

Comparison of Carrot (*Daucus carota* L.) Producing Farms with regards to Marketing Structures, Costs and Applications in Hatay Province

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ABSTRACT

The main objective of this study was to examine the relationships between marketing costs, applications and scales of the carrot farms in Hatay province. The average carrot cultivation area, carrot yield, production costs, sales revenues, record-keeping rate, members of farmers' organization rate were 8.253 ha, 31366 kg/ha, 14911 US\$, 28859 US\$, %46.23, %14 in the all farms, respectively. Labor, transportation, storage and packaging costs in all farms were calculated as 0.0031625, 0.005085, 0.00138 and 0.0022625 US\$, respectively. The average total marketing cost in all farms was determined as 0.001189 US\$. The marketing costs for the first, second and third group farms were calculated as 0.0121, 0.0107 and 0.0135 US\$, respectively. The research recommended that the farms should be subsidized so that they can increase production, improve their market share and decrease their input costs. Farmers should be organized under farmers' organization. Marketing channels should be created to ensure direct carrots deliveries to consumers resulting increase in revenues. Increasing the number and capacity of cold storage should be encouraged. Farmers should be subsidized to minimize their production expenses. The support to be provided by various stakeholders should involve branding and promotion in carrot production. Producers should be encouraged to process carrot as high value-added products.

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Hatay İlinde Havuç Üreten İşletmelerin Pazarlama Yapısı, Maliyetleri ve Uygulamaları Bakımından Karşılaştırılması

ÖZET

Bu çalışmanın temel amacı, havuç üreten işletmelerde işletme büyüklükleri ile pazarlama masrafları ve stratejileri arasındaki ilişkileri belirlemektir. İşletmelerin genelinde ortalama havuç üretim alanı 8.253 ha, havuç verimi 31366 kg/ha, üretim maliyeti 14911 \$ ve satış geliri 28859 \$ olarak belirlenmiştir. İşletmeler genelinde 1 kg havucun pazarlanması için 0.0031625 \$ işçilik, 0.005085 \$ nakliye, 0.00138 \$ soğuk hava deposunda muhafaza ve 0.0022625 \$' da paketleme masrafı olmak üzere toplamda 0.001189 \$ pazarlama masrafı yapılmıştır. Pazarlama masraf, birinci grup işletmelerde 0.0121, ikinci grup işletmelerde 0.0107 ve üçüncü grup işletmelerde ise 0.0135 \$ olarak gerçekleşmiştir. Araştırma sonuçları, havuç üreten işletmelerde üretimi ve pazarlama gücünü artırmak ve girdi maliyetlerini düşürebilmek; bir çiftçi örgütü altında bir araya gelmeleri, ürünlerini doğrudan tüketicilere ulaştırabilmeleri, soğuk hava deposu kapasitesinin artırılması, destek miktarı ve çeşitliliğinin (markalaşma ve promosyon gibi) artırılması, havucun katma değeri yüksek ürünlere dönüştürülmesi gerektiğini ortaya koymuştur.

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INTRODUCTION

Carrot (*Daucus carota* L.) belongs to the Apiaceae family. Carrots originated in Asia and evolved into many shapes and colors of roots. The plant is a biennial, which grows vegetatively in its first season and produces seeds in the second season. The plant is grown annually to produce roots (Stolarczyk and Janick, 2011). Carrot sustain a high nutritional value, a source of vitamin A that contains a large amount of beta carotene, which contributes to the growth humans, especially children and young people (Simon, 1992; Baranski et al., 2003, Szwejkowska et al., 2009).

Carrot is one of the most important vegetables consumed in the world. With European countries in lead, carrot is produced throughout the world. While carrot is a mostly winter consumed vegetable, it is consumed in every season in many countries. On the other hand, carrots are not used in any canning production other than as pickles in Pakistan (Ahmad et al., 2012). According to FAO (2017), world carrot plantation area was 1,147,155 ha and production was 42,831,958 tonnes. China, Ukraine, England, America, Uzbekistan and India are leading countries in terms of the carrot cultivation and production (FAO, 2017).

The total carrots cultivation area of Turkey is approximately 10,849 ha annually. The carrot production was realized in the amount of 569,553 tonnes (Anonymous, 2018a). Turkey exported 64,994 tonnes of carrots in 2016 while imports reached 1,842 tonnes. In Turkey, the carrot consumption per capita is 5.41 kg/year and its adequacy ratio is 113.2% (Anonymous, 2018a). Carrot is grown in many regions of Turkey as an important winter vegetable which ranks ninth in the world. Also, Hatay province has 2,038.9 ha of carrot cultivation area and 53,121 tonnes of production (Anonymous, 2018b). Followed by Konya and Ankara provinces, Hatay province ranks third on carrot production in Turkey. Traditionally, vegetables were grown in small truck farms located near major population centers, but since the emergence of large supermarket chain stores, vegetable production has been centralized in several provinces. Marketing is a discipline of science that examines all the stages of the goods passing from the producer to the consumer and the factors such as supply, demand, price and cost and their changes in different places and times. The main purpose of marketing is to ensure the satisfaction and confidence of the consumer in the long term (Güneş, 1996; Yurdakul, 2014). Today's marketing approach does not only mean the sale of goods production but also ensuring people's satisfaction, product supply, as well as pricing and distribution of the product, and the consumer's acceptance and hold of these products (İnan, 2016). Farms in the agricultural sector are generally small-scale with inadequate marketing opportunities. Marketing channels consist of brokers

who are active in order to overcome this shortage (Emeksiz ve ark., 2019). Agricultural marketing is involved in agricultural activities and the area of this activity is growing. In addition to the technical and economic issues related to production, producers should also know about the sale, distribution and acquisition of market information (Güneş, 1996). Agricultural products differ from each other in terms of quality due to different seed use, environmentally growing conditions, and the structure of crop growing soils. For this reason, products are classified according to their characteristics such as weight, volume, color, shape, taste, odor, length and diameter (Dere, 2006). Differences between products are eliminated by standardizing them into classes. This is a very important issue in terms of marketing strategy (Yurdakul, 2014).

The main purpose of this study was to reveal relationships between carrot marketing costs, applications and sizes of carrot farms in Hatay province of Turkey.

MATERIAL and METHODS

Material

The primary data of this study was collected via the surveys conducted with carrot farmers in the province of Hatay, Hatay is located at 36 °N latitude and 36 °E longitude in the Eastern Mediterranean region of Turkey. The questionnaires were conducted between May of 2017 and October of 2018. The secondary data was used as material in this study.

The farms were divided into three groups based on the size of carrot cultivation land. The first group farms have a carrot land from 0.10 to 7.5 ha (n = 40 farms). The second group farms have a carrot land from 7.6 to 15.0 ha (n = 26 farms) and the third group farms have a carrot land of 15.1 ha and over (n = 14 farms). Overall, 95% confidence level and 10% error margin were used in the study. The sample size was calculated as 80 farms using Simple Random Sampling in the Formula 1 (Yamane, 1967).

$$n = \frac{N * s^2 * t^2}{(N - 1)d^2 + s^2 * t^2} \quad (1)$$

In the formula:

n = example size,

s = standard deviation,

t = t value of 95% confidence limit (1.96),

N = total number of farms within the scope of the sampling,

d = an acceptable error (10% deviation).

Method

All data were analyzed using Kolmogorov Smirnov test for the homogeneity test. Since the data did not show normal distribution, non-parametric Kruskal-Wallis

H statistical test was applied for the analysis of variance among the farm groups. Tamhane's T2 multiple comparison test was performed to the main parameter results of farms groups. The Chi-square (χ^2) independence test was used to determine whether there is a statistically significant relationship between the two variables. The statistical differences of various parameters were tested at 5% of p value (SPSS, 2015). In this study, the 5-point Likert scale was used, and the attitudes of the farmers were measured from the positive to the negative and the degree of participation of the producers in the expressions was measured (McLeod, 2008).

RESULTS and DISCUSSION

The amount of cultivation area, yield and sale price in carrot cultivation

Carrot cultivation areas, yields and product prices of farms were given in Table 1. The average carrot cultivation area and carrot yield were 8.253 ha and 31.366 kg per hectare, respectively. The third group farms produced more carrots per hectare as 3.260 kg and 2.350 kg than those of first and second group farms. The third group farms had higher production rates for the first and second-class carrots as 10.854%, 3.656% and 2.344% and 0.285% than the first and second group farms. The first group farms had higher

production rates for the third-class carrots as 9.257% and 13.198% than the second and third group farms. The third group of farms marketed their first, second and third class carrots at higher prices as 0.004 US\$ and 0.002 US\$, 0.0243 US\$ and 0.0131 US\$ and 0.01 US\$ and 0.002 US\$ than the first and second group farms (Table 1).

Harvesting and marketing applications of farms

In the question regarding the criteria taken into consideration in determining the harvest time, the farmers answered more than one options, this question includes 49 farmers maturity, 45 farmers climatic conditions, 35 farmers market conditions, 11 farmers hardness and 1 farmer gave humidity criterias. Carrot harvest time maturity (85.71% and 62.50%), market conditions (78.57% and 37.50%) and climatic conditions (78.57% and 57.50%) in both third group farms with high production capacity and first group farms with low production capacity (Table 2). These results of harvesting and marketing structures were consistent with Acar (2013), Anonymous (2019a) and Anonymous (2019b). It was stated that the harvest times of the farmers were determined by the maturity of the carrots, marketing and the climatic conditions in the other references (Acar, 2013; Anonymous, 2019a; Anonymous, 2019b)

Table 1. The carrot production area, production amount and product prices of the farms

Çizelge 1. İşletmelerin havuç üretim alanları, üretim miktarları ve ürün satış fiyatları

Carrot Production Parameters	Farms' Groups			p-values
	First	Second	Third	
Total production area (ha)	5.056 ^a	10.917 ^b	12.438 ^c	0.0217
Total production amount (kg/ha)	30500 ^a	31410 ^b	33760 ^c	0.0456
The first class carrot production amount (kg/ha)	19060 ^a	21889.2 ^b	24761.4 ^c	0.0498
The first class carrot ratio in total production (%)	62.491 ^a	69.689 ^b	73.345 ^c	0.0320
The first class carrot sale price (US\$)	0.108 ^a	0.110 ^b	0.112 ^c	0.0451
The second class carrot production amount (kg/ha)	5157.4 ^a	5958.3 ^b	6500 ^c	0.0308
The second class carrot ratio in total production (%)	16.910 ^a	18.969 ^b	19.254 ^b	0.0449
The second class carrot sale price (US\$)	0.0280 ^a	0.0392 ^b	0.0523 ^c	0.0255
The third class carrot production amount (kg/ha)	6282.6 ^a	3562.5 ^b	2498.6 ^c	0.0104
The third class carrot ratio in total production (%)	20.599 ^a	11.342 ^b	7.401 ^c	0.0173
The third class carrot sale price (US\$)	0.003 ^a	0.011 ^b	0.013 ^b	0.0370
Average carrot sale price (US\$)	0.1098	0.1100	0.1107	0.0620

a, b and c indicate that there were statistically significant differences at $p < 0.05$ among the farms groups.

Table 2. The Criterias for determination of harvest time in farms

Çizelge 2. İşletmelerde havuç hasat zamanının belirlenmesinde dikkate alınan kriterler

Criterias*	Farms' Groups					
	First		Second		Third	
	n	%	n	%	n	%
Humidity	0	0.00	1	100.0	0	0.00
Maturity	25	51.02	12	24.49	12	24.49
Hardness	7	63.64	3	27.27	1	9.09
Market conditions	15	42.86	9	25.71	11	31.43
Climatic conditions	23	51.12	11	24.44	11	24.44

*Farmers were able to answer more than one criterion.

Sixty seven farms performed for the carrot harvesting by used only the labor force, 11 farms performed by used both the machinery and the labor force and 2 farms performed by used only machine power. While all of the first group farms harvested by labor force, third group farms harvested by machinery. All of the farms lost carrots during carrot harvesting, the average losses ratio was calculated as 8.81%. The average total cost of marketing in all farms was calculated as 0.01189 US\$. The marketing costs of the

third group farms were realized as 0.0014 and 0.0028 US\$ higher than the first and the second group farms. The differences between the enterprises in terms of other parameters were statistically significant ($p < 0.05$) except for the classification of carrot according to the shape. As carrots production capacity increased in the farms, total marketing costs, mechanization utilization rate, classification rate, cold storage rate and packing rate also increased. But, losses of carrot in harvesting decreased (Table 3).

Table 3. The results of marketing costs and applications in first, second and third group farms

Çizelge 3. Birinci, ikinci ve üçüncü grup işletmelerin havuç pazarlama maliyetleri ve uygulamalarına ait sonuçlar

Marketing Applications Parameters	Farms' Groups			p-values
	First	Second	Third	
Losses of carrot in harvesting (%)	10.26 ^a	7.95 ^b	6.28 ^c	0.0345
Labor cost per kg carrot (US\$)	0.0039 ^a	0.0026 ^b	0.0021 ^c	0.0461
Transportation cost per kg carrot (US\$)	0.0070 ^a	0.0038 ^b	0.0020 ^c	0.0023
Packaging cost per kg carrot (US\$)	0.0008 ^a	0.0025 ^b	0.0060 ^c	0.0072
Storage cost per kg carrot (US\$)	0.0004 ^a	0.0018 ^b	0.0034 ^c	0.0364
Total marketing cost (US\$)	0.0121 ^a	0.0107 ^b	0.0135 ^c	0.0443
Use of mechanization in harvest (%)	40.00 ^a	69.23 ^b	100.0 ^c	0.0035
Carrot classification rate after harvest (%)	62.50 ^a	88.46 ^b	100.0 ^c	0.0258
Rate of carrot color in classification (%)	44.00 ^a	86.96 ^b	85.71 ^b	0.0497
Rate of carrot shape in classification (%)	92.00 ^a	91.30 ^a	100.0 ^b	0.0408
Rate of carrot size in classification (%)	100.0	100.0	100.0	0.0879
Rate of cold carrot storage (%)	2.50 ^a	19.23 ^b	57.14 ^c	0.0201
Carrot packing rate (%)	50.00 ^a	92.31 ^b	100.0 ^c	0.0412

While 29 farmers obtained carrot marketing information from exporters and, fertilizers, herbicides and seed dealers, 19 farmers obtained from other experienced carrot producers (Table 4). Sixty-nine of the farmers stated that they collected sales revenues in cash or credit due to the constant change in market conditions. Fifty-nine of the farmers stated that the sales prices of carrots were determined by the companies as the sales prices changed according to the size of production. While 38 of the farmers stated that they marketed their crops either to the brokers or to the retailers or directly or wholesale or retail. Other 38 farmers marketed the carrots to both brokers and exporters such as wholesale or retail. Only 4 farmers marketed carrots themselves or to exporters, all of which were large-scale third group farms. Only 17 farms marketed carrots to factories. On the other hand, 14 farmers said that the best marketing channel was direct marketing to consumers because of their higher income. While twenty-nine farmers stated that the carrot sales prices were low, 18 farmers stated that carrot sales prices were very low. Only 18 farmers said that carrot sales prices was normal.

Forty five of the first group farms with low production capacity obtained market information from exporters, fertilizer herbicide promoters and seed dealers and 40.00% from other experienced carrot producers, while 71.43% of third group farms with high production

capacity obtained from the internet by their own efforts. Both the third group farms with high production capacity and the first group of low-capacity farms collected their sales revenue in cash or credit. In 72.5% of the first group of farms and 50.00% of the third group of farms the selling prices of carrots were determined by the buyer firms. All of the farmers marketing their carrots to the exporter were in the third group farms. In addition to 20% of the first group of farms sorted and graded to the carrots after harvest, 5% of them packaged carrots and 2.5% of them were stored in cold storage, while all of the third group of farms classified carrots after harvest, 92.86% of them were packaged and 64.29% of them and kept in cold storage. The ten percent of the first group of farms found the carrot sales price to be normal, while 50% of the third group of farms found it normal (Table 4). The results obtained in terms of the processes carried out during the marketing of carrots were similar to those indicated by Nunez et al. (2008). Nunez et al. (2008) revealed that carrots were sorted, graded, packed, stored, handled and marketed in post-harvest.

Forty-eight percent of the farms sell in January, 42.00% in December and January, 8.00% in February and March, and 2.00% in April and May. Farms to market the carrot in cash, credit or by storing to market them according to the marketing conditions. Due to the contracting, the two producers stated that

they marketed the carrots to the to the factories manufacturing turnip juice. Ninety-six percent farms transport to the carrot collection center and market them to the merchants. All first and third group farms and 84.00% of the second group farms transport to the carrot collection center and market them to the merchants. Forty-two farms classified carrots after harvest, 56 enterprises harvested by machine, 33 enterprises packaged carrots and 16 enterprises kept the carrots in cold storage. The relationship between

education levels of carrot producers and resources of market information, collection methods of sales revenues, determination methods of sale price, marketing channels, farmers' opinions on the best marketing channel and pre-marketing procedures were not statistically significant ($p>0.05$). As the sizes of the farms increased, there were increase in the rates of machine harvesting, classification, packaging and cold storage (Table 4).

Table 4. The procedures carried out pre-marketing and post-marketing of enterprises
 Çizelge 4. İşletmelerin pazarlama öncesi ve sonrası dönemde gerçekleştirdiği işlemler

Farmers' Opinions	Farms' Groups					
	First		Second		Third	
	n	%	n	%	n	%
Market Information Resources						
Provincial and district agricultural institutions	1	100.0	0	0.00	0	0.00
Experienced carrot producers	16	84.21	1	5.26	2	10.53
Via internet with your own efforts	5	16.13	16	51.61	10	32.26
Exporters, fertilizers, herbicides and seed dealers	18	62.07	9	31.03	2	6.90
Collection Methods of Sales Revenues						
Credit sales	2	40.00	2	40.00	1	20.00
Cash sales	3	50.00	3	50.00	0	0.00
Both Cash and credit sales	35	50.72	21	30.43	13	18.85
Determination Methods of Sale Price						
Determined together with firms	11	52.38	3	14.29	7	33.33
Firms determined in market condition	29	49.15	23	38.98	7	11.87
Marketing Channels						
Producers-brokers- retailers-consumers	19	50.00	15	39.47	4	10.53
Producers-brokers-exporters-consumers	21	55.26	11	28.95	6	15.79
Producers-exporters	0	0.00	0	0.00	4	100.0
Farmers' Opinions on the Best Marketing Channel						
Cooperatives	2	50.00	2	50.00	0	0.00
Contracted production	6	60.00	3	30.00	1	10.00
Direct wholesale to the consumer	10	41.67	8	33.33	6	25.00
Sales to brokers or merchants	4	44.44	3	33.33	2	22.23
Sales to firms	2	40.00	2	40.00	1	20.00
Direct retail sales to the consumer	7	53.85	5	38.46	1	7.69
Direct sales to the exporters	1	16.67	2	33.33	3	50.00
No idea	8	88.89	1	11.11	0	0.00
Pre-marketing Procedures						
Use of machinery in harvesting	21	37.50	21	37.50	14	25.00
Sorting and grading	8	19.05	20	47.62	14	33.33
Packaging	2	6.06	18	54.55	13	39.39
Cold storage	1	6.25	6	37.50	9	56.25
Carrot Sales Prices						
Very low	11	61.11	6	33.33	1	5.56
Low	14	48.28	11	37.93	4	13.79
Normal	4	26.67	4	26.67	7	46.66
Irregular	8	57.14	4	28.57	2	14.29
Neither good nor bad	3	75.00	1	25.00	0	0.00

The reasons why farmers met or did not meet under the farmers' organizations for the carrots marketing represented in Table 5. Fourteen farmers stated that they should meet under the farmers' organizations to sell carrots at a higher price, 3 farmers stated that they

should meet under the farmers' organizations for the easier marketing and 2 farmers stated that they should meet under the farmers' organizations to reduce production costs. The reasons why farmers did not come together were "lack of trust among farmers"

(20 farmers), no needed (14 farmers), “brokers and traders not giving opportunity” (11 farmers), “not to sell to brokers” (9 farmers) and “lack of cooperation among producers” (5 farmers). Both 12.5% of the first group enterprises with low production capacity and 50% of the third group farms with high production capacity stated that farmers should be acted together to sell carrots at high prices (Table 5). Also, 27.5% of

the first group farms with low production capacity and 35.71% of the third group farms with high production capacity stated that they could not act together in marketing because there were problems of trust and honesty among farmers. There was statistically significant ($p<0.05$) relationship between education levels of producers and membership of farmers' organizations.

Table 5. The reasons farmers do not act together to market carrots

Çizelge 5. Üreticilerin havuç pazarlama aşamasında birlikte hareket etmemelerinin nedenleri

Farmers' Opinions	Farms' Groups					
	First		Second		Third	
	n	%	n	%	n	%
Reasons for acting						
To sell at a high price	5	35.71	2	14.29	7	50.00
For ease of marketing	0	0.00	0	0.00	3	100.0
To reduce cost	0	0.00	1	50.00	1	50.00
Reasons for do not acting						
Lack of cooperation among producers	2	40.00	3	60.00	0	0.00
Not to sell to brokers	7	77.78	0	0.00	2	22.22
Lack of trust among farmers	11	55.00	4	20.00	5	25.00
Brokers and traders not giving opportunity	2	18.18	7	63.64	2	18.18
Insufficient facilities	0	0.00	2	100.0	0	0.00
No needed	12	85.71	2	14.29	0	0.00

The marketing problems encountered by farms were composed of impact of nature on production (52.00%), lack of purchase guarantee (43.75%), lack of storage facilities (40.56%), opportunities of brokers and merchants (39.99%), high cold storage cost (39.15%), low sale prices (39.10%), high packing cost (37.71%), high transportation cost (37.65%), high labor cost (37.53%) and lack of trust among buyers (34.86%) (Table 6). The results of current study for the harvesting, sorting and grading, packaging, storage,

marketing, and problems of carrot production were almost similar to previous studies (Özkan ve ark. 1999; Yılmaz ve Aydoğmuş 2007; Nunez et al., 2008; Yılmaz ve Yılmaz 2008; Yılmaz ve ark. 2015; Anonymous 2019a; Anonymous 2019b; Khokhar, 2019). Yılmaz ve Aydoğmuş (2007) and Yılmaz ve Yılmaz (2008) stated that the farmers had confidence problem to the brokers and merchants for the fresh vegetables and fruit marketing,

Table 6. The problems encountered by farmers in carrot marketing

Çizelge 6. Üreticilerin havuç pazarlama aşamasında karşılaştığı problemler

Marketing Problems	Farms' Groups					
	First		Second		Third	
	n	%	n	%	n	%
Opportunities of brokers and merchants	26	48.15	21	38.89	7	12.96
High transport cost	21	38.89	24	44.44	9	16.67
Lack of purchase price guarantee	20	46.51	20	46.51	3	6.98
Low sale prices	30	50.85	19	32.20	10	16.95
High labor cost	36	47.37	26	34.21	14	18.42
High cold storage cost	9	18.75	25	52.08	14	29.17
High packing cost	10	21.74	23	50.00	13	28.26
Lack of cold storage facilities	4	12.00	16	50.00	12	37.50
Impact of nature on production	0	0.00	2	40.00	3	60.00
Lack of trust among buyers	9	25.71	15	42.86	11	31.43
No idea	0	0.00	3	42.86	4	57.14

*Farmers were able to answer more than one criterion.

The farms suffered the most from labor, low sale price, high transport cost, lack of purchase price guarantee and opportunities of brokers and merchants. Only all of the third group farms complained about high labor

cost and high cold storage cost (Table 6). The results obtained by brokers and merchants in terms of opportunism were similar to those stated by Yılmaz and Yılmaz (2008). Yılmaz ve Yılmaz (2008) stated that wholesales were not put in place to the interests

of the producers, that the advance payment system restricted the marketing activities of the producers, that the brokers could not be fully controlled by the state and that the producers had to be organized, small producers could not easily enter the markets, market conditions were not equal for all producers, wholesale sales had negative effects on the marketing conditions of small producers and wholesale sales increased the costs of producers, profit margins, inadequate quality standards in products, inadequate infrastructure of most of the small wholesale markets, post-harvest losses in terms of quality and quality of fresh vegetables and fruits, intermediaries are opportunistic, intermediaries are dominant in the market, especially the producers of small producers. He stated that the legal arrangements that will balance the intermediary and the merchant must be issued by the state.

The responses of farmers on changes in carrot cultivation

The responses of farmers on changes in carrot farming over the last 20 years were presented in Table 7. Farmers stated that there were increases such as tool and equipment capital (1.20), the rate of use of mechanization (1.52), machine power used per hour (1.06), total cost (1.71), labor force usage per hour (1.71), number of irrigation, carrot quality, number of diseases and pest control, chemical herbicides used in the amount of dosage, fertilization number per hectare amount of fertilizer and the number of hoeing, but there were not changed such as harvested carrot amount per hectare (3.44), seed usage amount per hectare, planting frequency and hoe to dig time (3.20) in the last 20 years (Table 7).

Table 7. Farmers' opinions on changes of carrot cultivation over the last 20 years

Çizelge 7. Üreticilerin son 20 yılda havuç tarımındaki değişikliklere ilişkin görüşleri

Farmers' Opinions	Farms' Groups				
	First	Second	Third	Average	
Seed usage amount per hectare	3.08	3.08	3.54	3.20	
Planting frequency	3.08	3.17	3.46	3.20	
Number of herbicides applications	2.60	2.92	2.46	2.64	
Dosage amount of herbicides used	2.68	3.00	2.69	2.76	
Number of fertilization	2.24	2.58	2.00	2.26	
The amount of fertilizer used per hectare	2.36	2.67	2.08	2.36	
Machine power used per hour	1.08	1.00	1.08	1.06	
Machine power usage	1.50	1.52	1.54	1.52	
Number of hoeing	2.96	3.00	2.92	2.96	
Hoeing time	3.24	3.17	3.15	3.20	
Harvested carrot amount per hectare	3.92	2.58	3.31	3.44	
Quality	1.64	1.58	1.46	1.58	
Total cost	1.12	1.00	1.62	1.71	
Labor force usage per hours	1.92	1.42	1.62	1.71	
Tool and equipment capital	1.08	1.00	1.62	1.20	
Number of irrigation	1.71	2.42	1.85	1.92	
Scales	Too much increased	Not Increased	Changed	Decreased	Too much decreased
	1	2	3	4	5

The answers given by the farmers of the most important factors in carrot agriculture were given in Table 7. 33,21% of the farms (25 farms) increased their production costs, 20,69% of the farms (14 farms) increased the use of machinery in carrot agriculture, 15,42% of the farms (11 farms) and 23,24% of the farms (14 farms) reported an increase in the quality of the carrot produced. Farmers stated that labor, tool and equipment purchase, irrigation, total production costs and machine power usage increased considerably, and no changes in the amount of seed used in per hectare area, planting frequency, number of hoeing and time, and the amount of carrot harvested from per hectare area on changes of carrot cultivation over the last 20 years (Table 7). Increases in the use of mechanization, irrigation shortage due to drought and changes in the

carrot quality increase in the third group farms. The increases of the production costs were mostly in the first group farms. The eases of transportation and transfer, the increases in the amount of seeds used were mostly in the second group farms. Seventy percent farmers stated that they would grow carrot next year and 30.00% of them would not do it again. The rates of the farms for the production of carrots next year for the first, second and third group farms were 37.10%, 25.70% and 37.20% respectively (Table 8).

Thirty five percent of first group farms with the small production capacity, 34.62% of second group farms with medium production capacity and 14.29% of third group farms with high production capacity stated that the most important changes in carrot production were realized in production costs (Table 8).

Table 8. The most important factors on changes of carrot production
Çizelge 8. Havuç üretimindeki değişikliklere etkili en önemli faktörler

Very Important Factors	Farms' Groups					
	First		Second		Third	
	n	%	n	%	n	%
Increased use of mechanization	8	57.14	2	14.29	4	28.57
Increased production costs	14	56.00	9	36.00	2	8.00
Reduced yield	5	62.50	0	0.00	1	37.50
Seed amount	2	33.33	4	66.67	0	0.00
Drought and water shortage	6	54.55	2	18.18	3	27.27
Carrot quality increase	3	21.42	7	50.00	4	28.58
Easily transportation and transfer	2	50.00	2	50.00	0	0.00

CONCLUSIONS

It can be concluded that, overall, as production capacities of farms increased, modern production techniques and mechanization used were intensified. Within the total amount of carrots produced, the amounts of the first and second quality carrots increased as the production capacities of the farms increased. In the first group of farms with small production capacity, the third quality carrot amounts were produced more intensively. While third group farms obtained market information sources from the internet, the first group of farms obtained market information sources from fertilizer, herbicides and seed dealers and other experienced carrot producers. The third group farms determined the sale prices of carrots together with the buyer firms, while the first farms with small scales were dependent on market conditions and had no effect on price determination. All of the farms that export carrots showed that they consist of third group farms. While the lack of cold storage was seen as an important problem for the second and the third group of farms, it was seen as an important problem that opportunism of brokers and merchants in the first group of farms. In terms of the changing production factors, the increases in the use of mechanization and quality of carrot in the third group came to the fore, while the increase in the production costs in the first group farms came to the fore. The results of the research showed that especially the small farmers have the power to determine the sales price by keeping the market power in their hands, but it can only be possible with their organization. Farmers should be subsidized to use of suitable varieties in order to prolong the availability period with high carotene contents. All in all, farmers should be trained in the basics of carrot cultivation as well as use of mechanization and new techniques and marketing. Marketing channels need to be created to ensure that carrots are delivered directly to consumers to increase the revenues of producers. Increasing the number and capacity of cold storage should be encouraged. Farmers should be subsidized to minimize their production expenses. The support to be provided by various stakeholders should involve branding and promotion

in carrot production. Carrot producers should be encouraged to process carrot as a high value products. Organic carrot production should be promoted. In addition, production of carrots should be diversified to include innovations such as renewable, biomass energy.

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Statement of Conflict of Interest

Authors have declared no conflict of interest.

Author's Contributions

The contribution of the authors is equal.

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