711	42.090	47.849	43.843	221.775
Chard	4.136	12	231	278	60	1.027	209	5.953
Purslane	527	68	104	101	1.314	436	4.395	6.945
Garden cress	654	93	365	82	785	261	2.236	4.476
Parsley	26.821	638	4.046	1.424	9.186	1.558	12.914	56.587
Dill	469	3	630	2	365	211	1.219	2.899
Mint	3.158	228	439	7.823	596	251	103	12.598
Arugula	500	11	919	37	2.618	261	3.343	7.689
Cauliflower	42.465	3	47.403	-	1.829	22.925	54.472	169.097
Broccoli	14.525	5	9.990	-	1.211	831	4.245	30.807
Asparagus	-	-	-	-	-	-	7	7
Mushroom	24.762	-	1.218	-	3.976	300	3.494	33.750
Tomato	3.527.494	244.950	1.186.146	322.730	522.028	1.013.099	876.819	7.693.266
Tomato for paste	74.037	14.578	1.426.272	321.196	108.522	93.679	1.613.755	3.652.039
Cucumber	769.690	73.644	302.689	83.101	87.401	185.762	100.796	1.603.083
Cucumber for pickles	2.759	1.940	103.624	1.181	9.521	4.848	14.895	138.768
Armenian cucumber	6.666	1.000	3.001	15.956	5.913	-	45	32.581
Pepper for paste	100.430	6.127	233.854	91.110	1.577	72.556	242.768	748.422
Bell pepper	104.988	25.712	40.732	39.205	9.997	98.667	63.912	383.213

Vegetable tonnage (ton) and production area (da) in Turkey in 2012								
Vegetable types	MTR	EAR	AR	SAR	IAR	BSR	MR	Total
Vegetable production area (da)	1.808.806	306.291	1.561.524	690.874	1.653.029	1.224.342	1.473.961	8.718.827
Pepper	458.683	14.307	125.373	19.143	31.086	143.335	115.551	907.478
Okra	7.620	58	15.733	466	636	3.737	7.478	35.728
Eggplant	359.357	18.351	115.038	96.168	24.810	102.350	83.214	799.288
Green bean	126.769	20.101	90.993	3.853	48.581	226.437	102.579	619.313
Green pea	23.304	5	23.655	1.057	2.508	4.912	46.518	101.959
Green fava bean	19.491	-	9.981	19	183	1.932	8.865	40.471
Green cowpea	2.001	-	17.165	-	5	-	1.395	20.566
Green pinto bean	7.228	1.001	32.741	12	3.984	26.683	12.485	84.134
Marrow	152.788	6.075	32.949	7.282	44.806	21.730	36.744	302.374
Pumpkin	7.289	1.597	6.666	68	23.210	22.599	32.183	93.612
Pumpkin for seed	44	33	348	3	29.960	-	1.722	32.110
Melon	321.304	88.706	343.235	182.959	394.276	99.827	258.380	1.688.687
Watermelon	1.580.628	147.767	662.018	564.036	322.050	190.013	555.784	4.022.296
Scallion	26.349	11.743	27.296	9.500	42.003	11.067	22.974	150.932
Onion	344.215	13.948	66.096	56.237	562.019	507.350	185.981	1.735.846
Green garlic	6.316	175	5.043	8.000	2.207	641	3.424	25.806
Garlic	21.809	324	5.226	10.468	10.368	19.317	11.873	79.385
Leek	65.342	18	53.868	30	18.794	40.002	53.028	231.082
Carrot	83.302	328	12.593	629	611.028	1.245	5.155	714.280
Turnip	322	252	627	-	213	33	90	1.537
Red beet	10	-	2.947	-	-	3.014	1.569	7.540
Celery root	270	-	7.377	-	-	116	9.286	17.049
Horseradish	1.293	405	3.554	-	1.884	5.353	2.618	15.107
Radish	113.622	642	3.786	463	8.754	2.314	1.794	131.375
Total vegetable Production (ton)	8.676.052	735.818	5.253.683	1.852.879	3.210.012	3.310.694	4.776.544	

* Production area and tonnage data represents the sum of field and greenhouse production. There are 52 types of vegetables in the table. MTR: Mediterranean Region, EAR: Eastern Anatolian Region, AR: Aegean Region, SAR: Southeastern Anatolian Region, IAB: Inner Anatolian Region, BSR: Black Sea Region, MR: Marmara Region

5. GENERAL EVALUATION

The agricultural industry in Turkey holds great importance with regard to national income, employment, and foreign trade. This sector, providing nutrition for a local population of 75 million and a tourist population of 22 million, and raw materials for industry, also holds strategic importance. Especially in agricultural industry, Turkey is one of the largest vegetable producers among European countries, with Spain, Italy, and France being the closest competitors. Among the vegetables produced in Turkey, tomatoes have the greatest yield. This is thought to be substantially related to climate properties [14]. Furthermore, Turkey has the second highest watermelon and melon production after China; the third highest tomato, pepper, cucumber, and green bean production; fourth highest eggplant and spinach production; and fifth highest dry onion and scallion production. For almost all other vegetables, Turkey is among the top ten producers [15].

Turkey, a country that is under the influence of a moderate, continental, and Mediterranean (subtropical) climate at the same time, is a region where almost all cultivated plants are produced [16]. The highest yields were obtained in MTR as natural result of its climatic advantage and being a center for greenhouse agriculture. Yield per unit area was quite low in SAR and EAR.

Vegetable production in Turkey is heterogeneous among regions and concentrated along the coasts due to a more suitable climate. MTR had 30-35% greater production compared to those of AR and MR because of the dominance of greenhouse agriculture in MTR. Even though the availability of logistic resources and distribution systems have increased, vegetable production has been still inadequate in EAR and SAR. This inadequacy reflects on the vegetable consumption of the local population, suggesting that the vegetable production should be encouraged in these regions [12].

In MTR, the highly produced vegetables were tomatoes, watermelons, cucumbers, eggplants, peppers, onions, melons, marrow, radishes, green beans, head lettuce, bell peppers, leeks, and peppers for paste

In EAR, tomatoes, melons, watermelons, and cucumbers were the highly produced vegetables during the period of 2006-2012.

In AR, tomatoes for paste, tomatoes, watermelons, melons, cucumbers, peppers for paste, eggplants, peppers, white head cabbage, and cucumbers for pickles were produced in 2006. In 2008, onions and green beans joined this list.

In SAR, the highly produced vegetables were watermelons, melons, tomatoes, tomatoes for paste, peppers for paste, and eggplants in 2006. Cucumbers were added to this list in 2008.

In IAR, onions, carrots, tomatoes, melons, watermelons, white head cabbage, and cucumbers were produced during the period of 2006-2012. Tomatoes for paste and cucumbers were not among the highly produced vegetables in 2010 and 2012.

In BSR, tomatoes, cucumbers, watermelons, green beans, onions, white head cabbage, peppers, tomatoes for paste, eggplants, and collard greens were highly produced during the period of 2006-2012. Melons and red cabbage joined this list in 2008.

In MR, tomatoes for paste, tomatoes, watermelons, melons, peppers for paste, onions, cucumbers, and white head cabbage were produced highly during the period of 2006-2012.. Peppers was in the top list in 2006, not present in 2008 or 2010, rejoined in 2012. Green beans was the most produced vegetable in all years, except 2006.

Both winter and summer vegetables in MTR, AR, IAR, BSR, and MR rank among the highly produced vegetables; only winter vegetables are produced in EAR and SAR. Because of the requirement of warm climate, many vegetables are produced in the summer. This causes a decrease in production during the winter season and disparities between seasons. These disparities have been partially reduced in recent years due to greenhouse agriculture; the total share of vegetables produced in greenhouses reached 20%. However, there has been still a need to increase production in winter. Hill farming will be useful in overcoming this problem [12].

Despite the fact that Turkey is situated as a leading vegetable producer of the world, the yield per unit area is quite low and varies among its regions. The highest yields are obtained from MTR, no doubt thanks to its climatic advantage and being a center for greenhouse agriculture.

However, it should not be disregarded that more resources are utilized and more modern agricultural practices are utilized in this region. The yield per acre is especially low in EAR and SAR. More attention is needed in this region in terms of selecting which products to grow. Taking climate characteristics into account and the selection of more suitable vegetable types and varieties (cold tolerant, early flowering, etc...) have the potential to increase yields. Yields in AR and MR also need some improvement.

There has been an important production-planning problem in Turkey. Due to its nature, this is more evident in vegetable production. The determination of more profitable and competitive vegetables types that can be produced and marketed more efficiently is very important. In addition to traditionally produced vegetables, such as tomatoes, cucumbers, and peppers, alternative vegetables such as artichokes, asparagus, celery, and mushrooms should be included in this list. Turkey needs to take the advantage of climate in vegetable production [12]. If climate advantage is well utilized, Turkey has the capacity to achieve great breakthroughs in exports. The most important exported products are tomatoes (50%), onions (24%), cucumbers (8%), peppers (7%), carrots (6%), and watermelons (3%) in the order of decreasing ratio to total export, over 30 types of vegetables exporting [5].

When estimated, about 20% of all produced vegetables are processed and used as raw materials in industry. For industrial purposes, tomatoes has been always the leader. For production of tomatoes for paste, the Marmara and Aegean Region rank in the top list. These tomatoes are produced in very high quality, processed, and exported [12].

In terms of frozen vegetable exports, peppers and tomatoes have the biggest share in Turkey. The other two product groups that are important for the foreign processed goods market are pickles and various canned goods. Pickle exports are especially concentrated on pickled cucumbers. Among the exported canned vegetables, okra, peas, artichokes, green beans, and vegetable mixes have the highest share. Dried vegetable production is performed mostly through traditional methods and has not yet achieved industrial importance, with the exception of tomatoes and peppers. Recently,

important advances have been made, especially for dried red pepper in powder in flake form [12].

Production increases in Turkey over the next years should be planned towards exports. The current export rate, despite rapid increases, is still quite low. Ecological advantages and proximity to important markets have not been properly utilized. There is a great demand for reliable and high quality food, especially from developed countries. These countries do not have high enough vegetable production to be self-sufficient and their climate is not suitable for greater production. For this reason, they depend on external sources for vegetables, creating a significant market. Turkey has the potential to be an important player in this market. To achieve this, however, production of high quality goods should be prioritized and certain standards should be established, especially in vegetable production. Product variety should be increased parallel to demands of important markets, together with good agricultural practices, and certificated production. These measures have the potential to prevent pesticide-related problems in export. Turkey should improve its marketing strategies, especially towards the EU, USA, and Japan. The export of processed vegetable products consists mostly of raw materials or low quality goods, leading to low income. In this manner, Turkey should support branding and aim to increase its income through the export of goods with brand assurance [12].

Branding in vegetable products will provide quality assurance in domestic market. In addition to branding, Turkey needs to bring local products forward and adopt geographical tagging if necessary. For example, products such as Kırkagac melon, Ceyhan or Diyarbakir watermelon, Maraş red pepper, Tokat tomato, Manisa eggplant, Kastamonu garlic, Inegol leek, Cemele pepper, and Sıdıklı snap bean should be advertised. This approach will also help to preserve agricultural diversity, in situ preservation, and even regional development through strategies like agro-tourism. These efforts should not be perceived as threats to commercial sales of vegetable seeds from local or foreign companies, but focused to preserve local values, in addition to marketing commercial goods [17].

The reasons why production policies in the seven vegetable producing regions of Turkey fail to realize their goals can be listed as follows:

- Insufficient data infrastructure related to the agricultural sector
 - Problems in application of policies, production, and marketing caused by a lack of organization and low level of education among producers
 - Difficulties in the transformation from villager to producer in the context of good agricultural practices
 - An increase in population, giving up of farming and consequent socioeconomic conditions due to the new technology era [18].
- In order to overcome the above problems, the priorities in vegetable production policies should be followed as:
- Maintaining the stability of vegetable production and prices
 - Increasing farm income to achieve stability in vegetable production via improving vegetable yield per unit area
 - Using modern technologies in vegetable production
 - Applying good vegetable production practices
 - Utilization of public investments towards improving agricultural infrastructure (irrigation, drainage, dams, village roads, electricity, etc...)
 - Resource (fertilizer, seed, irrigation, etc.) subsidizations and tax reductions
 - Availability of credit loans at affordable conditions
 - Facility of international trade and related support mechanism and limit in imports [14].

6. CONCLUSION

Vegetable production, which is one of the most profitable branches of agriculture, is in constant development through the production in open fields, greenhouses, or completely closed systems. The demand for vegetables is constantly on the rise and vegetable prices have a tendency to constantly increase parallel to this. Due to these factors, vegetable production is losing its traditional qualities on a daily basis, and achieving a more industrial structure. In this context, vegetable production needs to be taken as a whole with its resource channels, production, pre-marketing preparation, conservation, processing, and cold chain distribution. Turkey has a distinctive advantage in this sector due to its ecological properties, production habits, and experience in vegetable production. Moreover, Turkey has an

important place due to its proximity to markets of important foreign buyers. Making better use of these advantages should be the main objective of Turkey in the coming years.

To conclude, vegetable production patterns of seven regions of Turkey are presented with regard to the most produced vegetables. Moreover, climate properties of each region should be benefited from when planning production, and regional agricultural policies should be created where necessary. The reason for this is the great vegetable production potential of Turkey is due to its soil and climate properties. Turkey has a rare position with regard to plant-based production, especially so for certain vegetable types.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

*The peer review history for this paper can be accessed here:
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