EJONS International Journal on Mathematic, Engineering and Natural Sciences | ISSN 2602 - 4136

Article Arrival Date: 8.05.2020 | Article Type: Research Article | Article Published Date: 12.06.2020

Doi Number: http://dx.doi.org/10.38063/ejons.239

A COMPARISON OF DIFFERENT SIZED CARROT (*DAUCUS CAROTA* L.) PRODUCING ENTERPRISES REGARDING SOCIO-ECONOMIC AND CAPITAL STRUCTURES, AGRICULTURAL TECHNIQUES, AND ATTITUDES OF FARMERS IN TURKEY: A CASE STUDY FROM HATAY PROVINCE

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ABSTRACT

Hatay province is a major producer of carrots (*Daucus carota* L.) ranking as the third in the Turkey. Therefore, the main objective of this study was to examine the agrarian techniques, attitudes of farmers, socio-economic and technical structures of carrot producing enterprises in Hatay. The enterprises were divided into three groups according to production lands. The average labor force, size of the cultivation area, annual carrot production, total production costs and sales revenues were calculated as 3.36-man workforce units, 8.253 ha, 262.2 tons, 14.911 and 28.859 US$ in all groups, respectively. As the production area expanded within the enterprises, the years of carrot production also extended. Sixty percent of the carrot farmers benefited from the other experienced carrot producers. All carrot producing enterprises in the first, 92.30% in the second and 78.60% in the third groups received fertilizer and diesel subsidies. The average record-keeping rate was 46.23% in all groups. The average amount of seed used per hectare was 3.198 kg. Eighty six percent of farmers were not members of any organization. The results showed that enterprises should be subsidized so that they could be increased production, improved their market share and decreased input costs. Farmers were encouraged to unite under farmers' organizations. Marketing channels should be created to ensure that carrots were delivered directly to consumers thus increasing the revenues of producers.

Keywords: Carrot production, Socio-economic structure, Capital, Farmer's attitude

1. INTRODUCTION

The agriculture sector is the main source of human nutrition (Er and Özçelik, 2016). According to data from the Food Agriculture Organization of the United Nations (FAO), the agricultural sector constituted 3.30% of total Gross Output (GO) in the world (FAO, 2017). The ratio of the agricultural sector in Turkey's economy was 6.20%, while the percentage of total employment was 20%. The ratio of the agricultural sector in total GO was 35.327 US$ billion (Anonymous, 2018). Although the ratio of the agricultural sector in the economy decreased after 2000 compared to other sectors, it is still an indispensable part of the economy. The agricultural sector also meets the raw material needs of the industrial sector, ensures the nutrition of the population and contributes significantly to export revenues. (Tatlidil, 2000). According to 2017 FAO data, carrots (*Daucus carota* L.) were produced on 114.7155 ha throughout the world resulting in production of 42.832 tons. Turkey produced 1.32% of world carrot production while its carrot production area constituted 0.9% of the world total (FAO, 2017). Turkey's carrot production was 235.000 tons in 2000 climbing to 569.553 tons in 2017, an increased of 135%. The carrot cultivation area was 10.849 ha in 2017. Turkey exported 64.994 tons of carrots in 2016 while imports reached 1.842 tons. In Turkey, the carrot consumption per capita was 5.41 kg per year and the carrot adequacy ratio was 113.2% (Anonymous, 2017a). Carrot is an important winter vegetable grown in many areas of Turkey, which ranks ninth in world production. Hatay had 2.039 ha of carrot cultivation and follows the Konya and Ankara districts with 53.121 tons. Konya had area of 5.378 ha of cultivation and produces 355.652 tons of carrots while Ankara had 2.350 ha of cultivation and 132.880 tons of production (Anonymous, 2017b). Hatay province occupied third position in Turkey for carrot production. Therefore, the main objective of this study was to reveal the socio-economic, technical and capital structures, and responses and attitudes of farmers regarding carrot production in Hatay, Turkey.

2. MATERIALS and METHODS

The primary material for this study was the data from the surveys on carrots conducted in the province of Hatay where is located at 36 ^{o}N latitude and 36 ^{o}E longitude in the Eastern Mediterranean region of Turkey. The data used within the scope of the research were obtained by completing a questionnaire with the owners of the enterprises between May 2017 and October 2018. In addition to the primary data, the findings of the study that was previously conducted formed the secondary data of the study. 95% confidence level and 10% error margin were used in the study. According to the calculations derived by applying the following “Simple Random Sampling” formula, it was deemed appropriate to conduct surveys in 80 enterprises (Dawson and Trapp, 2001).

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

In the formula:

n = example volume, s = standard deviation, t = t value of 95% confidence limit (1.96), N = total number of enterprises within the scope of the sampling, and d = an acceptable error (10% deviation). The enterprises were divided into three groups according to size of carrot production areas. The enterprises had 0.10 to 7.5 ha land were determined as the first group (n = 40 enterprises), those with 7.6 to 15.0 ha land were the second group (n = 26 enterprises) while those with 15.1 ha land and over were the third group (n = 14 enterprises). Kruskal–Wallis H statistical test was used to determine whether the size of the enterprise, the amount of fertilizer and pesticide, and the labor force and

machine power used per hectare had an effect on carrot production. The same method was used to test whether the age of the farmers impacted on carrot cultivation area as well as to test whether the experience of carrot producers affected the duration of carrot production. Tamhane's T2 multiple comparison test was used in comparison of enterprises groups. In addition to the Chi-square (χ^2) independence test was used to determine whether the relations between the two variables was statistically significant. The statistical differences of various parameters were tested at 5% of p value (SPSS 2015). The data regarding the use of inputs, subsidies and challenges were examined, and the ultimate data obtained were evaluated on a 5-point Likert scale. An analysis of variance was conducted between the size of the groups and the continuous variables of the enterprises examined to determine whether there was a relationship. Cronbach's alpha test was used to ensure "The Reliability Analysis" as well as to assess the internal consistency of a questionnaire made up of multiple 5 Likert-type scales and items (McLeod, 2008).

3. RESULTS and DISCUSSION

3.1. The agricultural productions of enterprises

The data and statistical analysis results of the agricultural products produced by the enterprises were presented in Table 1. Enterprises produced wheat, cotton and corn as well as carrot. The average total plant production areas were 21.598, 40.226 and 62.602 ha for the first, second and third group enterprises, respectively. The average size of the carrot cultivation area of all enterprise groups was 8.253 ha. Similar results in terms of carrot yield were reported by Koo and Taylor (1999). The average annual carrot production amount for all enterprises was determined as 262.2 tons. The average carrot production amounts for the first, second and third group enterprises were 154.21, 342.90 and 419.91 tons, respectively. The average total carrot production costs and sales revenues of all enterprises were 14.911 and 28.859 US$. Wheat, cotton and corn fields followed the carrot fields in terms of enterprises' sizes. Differences between enterprises groups for the wheat, cotton, carrot and total production areas, wheat, cotton and carrot yields, wheat, cotton and carrot sale prices were determined significant statistically ($p<0.05$) (Table 1). There was a positive and statistically significant ($p<0.05$, $p=0.0321$) relationship between farm sizes and wheat, cotton, corn and carrot sales prices. As business size increased, product sales prices also increased.

Table 1. Production areas, amounts and prices of various plant products in carrot producing enterprises.

Agricultural Products	Enterprises' Groups			P-values
	1st	2nd	3rd	
Wheat area (ha)	8.677[a]	11.900[b]	16.750[c]	0.021
Wheat yield (kg/ha)	6437.50[a]	6700.00[b]	6830.00[c]	0.047
Wheat price (US$/kg)	0.1484[a]	0.1516[b]	0.1623[c]	0.015
Cotton area (ha)	7.865[a]	12.409[b]	18.164[c]	0.034
Cotton yield (kg/ha)	4600.00[a]	5235.30[b]	5245.50[b]	0.018
Cotton price (US$/kg)	0.3430[a]	0.3655[b]	0.3738[c]	0.037
Corn area (ha)	0.00	5.000	15.250	0.011
Corn yield (kg/ha)	0.00	78.333	115.00	0.023
Corn price (US$/kg)	0.00	0.1421	0.1570	0.065
Carrot area (ha)	5.056[a]	10.917[b]	12.438[c]	0.043
Carrot yield (kg/ha)	30500[a]	31410[ab]	33760[b]	0.036
Carrot price (US$/kg)	0.1098[a]	0.1100[ab]	0.1107[b]	0.031
Total production areas (ha)	21.598[a]	40.226[b]	62.602[c]	0.024

a; b; c: means with different superscript letters in the line indicate significant differences at $p<0.05$.

3.2. The demographic characteristics of farmers

The average age of farmers engaged in carrot farming was calculated as 47.50 years. These average ages of farmers were determined as 46.24 years in the first group, 49.17 years in the second group and 48.38 years in the third group enterprises. There was only one female farmer in both first and third groups, the second group was composed only of male farmers. As for the education of the farmers, it was found that 62% of fifty farmers were middle school-high school graduated, 20% were primary school graduated, 14% were university graduated and 4% were high school graduated. The third group of enterprises (3 farmers) had the highest number of university graduated. In the study conducted by Acar and Gül (2015), 71.23% of the farmers were primary school graduated, 15.07% of the farmers were secondary school graduated, 8.22% of the farmers high school and 5.48% of the farmers were university graduated. In the studies conducted into carrot production in Konya province, the rates of primary school graduated were determined to be 62.41% and 87.50% (Çelik and Direk, 2008; Acar and Gül, 2015). There was no statistically significant relations between the carrot cultivation areas and the ages of farmers in the enterprise groups ($p>0.05$, $p=0.693$). The average number of working days in enterprises was 257.95 days. The number of working days during the year was not limited to the number of working days in carrot production as the farmers were also engaged in other agricultural activities. While the average plant production experience (carrots and others) in the enterprises was 27.32 years, the third group had the highest experience in plant production (27.85 years). The average carrot production experience was 13.56 years in all enterprise groups. There was no statistically significant relation between the enterprise sizes and the years of carrot production ($p>0.05$, $p = 0.882$). In a similar study conducted in Konya province, there was no relation between the working days of the groups and the crop production experience (Acar and Gül, 2015). As the size of the enterprises increased, an increased in the experience period was also observed. There was a statistical relation between the size of the enterprise and the farmer's experience in carrot production ($p<0.05$; $p = 0.005$). The average number of family members in all groups was four while the groups had averages of 3.84, 4.17 and 4.15 in the first, second and third group enterprises, respectively. Ninety-two percent farmers in the first group were untrained about carrot cultivation. In the third group enterprises, 53.80% of the farmers stated that they had received training of carrot farming. The majority of the enterprises used of traditional methods of carrot cultivation. Only one enterprise in the third group used modern carrot cultivation system. The average rate of record-keeping in enterprises was 46.23%. It was determined that 32% of the first group enterprises, 51.70% of the second and 76.70% of the third group kept business records. As the areas of carrot production increased, there was also an increased in the rate of business record-keeping. Acar and Gül (2015) stated that the record-keeping rate was 54.79% in Konya province. The current research results for record-keeping were comparatively lower than those reported by Acar and Gül (2015). Two enterprises in the first group engaged in animal husbandry with an average annual income of 4.675 US$. Fifty-six percent of farmers did not engage in any activity other than plant production. Forty-four percent of farmers engaged in non-agricultural activities. Thirteen farmers engaged in trade in addition to agricultural activities. One farmer was a local authority official, two farmers were construction contractors, one was a veterinarian, one was a pharmacist and two farmers were agricultural engineers. Sixty-eight percent farmers in all groups were covered by the Social Security Agency (SSA).

3.3. Land and family labor use of enterprises

The average number of family members employed in all enterprises was 3.36 Man Workforce Units (MWU). The values of family labor were 3.19, 3.50 and 3.60 for the first, second and third group enterprises, respectively. The total annual family labor hours was 7.654 h. The family labor hours were 6.111, 8.115 and 10.197 hours for the first, second and third group enterprises, respectively. In a similar study, the potential family work force time was 13,564.73 h (Acar and Gül, 2015). Kıral (1987) stated that the existence of the labor force and its correct use positively affected the results of the operation. Tatlıdil (2000) stated that "The effect of different preservation methods on carrot costs in Beypazarı, Turkey" requires 3166.1 h of manpower per hectare of carrot production.

In another study entitled "Factors affecting yield and profitability in two districts of the Punjab", average labor hours were given as 4.786 and 4.509 hours, respectively (Ahmad et al., 2005).

3.4. Bank loans and beneficiaries from incentives of enterprises

Loans were received by 65% of enterprises (52 enterprises). The number of enterprises receiving bank loans in the first, second and third group were determined as 12, 13 and 27, respectively. The average amount of loans was 2.574, 44.486 and 64.901 US$ for the first, second and third group enterprises, respectively.

Table 2. The number and rates of carrot producing enterprises to benefit from different state agricultural supports.

	Number of enterprises			Rates (%)		
Agricultural Supports	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Fertilizer	40	24	11	100	92.3	78.6
Diesel	40	24	11	100	92.3	78.6
Irrigation Systems	5	0	0	12.5	0.0	0.0
Livestock Animals	6	0	0	15	0.0	0.0
Forage	2	0	0	5	0.0	0.0
Agricultural Products	40	24	12	100	92.3	85.7
Carrot Production	0	0	0	0.0	0.0	0.0
Cronbach's Alpha= 0.648[þ]						

Agricultural incentives in Turkey in the 2000s involved direct income support (DIS) including the formalization of farmers under the title with different forms of payments. According to the Farmers Recording System (FRS), different types of products and methods of production are subsidized by different forms of support payments such as premium, additional payment, livestock, diesel, and fertilizer support depending on the area of the land cultivated (Anonymous 2011). All enterprises in the first group, 92.30% in the second and 78.60% of the third group received fertilizer support. The proportional distribution of the enterprises receiving diesel support was the same as for fertilizer support. While 15% of the first group enterprises received livestock support, none in other groups received animal support. Only 12.50% of all enterprises received irrigation support. In addition, no enterprises in the carrot production sector received support for their carrot production (Table 2).

3.5. The seed, fertilizer, pesticide, labor and machine power uses in enterprises

While 65 of the enterprises performed carrot planting in August, 15 enterprises completed planting in September. Nunez et al. (2008) reported that carrots were planted in California throughout the year. Seeders were used in seeding. The most common seed types were Maestro (58%), Miracle (10.30%), Sofrano (17.40%), and Nantes (13.70%). Acar and Gül (2015) stated that Maestro and Bolero seed varieties were widely used in Konya, Turkey. Gocan et al. (2011) demonstrated that Nantes and Flaker seed varieties were preferred for their economic effectiveness. The average amount of seed used in carrot production was 3,198.40 kg/ha. The average amounts of seeds used were 3,156, 3,204.10 and 3,274.60 kg/ha for the first, second and third group enterprises, respectively. The relation between farm sizes and amount of carrot seed used per hectare was found to be statistically insignificant. ($p>0.05$, $p = 0.609$). The enterprises in all groups procured the carrot seeds from dealers. Acar and Gül (2015) stated that carrot seed selection was a crucial factor in obtaining high quality and high yields as well as having an important role in terms of increasing or differentiating the effect of the inputs on plants. Carrots need plenty of nutrients in the soil. The nitrogen available in the soil affects the color of the carrot. Excessive application of nitrogen fertilizer increases leaf growth and results in loss of yield. Phosphorus and potassium affect the quality and long-term preservation of the

product. Experts recommend using 150-200 kg of nitrogen, 100-120 kg of phosphorus and 100-300 kg of potassium fertilizer per hectare area. The studies demonstrated that 50% of the nitrogen available in the soil makes the planting effective while the other 50% ensures the development of roots (Anonymous 2016). In this study, the average used amount of pure nitrogen was found to be 220.50 kg, the use of phosphorus was 280.10 kg and potassium was around 54.50 kg. The highest amounts of nitrogen, phosphorus and potassium were used in the third group enterprises (Table 3). The average used amounts of nitrogen, phosphorus and potassium were found to be close to each other. The correlation between enterprise sizes and the amount of fertilizers used per hectare was not statistically significant ($p>0.05$, $p = 0.381$). The use of potassium was lower, nitrogen use was almost the same and phosphorus use was found to be higher than the recommended doses. Acar and Gül (2015) reported that the used amount of nitrogen in Konya province was 225 kg, phosphorus was 272.60 kg and potassium was 47.7 kg on carrot production. The results of the research were similar to those reported in the literature.

Pesticides such as insecticides, herbicides, bactericides and fungicides to prevent various diseases, pests and weeds were used on carrot cultivation (Yürekli-Yüksel and Canik, 2011; Acar and Gül, 2015). The relation between enterprise size and the amount of pesticides used for per hectare carrot production area was not statistically significant ($p<0.05$, $p = 0.127$). Total used amounts of herbicide, fungicide and insecticide were 28.750, 34.704 and 42.145 kg for the first, second and third group enterprises, respectively. The highest used amounts of herbicide, fungicide and insecticide per hectare were in the first group (3.6491, 4.3064 and 5.2784 kg) (Table 3).

The average labor force and machine power use in all enterprises were 29.580 and 320.45 hours, respectively. The average labor force and machine power use per hectare area were 824 and 8.2 h/ha. The correlation between enterprise sizes and the amount of labor and machine power uses for per hectare carrot production area was significant statistically ($p<0.05$, $p= 0.013$). As the sizes of enterprises increased, the used amount of labor decreased (Table 3). Similar results were reported by Molendowski and Wiercioch (2014) and Acar and Gül (2015). Acar and Gül (2015) reported that the labor force and machinery power of carrot cultivation per hectare were 849.9 and 9.4 hours in Konya province, respectively.

Table 3. The amounts of fertilizers, pesticides, labor force and machine power usage of carrot producing enterprises.

	The average amount of fertilizer used in the cultivation area (kg/ha)		
Enterprises' Groups	Nitrogen	Phosphorus	Potassium
1st	213.2	271.7	53.0
2nd	222.5	287.0	55.5
3rd	237.7	291.0	56.8
Average	220.5	280.1	54.5
	The average amount of pesticides used in the cultivation area (kg/ha)		
Enterprises' Groups	Herbicides	Fungucides	Insecticides
1st	3.6491	4.3064	5.2784
2nd	3.4436	4.2892	5.0333
3rd	3.3569	3.9508	5.0276
Average	3.5312	4.2386	5.1549
	Labor force and machine power use values in the cultivation area (h/ha)		
Enterprises' Groups	Labor Force	Machine Power	
1st	854.5	7.5	
2nd	827.7	8.9	
3rd	729.8	9.1	
Average	824.0	8.2	

3.6. Knowledge sources, responses and attitudes of farmers on the carrot cultivation

The knowledge sources of farmers on carrot cultivation were represented in Table 4. The farmers obtained the most information on carrot farming from pesticides and fertilizer dealers (61 farmers), while the least information was obtained from universities (5 farmers). While the majority of the farmers who obtained information from the pesticides and fertilizer dealers on carrot cultivation were in the first group farms (35 farms), mostly of the farmers who obtained information from the universities were in the third group farms (4 farms).

Table 4. The knowledges sources of farmers on carrot cultivation in all enterprises.

Knowledge Sources	Enterprises' Groups						Average
	First		Second		Third		
	n	%	n	%	n	%	
From pesticides and fertilizer dealers	35	57.38	17	27.87	9	14.75	42.87
From other experienced farmers	29	53.70	21	38.89	4	7.41	44.51
From agriculture engineers and consultants	8	25.00	11	34.38	13	40.62	34.57
Own experiences	11	35.48	18	58.07	2	6.45	46.72
From technical staff of state institutions	4	18.18	6	27.27	12	54.55	40.50
From merchants	6	30.00	10	50.00	4	20.00	38.00
From farmers' associations	0	0.00	1	10.00	9	90.00	82.00
Universities	0	0.00	1	10.00	4	80.00	66.00

*Farmers were able to answer more than one criterion.

The results of current research are in agreement with the research results reported by Acar and Gül (2015). Acar and Gül (2015) stated that 89.04% of the carrot producers in the Konya province obtained about carrot cultivation from the other experienced farmers and 10.96% of them learned self-carrot farming (Table 4).

Responses and attitudes of farmers regarding sources of knowledge on carrot production were evaluated using a Likert scale. According to Table 5, the statements "own knowledge and experience" (4.48), "from the pesticide dealership proposals" (4.42), "from fertilizer dealership proposals (4.36) and "from agricultural engineers" (4.19) were found to be very important within the scope of this study. The farmers expressed that their knowledge and experiences, the knowledge of fertilizer and pesticide dealers and the knowledge of agricultural engineers on the carrot cultivation were as important, while the knowledge of agricultural advisors, merchants and producer associations were as less important (Table 5).

Table 5. The average scores of farmers' responses to knowledge sources on carrot production in all enterprises.

Responses of Farmers	Enterprises' Groups			
	1st	2nd	3rd	Average
Own knowledge and experience	4.28	4.67	4.69	4.48
Recommendations from other farmers	3.60	3.25	2.38	3.27
Technical staff of state institutions	2.83	3.36	3.54	3.13
Recommendations from pesticides dealers	4.48	4.42	4.23	4.42
Recommendations from fertilizer dealers	4.72	4.31	3.42	4.36
Labels of packaging	2.54	4.17	4.54	3.42
Merchants	3.44	2.00	1.17	2.57
Audio and visual media	1.54	2.86	3.17	2.25
Technical advisors	1.00	1.31	2.53	1.37
Agricultural engineers	3.62	4.67	4.92	4.19
Producer associations	2.08	3.67	4.15	2.96

Cronbach's Alpha=0.741					
Scale	Unimportant	Less Important	Unstable	Important	Very Important
	1	2	3	4	5

While the rates of farmers registered in the irrigation cooperatives in the first, second and third group enterprises were 50%, 20.83% and 29.17%, the rates of farmers registered in agricultural credit cooperatives in the first, second and third group enterprises were 62.50%, 25% and 12.50%, respectively.

The attitudes scores of farmers regarding carrot production were established via a 5-point Likert scale. According to Table 6, "poisoning might occur if no precautions were taken during the pesticides application (4.78)", "carrot selling prices did not follow a regular course (4.74)", "producers should be trained in the use of chemical pesticides and fertilizers (4.73)", "excessive use of chemical fertilizers and medicines might be harmful for the products and the environment (4.65)", "inadequate government supports in carrot production (4.63)"; "carrot production policies were insufficient (4.62)", "waste chemical pesticides boxes were to be wiped off (4.60)", "no spraying should be done at harvesting (4.44)" and "the total amount of carrot production cost was higher than other plant products (4.05) were the statements used to express their concerns regarding carrot production. The farmers declared that they were agree with these subjects, such as it could be poisoning during chemical spraying, carrot sales prices were irregular, they needed to be trained on the use of chemical fertilizers and pesticides, excessive chemical fertilizers and pesticides were harmful to the environment, state supports were insufficient, state agricultural policies were insufficient, and boxes of pesticides should be disposed, no pesticides were used during harvesting and carrot production costs were higher than other agricultural production costs on in carrot farming (Table 6).

Table 6. The average scores of the farmers' attitudes on carrot production in all group enterprises.

Attitudes of Farmers	**Enterprises' Groups**			
	1st	**2nd**	**3rd**	**Average**
Only pesticides should be used in the fight against diseases and pests	2.31	3.56	4.00	3.01
The more chemical fertilizers, the better the carrot yield	2.88	1.92	1.77	2.37
High-dose of pesticides and fertilizers can sometimes be used	2.58	3.60	3.77	3.12
Overdose chemicals can damage the products and environment	4.58	4.64	4.85	4.65
Possibility of poisoning during the pesticides use	4.72	4.76	5.00	4.78
Using pesticides despite no available disease and harm	1.92	1.69	1.50	1.77
Waste chemical pesticides boxes should be wiped off	4.48	4.69	4.75	4.60
No spraying should be done harvesting	4.28	4.50	4.77	4.44
Training of farmers on the use of pesticides and fertilizers	4.60	4.83	4.92	4.73
Insufficient premium in production	1.00	2.60	3.24	1.91
Insufficient government supports in production	4.56	4.66	4.77	4.63
Insufficient fertilizer support in production	1.00	2.15	2.48	1.63
Insufficient diesel support in production	1.16	1.94	2.20	1.60
Insufficient policies concerning carrot production	4.56	4.58	4.85	4.62
Carrot is not a profitable product in the region	2.72	2.92	3.23	2.87
Carrot yield is low in per hectare	3.50	3.00	2.45	3.15
Carrot production costs are higher than other productions	3.60	4.28	4.92	4.05
Carrot sale prices do not follow a regular course	4.67	4.72	5.00	4.74

Cronbach's Alpha= 0.930					
Scale	Strongly Not Agree	Not Agree	Unstable	Agree	Strongly Agree
	1	2	3	4	5

Responses of the farmers regarding the challenges they encountered in carrot farming were also investigated. “Low product prices (4.89)”, “Not big enough market and no buyer presence (4.72)”, “High input prices (4.36)”, “Lack of organization among producers (4.29)”, Water supply and irrigation (3.39)”, “Use of machinery (2.98)”, “Appropriate loan supply (2.37)”, “Quality seed, fertilizer and pesticides supply (1.17)” and ”Equipment supply (1.15)” were the statements used to express their concerns regarding challenges of carrot production. The farmers stated that they were agree with these subjects, such as reduction of production costs, insufficient market and buyers, high input costs and insufficient organization of producers problems encountered in carrot farming (Table 7).

Table 7. The average scores of farmers’ responses about problems encountered for carrot production.

Responses of Farmers	**Enterprises’ Groups**			
	1st	**2nd**	**3rd**	**Average**
Lack of knowledge on carrot cultivation	2.44	1.83	2.08	2.18
Disease and pest control	3.16	2.71	2.08	2.82
Fertilizer and fertilization	1.92	1.84	1.50	1.82
Water supply and irrigation	2.67	3.88	4.54	3.39
Machinery use	3.69	2.36	2.08	2.98
Appropriate loan supply	1.12	3.58	3.69	2.37
Quality seed, fertilizer and pesticides supplies	1.12	1.15	1.33	1.17
Equipment supply	1.23	1.12	1.00	1.15
High input prices	4.24	4.46	4.50	4.36
Insufficient control of input dealers	2.83	1.20	1.05	1.99
Low product prices	4.84	4.92	5.00	4.89
Insufficient markets and buyers	4.85	4.64	4.50	4.72
Lack of cooperation and organization among producers	3.72	4.83	4.92	4.29
Cronbach’s Alpha= 0.855				

Scale	Unimportant	Less Important	Unstable	Important	Very Important
	1	2	3	4	5

3.7. The economic structures and capital components of enterprises

According to Table 8, 42.50% of the enterprises in the first group (17 enterprises) own land worth between 100.001 and 300.000 US$, 34.60% of the second group (six enterprises) and 42.90% of the third group (six enterprises) own land worth between 500.001 and 1.000.000 US$. Enterprises with land valued above 1.000.000 US$ were only found in the second (23.10%) and third group enterprises (21.40%). For land improvement, 57.50% of the first group and 46.10% of the second group enterprises had a budget between 2.001 and 6.000 US$. 42.90% of the third group enterprises had between 10.001 and 15.000 US$. As for the tool and machinery budget, it was over 50.000 for 72.50% of the first group, 96.20% of the second group and 100% of the third group, respectively. The average amounts of land, real estate, land improvement, tools and machinery, livestock, materials and ammunition, capital stock and credit and debt capital were calculated as 389.275, 47.457, 6.178, 58.473, 16.778, 32.238, 21.276 and 42.673 US$, respectively (Table 8).

Table 8. The capital structures and capital components of carrot producing enterprises.

Capital Components (US$)	Enterprises' Groups							
	1st		2nd		3rd		Total	
	n	%	n	%	n	%	n	%
Land								
Less than 100000	6	15.0	2	7.7	0	0.0	8	10.0
100001-1000000	34	85	18	69.2	11	78.6	63	78.8
More than 1000000	0	0.0	6	23.1	3	21.4	9	11.2
Real Estate								
Less than 2000	0	0.0	0	0.0	0	0.0	0	0.0
2001-50000	26	65.0	12	46.2	0	0.0	38	49.4
More than 50000	11	27.5	14	53.8	14	100	39	50.6
Land Improvement								
Less than 2000	16	40.0	6	23.1	0	0.0	22	27.5
2001-15000	24	60.0	20	76.9	12	85.8	56	70.0
More than 15000	0	0.0	0	0.0	2	14.2	2	2.5
Tool and machinery								
5000-50000	11	27.5	1	3.8	0	0.0	12	15.0
More than 50000	29	72.5	25	96.2	14	100.0	68	85.0
Livestock								
5000-30000	5	12.5	4	15.4	0	0.0	9	100
Material and Ammunition								
Less than 1000	1	2.5	0	0.0	0	0.0	1	1.2
1001-30000	27	67.5	11	42.3	1	7.1	39	48.8
More than 30000	12	30.0	15	57.7	13	92.9	40	50.0
Capital Stock and Credit								
Less than 1000	7	17.5	4	15.4	1	7.1	12	26.1
1001-50000	3	7.5	6	23.1	0	0.0	9	19.6
More than 50000	3	7.5	9	34.6	13	92.9	25	54.3
Debt								
Less than 1000	4	10.0	0	0.0	0	0.0	4	5.3
1001-50000	27	67.5	7	26.9	1	7.1	35	46.7
More than 50000	6	15.0	17	65.4	13	92.9	36	48.0

4. CONCLUSION

As a results, the bigger enterprises were caused by the use of modern agricultural techniques and technologies in the production of carrots, the more careful selection of seeds, the more sensitive behaviors of chemical herbicides, fertilizer and irrigation, and the higher level of technical knowledge and experience. The high costs, low sales prices, quality seeds, fertilizers, pesticides, equipment supply and finding suitable loans were the main challenges that the farmers encountered. All farmers should be trained in the basics of carrot cultivation as well as irrigation, chemical fertilizers, pesticides, mechanization and new techniques uses, and marketing. 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 unite under farmers' organizations in order to overcome the challenges encountered. Marketing channels needed to be created to ensure that carrots were delivered directly to consumers so increasing the revenues of producers. In addition, production of carrots should be diversified to include innovations such as renewable, biomass energy.

ACKNOWLEDGMENT

We would like to thank to the carrot producers of Hatay province and Hatay Mustafa Kemal University Scientific Research Projects Coordinator (Project No: 16699) for supporting this project.

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