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CONTENTS

Relative Stand Density And Its Influence On Tree Growth In Mixed Fir-Pine Stands

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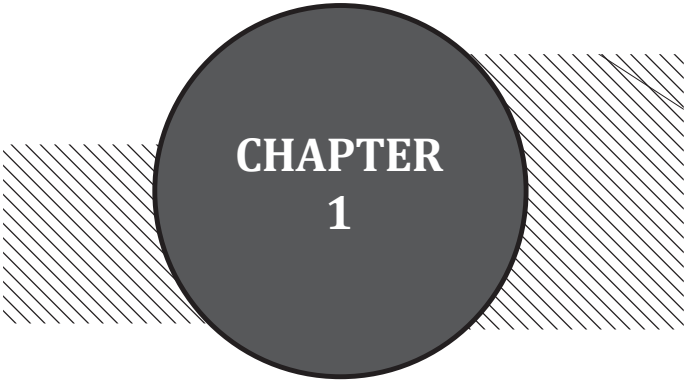

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INTRODUCTION

Forests are very critical for the sustainability of life since they have several benefits on most of the living things. Recently, it has been stated that mixed forest provide more ecosystem services compared to pure single-species forests (Pretzsch et al. 2017). Therefore, the potential benefits of mixed forests have been discussed in recent forest management planning. Mixed forests usually exhibit uneven-aged stand structure with varying heights and diameters among tree species (Kelty et al. 2013). The tree mixtures in these forests enhance ecosystem functioning, and improve ecosystem stability (Noss 1990). The biological biodiversity, which can influence the quality of an ecosystem by providing more ecological services (Pádua and Chiaravalotti 2012), is generally higher in mixed stands than pure stands (Pretzsch et al. 2017). The amount of deadwood, which is also an indicator of biological diversity in a stand, is also usually higher in mixed forests in comparison to pure forests (Kelty et al. 2013). Mixed forests are known to be more durable and resilient against wind, insects and frost (Odabaşı et al. 2004). They are also more preferable for recreation and aesthetics services, as well as they provide better wildlife habitats.

Turkey has approximately 21.700.000 hectare of forested land as of 2014, which constitutes 27.6 % of total acreage of the country (General Directorate of Forestry 2014). About 41% (8.982.000 hectare) of the total forested land consists of mixed forests in Turkey indicating that vast acreage of mixed forests is present in the country, Turkish forests are regarded "rich" in biological diversity (Çolak et al. 2009). Trojan fir (*Abies nordmanniana* subsp.*equi-trojani*) and Scots pine (*Pinus sylvestris* L.) trees create mixed stands especially in northern Turkey (Figure 1). These tree species are two of the most economically and ecologically important trees species in the country. In addition to their high quality timber, they also exhibit several ecosystem services including wildlife habitat, aesthetics and recreation in northern part of Turkey (Çalışkan 1992). For this reason, the concern over the maintenance and sustainability of the mixed forests has recently increased in Turkey as well. Despite their importance, the management of mixed stands is known to be more difficult because of the more structural complexity compared to pure stands (Odabaşı et al. 2004). Therefore, better silvicultural prescriptions that ensure mixed stand structure while producing high quality timber is critical in the mixed stands of Turkey.

Figure 1. A scene from the mixed Trojan fir-Scots pine forests in Ilgaz region.

Sustainability and maintenance of the mixed stands can be achieved through the better understanding of the stand dynamics of these forests, as well as the comprehension on the response of trees to varying levels of stand densities (Kelty et al. 2013). Stand density has influence on many parameters including productivity, photosynthesis, seed quality, seedling growth, decomposition, soil moisture, tree stem quality, wildlife animals, fire frequency and many others (Curtis and Rushmore 1958; Bormann and Gordon 1984; Smith et al. 1988; Peterson and Reich 2001; Odabaşı et al. 2004). Therefore, measure of stand density constitute the basis of silvicultural decisions. The target condition of a forest following the silvicultural treatment is commonly defined by the measure of stand density (Nyland 2002).

Stand density is commonly presented via absolute density measures such as stand basal area (m^2 / hectare), tree volume (m^3 / hectare) and number of trees per hectare (Johnson et al. 2009). Absolute stand density is quantitative that is defined by one or several physical characteristics of a stand. Other definition of stand density is relative stand density (RSD). The use of RSD measures including stand density index and stand stocking percentage (SSP) have increased. RSD measures compare an absolute density to a reference, and exhibit additional information regarding the crowd of the stand (Nyland 2002). Several methods have been created to express RSD (Reineke 1933; Gingrich 1967). It has been recommended that RSD measures are better indicators than absolute stand density measures for predicting

tree growth in a stand (Kara et al. 2018). This is because growing space for a given absolute measure of stand density (for example; basal area) may change depending on the average tree dimeter of the stand; stands with larger average tree diameter represent more growing space than stands with smaller trees (Gingrich 1967). SSP is one of the most commonly used relative density measures in forest management activities (Larsen et al. 2010; Kara et al. 2018).

Varying RSD measures have been developed for many forest types across the world. Given the ecological and economic importance of mixed Trojan fir-Scots pine forests in Turkey, and the advantages of RSD measures over the absolute measures, the development of a RSD measure seems to be essential for these forests as well. In this study, Gingrich's (1967) SSP was followed as the measure of RSD. The determination of SSP levels as a function of the number of trees per hectare and quadratic mean dimeter (QMD) (cm) would help forest managers for a better management and maintenance of mixed Trojan fir-Scots pine forests. There has not been any research on a RSD measure and its influence on tree growth in mixed Trojan fir-Scots pine forests. Therefore, in this chapter, it was aimed to develop SSP levels corresponding to the number of trees per hectare stand basal area, and QMD for mixed Trojan fir-Scots pine forests. Moreover, the influence of developed RSD on five-year diameter growth of Trojan fir and Scots pine trees was examined in this forest type.

MATERIALS AND METHODS

Study area: This study was conducted in mixed Trojan fir-Scots pine forests in Ilgaz region, northern Turkey (Figure 2). The area is mostly dominated by pure Trojan fir and Scots pine forests, and mixed stands of these two tree species. In the region, other tree species are black pine (*Pinus nigra* Arnold.), Oriental beech (*Fagus Orientalis* L.) and oaks (*Quercus* spp.). Understory species in the region include Common juniper (*Juniperus communis* var. *saxatalis*), oaks, mastic tree (*Pistacia lentiscus*), tree heath (*Erica arborea*), common hazel (*Coryllus avellana*), Cornelian cherry (*Cornus mas*.) and blackberry (*Rubus fruticocus*). These forests are mostly located at elevation between 1000 and 1900 m, but the study plots were situated at elevation of 1750-1850 m. Study area is on the transition zone between the Black Sea climate and the terrestrial climate of central Turkey. Average annual precipitation is relatively high (approximately 1050 mm) in the study area. The average temperature is 5.1 °C. The terrain of the study area is mostly sloping ranging from 12 to 60%. Brown calcareous is considered as the dominant soil type in the region.

Figure 2. Locations of the study area.

RSD: In order to determine the SSP levels, the first step is to define the average maximum density. Average maximum density is estimated from the fully stocked stands that are undisturbed stands at maximum stand density. The undisturbed Trojan fir-Scots stands are present in Ilgaz Mountain National Park, Kastamonu, within the study area. Therefore, forty-five study plots with an area of 100-m^2 were selected within the mixed Trojan fir-Scots pine stands, in summer of 2018, in the national park. Diameter at breast height (d.b.h.) of all trees larger than 5 cm was recorded using a diameter tape in each study plot. For each plot, the number of trees per hectare and QMD were calculated. Table 1 represents the descriptive statistics of the study plots selected.

Variables	Min.	Max.	Mean	SD
Trees / hectare	300	1700	849	231
Basal area	26.5	164.9	90.7	37.7
QMD (cm)	19.3	46.6	36.1	6.7

Table 1: Summary of data from the inventory plots. SD refers to standard deviation.

First, to identify the fully stocked stands, stand density index of each plot was calculated using the Reineke's (1933) formula of stand density index. Next, RSD of each plots was determined by dividing the stand density index of the plot to the maximum stand density index obtained among all study plots (Drew & Flewelling, 1979). As recommended by Shaw and Long (2007), the study plots that have RSD higher than

0.6 were chosen as the fully stocked stands. In this study, the number of fully stocked plots was twenty-two, which is acceptable given the previous studies (Solomon and Zhang 2002; Larsen et al. 2010). After the selection of the fully stocked plots, the average maximum density for mixed Trojan fir-Scots pine forests was quantified using the Reineke's (1933) equation below. Number of trees per hectare and the associated QMD from the fully stocked stands were plotted on a logarithmic scale. Then, the ordinary least square regression was utilized to fit the average maximum density model for this forest type.

$$\log_e(\text{Number of Trees}) = b_0 - b_1.\log_e(\text{QMD})$$

where b_0 and b_1 are the coefficients. Following the determination of coefficients for the Reineke's (1933) model, the number of trees per hectare for each 5 cm QMD class (from 20 to 55 cm) was calculated using the model above (Reineke 1933) for average maximum density. It should be noted that average maximum density represents hundred percent SSP level in a stand. SSP levels below 100% (i.e., SSP levels between 100% and 10%) was defined as a proportion of average maximum density using number of trees per hectare and QMD. Finally, the SSP levels corresponding to the number of trees per hectare and QMD was represented in a table.

Tree growth: In order to observe the influence of RSD (i.e., SSP) on five-year diameter increment, two dominant trees (one tree for each species) were selected in twenty study plots in mixed Trojan fir-Scots pine forests. Increment cores were obtained from the selected trees at 1.3 m height using a Haglöf increment borer. A high definition picture of each core sample was taken in the field on a scaled paper. Next, the pictures were uploaded to an image analyzer software, ImageJ, and the d.b.h. increment (cm) from 2012 to 2017 (i.e., five-year growth) were measured.

Statistical analysis: The influence of RSD (i.e., SSP) on five-year diameter increment was examined using the mixed-effect regression model at α=0.05. Plot was treated as random effect while SSP was the fixed effect in the analysis. Residual analysis was utilized for normality and homogeneity of variance of the data. Statistical analysis was conducted using the R-Statistical software (R Development Core Team 2010).

RESULTS AND DISCUSSION

In mixed Trojan fir-Scots pine forests, the relationships between the number of trees and QMD was linear on logarithmic scale as expected

($p<0.005$) (Figure 3). The slope of the average maximum density was -1.0975 which is lower than the universal average maximum density slope (i.e., -1.605) for the mixed Trojan fir-Scots pine forests. The coefficient of variance of the relationship was over eighty percent (Figure 3).

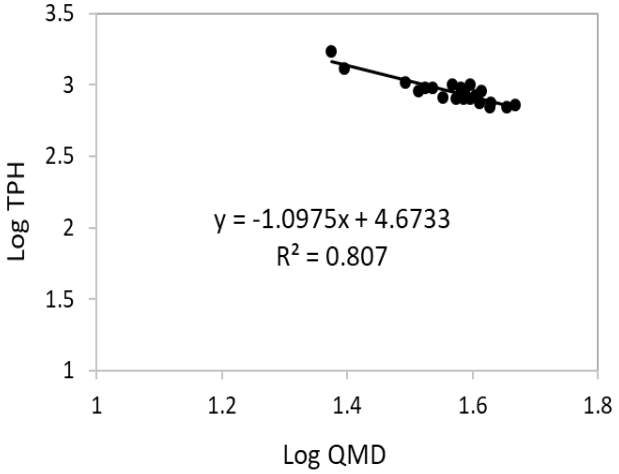

Figure 3. Trees per hectare (TPH) and QMD from fully stocked stands plotted on logarithmic scale.

Table 2 gives the mutual relationships among SSP, QMD and number of trees per hectare for the mixed Trojan fir-Scots pine forests. The number of trees per hectare for a given QMD can be determined to reach a predetermined SSP (Table 2). The SSP ranged between 20 and 55 cm in QMD, which is within the range of minimum and maximum QMD of study plots (Table 1). The SSP of a stand can also be determined using the number of trees per hectare available in stand and its QMD in mixed Trojan fir-Scots pine forests (Table 2). For example, a stand with approximately 900 trees per hectare and QMD of 30 cm, the SSP is eighty percent (Table 2). In another example, a stand with 800 trees per hectare can reach 100 percent SSP when QMD becomes about 41 cm in a mixed Trojan fir-Scots pine forest (Table 2).

Table 3 presents the relationships among SSP, QMD and stand basal area for the mixed Trojan fir-Scots pine forests. The stand basal area for a given QMD can be found to reach a predetermined SSP (Table 3). The SSP of a stand can also be determined using the stand basal area and the QMD in mixed Trojan fir-Scots pine stands (Table 3). For example, in a stand with approximately 64 m2/ha of basal area and QMD of 30

cm, the SSP is eighty percent (Table 3). In another example, a stand with a QMD of 30 cm reaches hundred percent SSP when the basal area becomes about 80 m2/ha in a mixed Trojan fir-Scots pine forest (Table 3).

QMD (cm)	SSP levels										
	10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
20	176	352	528	704	880	1056	1232	1408	1584	1760	1936
21	167	334	500	667	834	1001	1168	1334	1501	1668	1835
22	158	317	475	634	792	951	1109	1268	1426	1585	1743
23	151	302	453	604	755	906	1057	1208	1358	1509	1660
24	144	288	432	576	720	864	1008	1152	1296	1441	1585
25	138	275	413	551	689	826	964	1102	1240	1377	1515
26	132	264	396	528	660	792	924	1055	1187	1319	1451
27	127	253	380	506	633	760	886	1013	1139	1266	1392
28	122	243	365	487	608	730	851	973	1095	1216	1338
29	117	234	351	468	585	702	819	936	1053	1170	1287
30	113	226	338	451	564	677	789	902	1015	1128	1240
31	109	218	326	435	544	653	761	870	979	1088	1197
32	105	210	315	420	525	630	735	840	945	1051	1156
33	102	203	305	406	508	609	711	812	914	1016	1117
34	98	197	295	393	491	590	688	786	885	983	1081
35	95	190	286	381	476	571	666	762	857	952	1047
36	92	185	277	369	462	554	646	738	831	923	1015
37	90	179	269	358	448	537	627	717	806	896	985
38	87	174	261	348	435	522	609	696	783	870	957
39	85	169	254	338	423	507	592	676	761	845	930
40	82	164	247	329	411	493	576	658	740	822	905
41	80	160	240	320	400	480	560	640	720	800	880
42	78	156	234	312	390	468	546	624	701	779	857
43	74	148	222	296	370	444	518	593	667	741	815
44	76	152	228	304	380	456	532	608	684	760	836
45	72	145	217	289	361	434	506	578	650	723	795
46	71	141	212	282	353	423	494	564	635	705	776
47	69	138	207	276	344	413	482	551	620	689	758
48	67	135	202	269	337	404	471	539	606	673	741
49	66	132	197	263	329	395	461	527	592	658	724

50	64	129	193	257	322	386	451	515	579	644	708
51	63	126	189	252	315	378	441	504	567	630	693
52	62	123	185	247	308	370	432	493	555	617	678
53	60	121	181	242	302	362	423	483	543	604	664
54	59	118	177	237	296	355	414	473	532	592	651
55	58	116	174	232	290	348	406	464	522	580	638

Table 2. SSP levels corresponding to QMD and trees per hectare in mixed Trojan fir-Scots pine forests.

QMD (cm)	SSP levels										
	10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
20	5.5	11.1	16.6	22.1	27.6	33.2	38.7	44.2	49.8	55.3	60.8
21	5.8	11.6	17.3	23.1	28.9	34.7	40.4	46.2	52.0	57.8	63.5
22	6.0	12.0	18.1	24.1	30.1	36.1	42.2	48.2	54.2	60.2	66.3
23	6.3	12.5	18.8	25.1	31.4	37.6	43.9	50.2	56.4	62.7	69.0
24	6.5	13.0	19.6	26.1	32.6	39.1	45.6	52.1	58.7	65.2	71.7
25	6.8	13.5	20.3	27.0	33.8	40.6	47.3	54.1	60.9	67.6	74.4
26	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0	77.1
27	7.2	14.5	21.7	29.0	36.2	43.5	50.7	58.0	65.2	72.5	79.7
28	7.5	15.0	22.5	30.0	37.4	44.9	52.4	59.9	67.4	74.9	82.4
29	7.7	15.5	23.2	30.9	38.7	46.4	54.1	61.8	69.6	77.3	85.0
30	8.0	15.9	23.9	31.9	39.9	47.8	55.8	63.8	71.7	79.7	87.7
31	8.2	16.4	24.6	32.8	41.1	49.3	57.5	65.7	73.9	82.1	90.3
32	8.4	16.9	25.3	33.8	42.2	50.7	59.1	67.6	76.0	84.5	92.9
33	8.7	17.4	26.1	34.7	43.4	52.1	60.8	69.5	78.2	86.9	95.6
34	8.9	17.8	26.8	35.7	44.6	53.5	62.5	71.4	80.3	89.2	98.2
35	9.2	18.3	27.5	36.6	45.8	55.0	64.1	73.3	82.4	91.6	100.8
36	9.4	18.8	28.2	37.6	47.0	56.4	65.8	75.2	84.6	94.0	103.4
37	9.6	19.3	28.9	38.5	48.2	57.8	67.4	77.1	86.7	96.3	105.9
38	9.9	19.7	29.6	39.5	49.3	59.2	69.1	78.9	88.8	98.7	108.5
39	10.1	20.2	30.3	40.4	50.5	60.6	70.7	80.8	90.9	101.0	111.1
40	10.6	21.1	31.7	42.3	52.8	63.4	74.0	84.5	95.1	105.7	116.2
41	10.3	20.7	31.0	41.3	51.7	62.0	72.3	82.7	93.0	103.3	113.7
42	10.8	21.6	32.4	43.2	54.0	64.8	75.6	86.4	97.2	108.0	118.8
43	11.3	22.5	33.8	45.0	56.3	67.6	78.8	90.1	101.4	112.6	123.9

44	11.0	22.1	33.1	44.1	55.2	66.2	77.2	88.2	99.3	110.3	121.3
45	11.5	23.0	34.5	46.0	57.5	69.0	80.4	91.9	103.4	114.9	126.4
46	11.7	23.4	35.2	46.9	58.6	70.3	82.1	93.8	105.5	117.2	129.0
47	12.0	23.9	35.9	47.8	59.8	71.7	83.7	95.6	107.6	119.5	131.5
48	12.2	24.4	36.5	48.7	60.9	73.1	85.3	97.5	109.6	121.8	134.0
49	12.4	24.8	37.2	49.6	62.1	74.5	86.9	99.3	111.7	124.1	136.5
50	12.6	25.3	37.9	50.6	63.2	75.8	88.5	101.1	113.8	126.4	139.0
51	12.9	25.7	38.6	51.5	64.3	77.2	90.1	102.9	115.8	128.7	141.5
52	13.1	26.2	39.3	52.4	65.5	78.6	91.7	104.8	117.8	130.9	144.0
53	13.3	26.6	40.0	53.3	66.6	79.9	93.2	106.6	119.9	133.2	146.5
54	13.5	27.1	40.6	54.2	67.7	81.3	94.8	108.4	121.9	135.5	149.0
55	13.8	27.5	41.3	55.1	68.9	82.6	96.4	110.2	124.0	137.7	151.5

Table 3. SSP levels corresponding to QMD and stand basal area (m^2/ha) in mixed Trojan fir-Scots pine forests.

The RSD provides an idea about the amount of growing space available in a stand. It has been recommended that trees in a stand of hundred percent SSP level have minimum growing space available for them to survive (Gingrich 1967). In addition, it has been stated that density-related tree mortality may occur when stands reach approximately eighty percent SSP (Shaw and Long 2007). Moreover, canopy closure usually occurs between 50 and 60 percent of SSP depending on the forest type and tree species (Gingrich 1967; Sandler 1977; Myers and Buchman 1992). Therefore, using the Table 3 above, forest managers can predict whether their stands are near to density-related tree mortality in mixed Trojan fir-Scots pine forests, and treat the stands to create more growing space for the residual trees. In another word, they can estimate how much their trees could grow until canopy closure or density-related mortality.

The mixed forests present greater biodiversity and more ecosystem services than pure forests, thus, their sustainability is critical for forests ecosystems (Pretzsch et al. 2017). Mixed Trojan fir-Scots pine forests provide many benefits including high quality timber, recreation, aesthetic and biodiversity. In the northern Turkey, recently, forest managers have an increasing concern over the decreasing amount of Scots pine trees in the mixed Trojan fir-Scots pine forests. This reduction in the proportion of Scots pine can be attributed to the management methods that have been used in these forests for decades (Odabaşı et al. 2004), as well as the lack of information on the stand dynamics of these forests. Unsuccessful management of mixed Trojan fir-Scots pine forests will likely result in conversion of these forests into pure Trojan

fir forests in the region. Well-management of growing space and stand density in mixed forests is especially essential in forestry (Odabaşı et al. 2004). Therefore, stand density management and growing space allocation in the mixed Trojan fir-Scots pine forests can be conducted more effectively using the relative density measure presented in this chapter.

There was a significant relationship between the RSD and five-year diameter increment in mixed Trojan fir-Scots pine forests ($p<0.05$) (Table 4). Diameter growth decreased with increasing stand density (Figure 4). It should be noted growth data were collected from relatively denser stands (i.e., over ninety percent of SSP) (Figure 4); however, there was still significant influence of stand density on tree growth. This relationship substantiates the importance of growing space management in forestry activities. It has been stated that the significant relationship between RSD and tree growth is usually expected (Johnson et al. 2009). The negative effects of stand density, absolute or RSD, on tree growth have been well understood. However, previous research has revealed that RSD is a better predictor of tree growth and growing space allocation (Gingrich 1967; Kara et al. 2018). RSD has been commonly used to create graphical density management charts and diagrams (Gingrich 1967; Larsen et al. 2010). These graphical tools developed through RSD measures have been commonly utilized for wildlife management as well (Moore and Deiter 1992; Shaw and Long 2007).

Variable	Value	Std.Error	DF	t-value	p-value
Intercept	16.9042	2.8157	18	6.0035	0e+00
Stocking	-0.1004	0.0251	18	-3.9964	8e-04

Table 4. Summary of statistical analysis following random effect model.

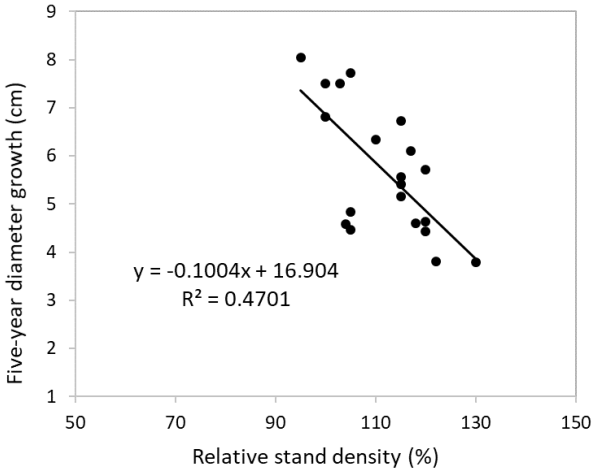

Figure 4. Relationship between RSD and five-year diameter increment.

In conclusion, the SSP levels obtained for the mixed Trojan fir-Scots pine forests would be helpful for a better management of these economically and ecologically important forests. This chapter aims to present complementary data for current silvicultural implications that have been conducted in these forests. Further research regarding the long-term influence of RSD on regeneration and wildlife management in the mixed Trojan fir-Scots pine forests is recommended.

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Analysis Of The Current Situation Of Ornamental Plant Retailers İn The Province Of Yozgat (Turkey)

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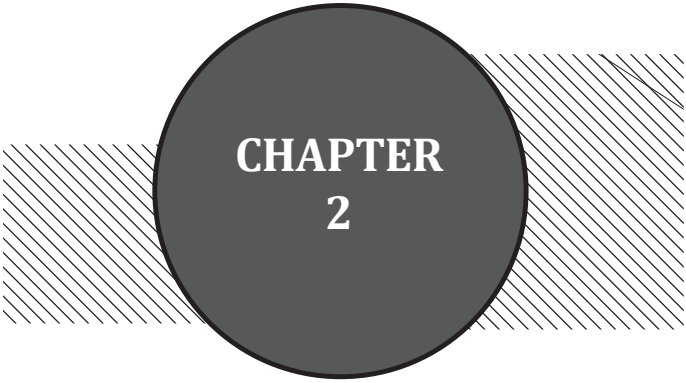

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INTRODUCTION

Ornamental plants that are grown for aesthetic and decorative purposes, to supply with the spiritual needs of people, are an important tool used to symbolize human relationships like love, respect, friendship, and social solidarity (Shimmenti et al., 2013; Ascıuto et al., 2008; Palma Marco et al., 2011). Due to the positive effects of the ornamental plants on people, the sector has become significantly and indispensable in terms of production area and values, particularly at the second half of the 20th century (Kızılkan, 2016; Yazici and Gülgün 2016). The sector has grown rapidly with the increased interest and separated into 4 sub-sectors as cut flowers, potted plants, design plants and flower bulbs (geophytes) (Karagüzel et al., 2010). Nowadays, cut flowers have an important place in the world with foreign trade volume (Gençer, 2014; Hernandez et al., 2014; Kelley et al, 2006; Di Vita et al., 2015).

The production and trade of cut flowers in the world has been increased with the cut flower consumption per capita in many countries (Demir, 2015; Niemıerabetsy and Holle, 2009) and the marketing network that covers the whole process has gained considerable importance. Cut flowers can be delivered directly to retailers through the manufacturer or through auctions, while they can also be delivered through wholesalers. Retailers also provide the delivery of cut flowers to the consumer. The retailers who are the most important link of the marketing network are in direct contact with the consumer and are also significant for the sector as they are influential in spreading the cut flower consumption habits (Güngör et al., 2014). Therefore, it is necessary to reveal retailers' current situation, general structure, and relations with the sector by taking into consideration the development difference of regions or provinces. In this study, the demographic characteristics, socio-economic status of ornamental plant retailers, purchase, storage and sale methods of cut flowers and the problems of marketing of the cut flowers were investigated, and consumption behavior of the cut flower consumers was inquired upon.

MATERIALS AND METHOD

The main material of the study consists of the data obtained from the ornamental plant retailers in the central and districts of Yozgat province. In the survey carried out in January 2019. First of all a list of retailers registered to Yozgat Union of Chambers of Artisans and Craftsmen (YESOB) was obtained and the 21 registered retailers were identified. While 9 of the retailers were registered in the city center and 16 were in its districts, detailed information regarding addresses

and their distribution in the basis of districts couldn't be obtained. For this reason, in a result of face to face meetings and searching through the web was reached all 21 of the retailers, and their locations were thusly determined. The distribution of the retailers by districts of Yozgat is provided in Table 1. As the survey method, face-to-face interview method used in this study. While preparing the survey, the questionnaires were referred according to Bulut et al. (2007) and Aydınşakir et al. (2014). The survey consists of 25 questions. To investigate demographic characteristics of retailers were asked the gender distribution, ages and educational backgrounds.

Districts	Number of retailers	Districts	Number of retailers
Akdağmadeni	2	Şefaatli	0
Aydıncık	0	Yenifakılı	0
Boğazlıyan	2	Yerköy	2
Çandır	0	Merkez	9
Çayıralan	0	Saraykent	0
Çekerek	1	Sarıkaya	3
Kadışehri	0	Sorgun	2
Sum 21			

Table 1. Distribution of ornamental plant retailers by districts

To determine socio-economic status of them were questioned experiences in the sector, annual turnover, enterprises' size, number of employee and whether they operated in other sectors. Retailers were asked about their cut-flower supply channels and the most supplied provinces, sales and transportation methods, the problems they encountered during the purchase-sale and transportation, the reasons for not being able to make sufficient sales and the general problems of the sector. In addition, questions about the methods of cut flower storage, the problems they encountered during the storage and whether they used preservative solutions after harvesting were also asked. Finally, to determine the consumption behavior of the cut flower consumers, the most commonly preferred cut species and their colors, presentation style for the flowers, the special days the consumption of cut flowers peak were questioned. The questions were demographic, multiple-choice, and closed-ended.

In the analysis of the data obtained as a result of the survey, SPSS 20 statistical package software and descriptive statistics were used. The analyzed data were put into a proper format for the study and gathered in tables prepared in the computer for interpretation. Furthermore,

observations performed by the researcher during the survey was also included and based on both the survey results and these observations, solutions for the problems of the ornamental plant retailers were provided.

RESULTS AND DISCUSSIONS

Demographic Characteristics of Ornamental Plant Retailers in Yozgat Province

The gender and age distributions and educational backgrounds of the ornamental plant retailers in Yozgat province are given in Table 2. According to the Table 2, 80,9% of retailers were male and 19,1% were female, and 4,8% were under 25 years of age, while 9,5% were over 26-35, 57,1% were over 36-45, and 28,6% were over 46 years of age. Furthermore, 14,3% of the participants graduated from primary schools, whereas 14,3% graduated from secondary schools, 47,6% from high schools, 9,5% from colleges, and 14,3% from various universities.

	The gender		**Sum**	**Rate (%)**
Age distributions	**Female**	**Male**		
≤ 25	1	-	1	4,8
26-35	-	2	2	9,5
36-45	3	9	12	57,1
≥46	-	6	6	28,6
Educational backrounds				
Primary school	-	3	3	14,3
High school	1	9	10	47,6
College	1	1	2	9,5
University	1	2	3	14,3
Sum	4	17	21	-
Rate	19,1	80,9	-	-

Table 2. The gender and age distributions and educational backgrounds of the ornamental plant retailers in Yozgat province

Inspection of the gender distribution of the ornamental plant retailers in Yozgat reveals that the male population is larger than the female population. Similarly, the male retailer population of the Antalya province was found to be higher compared to females' (Aydınşakir et al., 2014). This shows that the gender factor is influential in ornamental plant retailing as it is in certain other sectors. The lack of women business owners in this sector despite being considered an interesting avenue for woman entrepreneurs might be due to lack of support for woman entrepreneurs in the country in general or due to women not having the same status with men in business life (Keskin, 2014). When the level of education of the participants is investigated, it has seen that 76.2% are primary, secondary, and high school graduates, while the remaining 23,8% are university graduates. 50,0% of female participants are college and university graduates compared to 17,6% of the male participants. 85,7% of the participants are 36 years of age and above, while 14,3% are young people. This is a clear indicator that the ornamental plant retailing in Yozgat province does not have a young, educated, dynamic, and innovative population. Besides, although the male population working in the ornamental plant retailers is high, it is noteworthy that the educated female population is high.

Socio-Economic Status of Ornamental Plants Retailers in Yozgat Province

The information about the professional experience, their business ownership status, the size of the enterprise, the number of employees, their annual turnover and whether they have any other business activity of the retailers were evaluated. 9,5% of retailers are 1-5 years, 4,8% are 5-10 years, 38,1% are 10-15 years, 47,6% have business experience for more than 15 years (Figure 1).

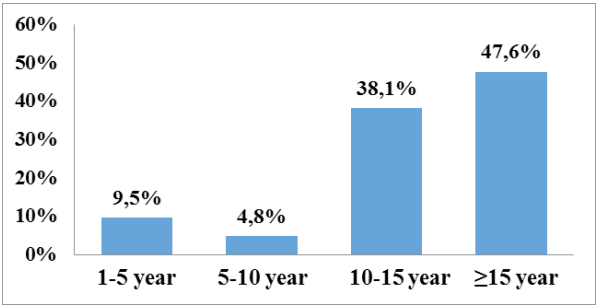

Figure 1. Business experience of the ornamental plant retailers in Yozgat province

76,2% of the enterprises are rental and 23,8% are own possession. 66,6% are less than 50m^2, 28,6% are between 51-100 m^2, and 4,8% are larger than 100 m^2 (Figure 2).

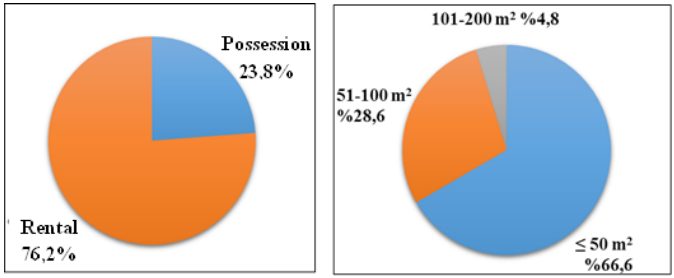

Figure 2. Business ownership status (left) and enterprise size (right) of the ornamental plant retailers in Yozgat province

In the 38,1% of enterprises have only the business owners as workers, while 57,1% have 1-3 employees and 4,8% have 4-6 employees (Figure 3).

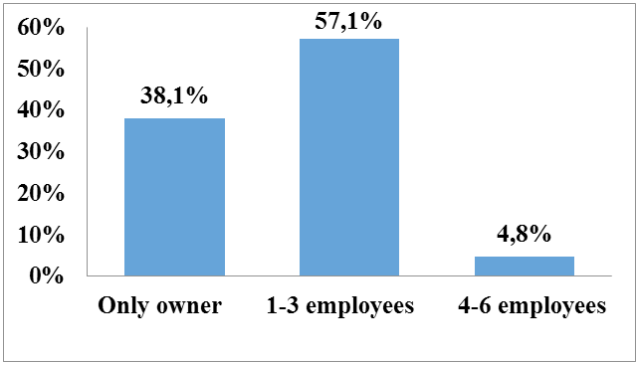

Figure 3. Number of employees of the ornamental plant retailers in Yozgat province

52,4% of business owners did not want to give information about their annual turnover rates, while 9,5% of retailer has a turnover rate between 10.000 - 50,000 ₺, 23,8% of them have between 50.000 - 100,000 ₺, and 14,3% of them have turnover over 100.000 ₺ (Figure 4). While 76,2% of retailers also operated in another sector, 23,8% operated only in the field of ornamental plants (Figure 4).

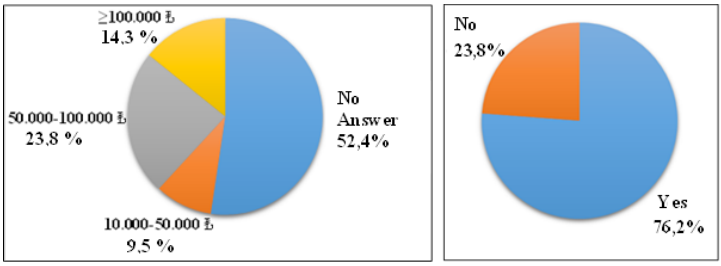

Figure 4. Annual turnover rates (left) and other business activities (right) of the ornamental plant retailers in Yozgat province

The retailers who participated in the survey were asked about their professional experience on a yearly basis and it was determined that 85.7% of them have professional experience of 10 years or more. 14.3% stated that they have business experience for less than 10 years. This results show that ornamental plant retailing in Yozgat province is not a preferred business area in recent years. Among the reasons why ornamental plant retailing is not preferred in Yozgat province which has a lower level of development than many other cities, (Özceylan and Coşkun, 2012) it can be said that ornamental plant retailing not being considered a revenue-generating sector, cut flowers are seen as a luxury items and sector not being found interesting by the young generations. On the other hand, the number of people working as retailers over 10 years is considerably high, which would mean this profession is capable of generating high-income rates and job satisfaction. When the ownership status of retailers is examined, 76.2% of the enterprises have rent and 66.6% of them have a size below 50 m^2. It means that the enterprise owner is enough either the only worker of the establishment or 1 to 3 personnel is considered sufficient. The fact that the enterprises are smaller than 50 m^2 and a low number of employee might be seen as indicators of low interest in ornamental plants in the province of Yozgat. When the annual turnovers of the retailers were evaluated, it was seen that 70,0% of the retailers had below 100.000 ₺ turnover, and the number of enterprises exceeding this number is quite low. Considering that in the province of Antalya, the cut flower sector is strong and only 14,6% of the retailers were found to have above 100,000 ₺ turnover (Aydınşakir et al., 2014) whereas only the 14,3% of the Yozgat province have above 100,000 ₺ turnover. It can be said that the ornamental plant retailing is an effective business area for the province of Yozgat.

Investigation on whether the participants were involved in another business area revealed that 76.2% of them were involved in other

sectors. Amongst these are event organization planning offices for engagements, circumcision ceremonies and weddings, and souvenir, hunting equipment, and ready-to-wear retailing shops. Based on the oral representations of the ornamental plant retailers, it is possible to say that they are involved in commercial activities in other sectors due to their concerns regarding low incomes.

Cut Flower Purchase and Selling Methods of Ornamental Plant Retailers in Yozgat Province

Figure 5 shows the provinces where the ornamental plant retailers in the Yozgat province procure their cut flowers, while Table 3 indicates their supply channels, cut flower transportation and sales methods. 33,3% of the retailers supply cut flowers through auctions, 23,8% from producer and 76,2% from wholesalers. As for provinces, 57,1% procure them from Antalya, 47,6% from Izmir, 28,6% from Sivas, 28,6% from Aksaray, 23,8% from Kayseri, 19,1% from Adana, 19,1% from Yalova, 19,1% from Ankara, 9,5% from Mersin, 9,5% from Konya, and 4,8% from Şanlıurfa provinces.

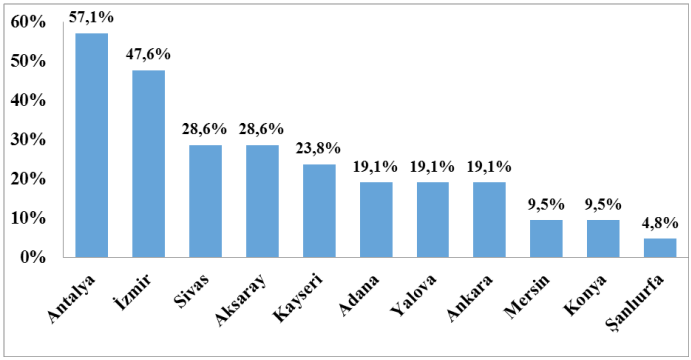

Figure 5. The provinces where the ornamental plant retailers in the Yozgat province procure cut flowers

Transportation Methods	Rate (%)	Supply Channels	Rate (%)	Sale Methods	Rate (%)
Cargo	9,5	**Auction**	33,3	**Shop**	95,2
Bus	61,9	**Producer**	23,8	**Telephone**	90,5
Air-conditioning cooled vehicles	66,6	**Wholesalers**	76,2	İnternet	57,1
Personel vehicles	19,1	**-**	-	-	-

Table 3. Yozgat province ornamental plant retailer's cut flower transportation methods, supply channels and sales methods

While 66,6% of retailers transport cut flowers with air-conditioning cooled vehicles, 61,9% bring them in by bus, 19,1% by their personal vehicles, and 9,5% by cargo services. In terms of sales methods, 95,2% of retailers conduct direct sales, where 90,5% make sales via telephone marketing and 57,1% via the internet.

The retailers of ornamental plants in Yozgat province mainly supply their cut flowers from wholesalers, mostly from the provinces of Antalya and Izmir, and transport them with air-conditioning cooled vehicles. In Yozgat where land route transportation is the only option, it is possible to use air-conditioning cooled vehicles to bring in the flowers from wholesalers, and this option is probably preferred since it lowers the loss of products during transportation. That being said, the supply of cut flowers to Yozgat with busses is still quite prominent. This may be due to retailers not liking the quality of the products coming from wholesalers and instead wanting to supply directly from the producer or auctions. Furthermore, procurement from auctions or producers in the nearby provinces is also quite low. It is possible that the relatively high number of wholesalers coming from Antalya and İzmir to the route that includes Yozgat may have increased the rate of procurement from these provinces. When the sales methods of cut flowers are evaluated for Yozgat province, it can be seen that direct and telephone sales methods are dominant. More than half of the retailers are selling on the internet and the retailers state that internet sales are necessary for competition.

Cut Flower Storage Methods of Ornamental Plant Retailers in Yozgat Province

Figure 6 summarizes the information regarding the cut flower storage methods of the retailers, and whether they use post-harvest preservative solutions during the storage. 90,5% of retailers use

refrigerators as a storage method, 19,1% use cold storage, and 4,8% do not use any storage methods. In terms of using preservative solutions, 42,9% use preservative solutions, and 57,1% do not use any solution at all.

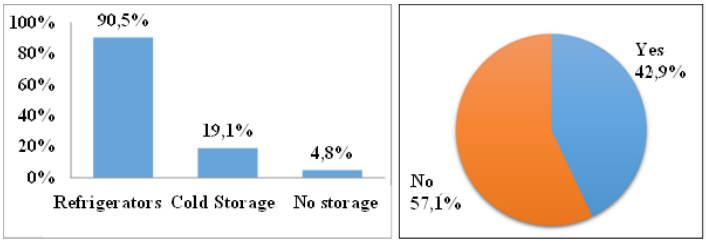

Figure 6. Storage methods (left) and using post-harvest preservative solutions (right) of the ornamental plant retailers in Yozgat province

It is evident that the retailers prefer refrigerators in the storage of cut flowers. Only four retailers have cold storage, and one retailer states that he only buys the amount he can sell and thus he doesn't need any storage process to preserve the flowers. The reason why retailers do not prefer cold storage is believed to be their business premises being too small to place a storage unit inside, and because the rental price of cold storage equipment would increase the operating costs. The number of retailers using both refrigeration and post-harvest preservative solutions is less than half of their total number. The retailers who use post-harvest preservatives mostly use bleach, though some also use aspirin. The retailers who don't use any post-harvest preservatives stated that they change the water in the vases every week, or once every 2-3 days. One retailer indicate that he tries preserving the freshness of the flowers by dropping 2-3 ice cubes into the water. Application of post-harvest preservative solutions is quite important to reduce the product loss (Kazaz, 2015). It is possible that cut flower retailers of Yozgat province don't prefer preservative solutions because of their lack of technical know-how.

Cut Flower Consumption Trends in terms of Yozgat Province Ornamental Plant Retailers

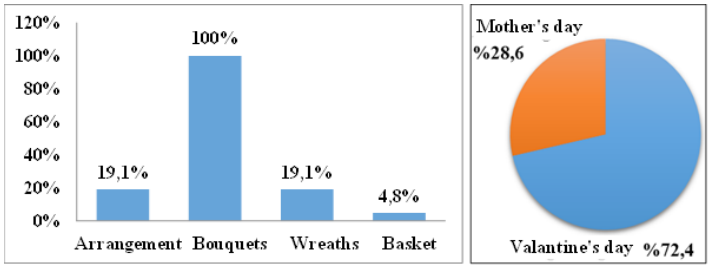

Figure 7 represents the preferred presentation styles and the special days during which the most sales occur. Table 4 represents the flower species and colors that are sold the most. All of the retailers agree that bouquets are the most preferred presentation style, when asked for other presentations; 19,1% wreaths, 19,1% arrangements, and 4,8% baskets were also preferred. 71,4% of the retailers indicate that Valentine's Day is where the highest sales occur; while 28,6% of retailers say the mother's day.

Figure 7. Presentation styles (left) and the special days during which the most sales occur (right) of the ornamental plant retailers in Yozgat province

All of the retailers agree that roses and chrysanthemums are the most preferred flower species, and when asked what other flowers were favored, 14,3% gerbera, 4,8% lillium, 4,8% carnation and 4,8% sweet william were also preferred in special days. All of the retailers agree that red is the preferred rose color, while white is the preferred chrysanthemums color.

Color	Cut flower species (%)				
	Rose	Gerbera	Carnation	Chrysanthe-mums	Others (Sweet William)
Red	100	-	4,8	-	-
White	-	-	-	100	-
Pink	-	14,3	-	-	-
Purple	-	-	-	-	4,8

Table 4. The cut flower species and colors that are mostly preferred in Yozgat Province

According to the ornamental plant retailers of the Yozgat province, bouquets are the most preferred presentation style. Cut flower consumers were reported to make their choices based primarily on the price of the flowers, and considering the bouquets are cheaper than the other presentation styles, it is possible that they are more preferred due to this reason. Retailers also report that flower sales are higher on special days, particularly on Valentine's Day. While the range of sold flower species also increases in special days, it can be seen that roses and chrysanthemum are the most favorite flowers of the consumers. It might have influenced the selections of the retailers, causing them to offer a limited range of products because of consumers are not selective about the cut flower species.

Cut Flower Marketing Problems of Ornamental Plant Retailers in Yozgat Province

The problems encountered by ornamental plant retailers in the cut flower marketing network in Figure 8, product losses during storage in Figure 9 and reasons for low sales, general problems of the sector are summarized in Table 5. While 47,6% of retailers have no problems related to the current situation in the marketing network, 33,3% of them have problems related to cut flower supply channels, 33,3% of them have problems related with transport, 33,3% of them have problems related with storage, and 19,1% of them have problems related with consumer demand.

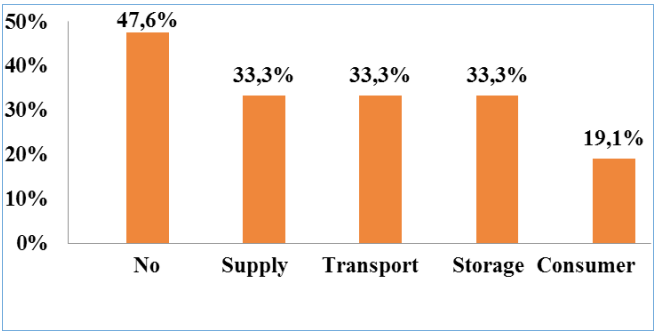

Figure 8. The problems encountered by ornamental plant retailers in the cut flower marketing network

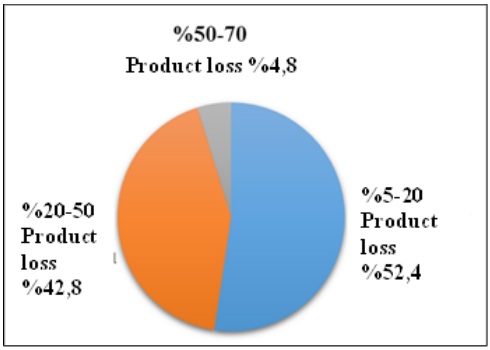

Figure 9. Product losses during storage of the ornamental plant retailers in Yozgat province

52.4% of retailers have 5 to 20% product loss during storage, while 42,8% of them lose 20 to 50% and 4,8% of them lose 50 to 70%. 23,8% of retailers indicate that their sales are adequate. Remaining retailers who indicate that they could not make sufficient sales because of the cultural habits (57,1%), shopping malls and internet sales (57,1%), lack of occupational organization (42,6%), the economic crisis (38,1%), lack of consumer demand (33,3%), competition business environment (19,1%) and the location of their sales shops (14,3%).

Reasons for low sales	**Rate (%)**
Cultural habits	57,1
Shopping malls and internet sales	57,1
Lack of professional organization	42,6
Economic crisis	38,1
Lack of demand	33,3
Competitive business environment	19,1
Location of their sales shops	14,3
General problems of the sector	
Economic crisis	47,6
Price instability	42,9
Additional challenges	23,8

Table 5. Reasons for low sales and general problems of the sector according to the ornamental plant retailers in Yozgat province

While 14,3% of retailers did not report any opinion on the sector, 47,6% of them say the economic crisis was quite influential, 42,9% of them express price instability and 23,8% express educational problems as additional challenges.Almost half of the participants are seemingly not encountering any problems related to the current situation of the marketing network. That being said, the retailers who are facing problems have expressed issues regarding both the supply channels and the transportation and preservation methods. Amongst the problems regarding the supply channel, having to buy low-quality products from wholesalers and inability to make contact with producers, auctioneers or wholesalers were cited the most. In terms of transportation methods, the retailers express that they are facing product loss when they use busses or cargo services as transportation methods. Furthermore, land route transportation is often encountering challenges due to the hard winter conditions of the Yozgat province, and the retailers have stated that they were unable to obtain a sufficient amount of products in winter months. The retailers who expressed they were facing preservation problems report that the products are damaged due to dense placement inside the refrigerators.

All of the participants have problem about product loss during storage, and 95,2% of retailers state that the rate of loss is between 5 and 50%. The refrigerators that the retailers use for storage are unable to provide the optimum conditions for the flowers and the retailers lack the know-how in terms of post-harvest preservative solution applications, so the problems encountered regarding the product loss during the storage is not unexpected.

The majority of the participants believe that they aren't making enough sales because of the cultural habits and shopping mall and internet sales. Based on the socio-economic status of the province, it can be seen that the lack of flower consumption habits of the population affects sales. Retailers state that they are unable to compete with the market due to shopping mall and internet sales, causing their sales to drop. It is possible to see the relatively lower pricing in the cut flowers within the shopping malls as a reason why the consumers prefer them over the retailers.

The majority of the ornamental plant retailers agree that lack of occupational organization affects their sales. They believe the current unfair competition can be overcome and economic development can be achieved by establishing a occupational association.

The retailers also indicate that the economic crisis is amongst the reasons as to why they are unable to reach the desired sales levels, but they state that this is a problem faced by the sector in general. The increase in product prices and the drop in the purchasing power of the

consumer have influenced the sales of cut flowers -which are seen as luxury items- significantly. The price instability, which is believed to be a byproduct of the economic crisis, also seems to be an important problem for the ornamental plant retailers of the Yozgat Province. The price instability is indeed a factor that affects the development and direction of the cut flower sector as it hampers entrepreneurship and innovation, while also causing an increase in borrowing costs interest rates, potentially limiting the effectiveness of the ornamental plant retailers in the sector.

According to the retailers who also recite lack of education in the sector as a problem, each individual who is taking an active role in the sector needs to receive professional education, and professional courses and publications should be given more attention.

CONCLUSIONS

In this research to reveal the current situation of ornamental plant retailers in Yozgat province, has been determine that the marketing situation of retailers and the problems they encountered in marketing. A general evaluation of the survey results shows that in terms of demographic characteristics, there are more male retailers than females and female retailers have higher education levels. The retailers are found to be in the middle age group generally. Evaluation of the socio-economic status of the retailers shows that most of them have been working in the sector for more than 10 years, ownership status are mostly rent, most of the enterprise are small-sized and they have a low number of employee. Most of the retailers are also involved in work in other sectors. As for the marketing methods, the retailers seem to prefer the wholesalers as a means of supply channel and they bring in cut flowers mostly from Antalya and İzmir using air-conditioned refrigerated vehicles or busses and they use refrigerators for storage the cut flowers. Considering the tendency of consumers, it is found that bouquets is the most preferring presentation style, red roses and white chrysanthemums are most popular cut flowers, and the special days which are bought the cut flowers mostly are valentine's day and the mother's day. The problems encountered by the retailers in terms of marketing and related to the sector are also determined as the following: loss of products due to transportation and storage methods, lack of cut flower consumption habits, preferring shopping malls and internet sales by consumers, economic crisis and the price instability.

Ornamental plant retailing, which plays a role in the distribution of cut flowers to consumers, is one of the cornerstones of the sector as it will directly affect consumer demand. The right strategy in the marketing of cut flowers has a great importance. In order to develop

the right strategies, the current situation and problems faced by the retailers should be determined and addressed. It is understood that the current situation of ornamental plant retailers in Yozgat province, it is seen that there are small-sized enterprises. In addition, due to the region, they encounter problems in supplying quality products and in transportation of products. They also have problems in the storage of the products because they do not have enough knowledge. On the other hand, they don't develop due to the low consumption of cut flowers. Considering the current situation of the ornamental plant retailers in the province of Yozgat, some suggestions were introduced in this study in order to improve their economic conditions, develop right business policies for their future, and to ensure they can achieve a better position within the sector.

- Since the retailing of ornamental plants is an activity that requires a sense of aesthetics, the active participation of the female population can be important in order to develop different designs that are more attractive to the consumer and thus to increase consumer demand. It is also a very convenient business choice for women entrepreneurs. The active participation of the female population will contribute significantly to the regional economy.
- The existence of a young, dynamic and innovative population in ornamental plant retailing is important for the development of the sector. This business area, which is an important source of income, should be promoted to younger population with the fairs, exhibitions, promotional meetings, advertising and technical trips and they are provided to direct them towards the sector.
- Marketing strategies can change depending on the development of technology. Use of internet for sales by the retailers should increase, as it provides them to reach more consumers. Also, in order to increase the annual turnover of the ornamental plant retailers, they should participate in advertising, promotion, fairs, and special offer activities, and develop sales strategies.
- While Yozgat is the central of Turkey; there are problems in product supply. These problems being faced by ornamental plants retailers in the region is a reflection of the general problems of the sector. Auction system which is widely used in the world should be renewed and the quality of the products supplied to the retailers should be increased. In addition, a healthy logistics system will also be influential in increasing the competitive capacity of the retailers. In Yozgat have no opportunity air or sea transportation, the only transportation way is the land route. Considering that the high-speed train network in Turkey is spreading, transportation through railways might be considered as a fast and relatively more controlled means of delivery.

- One of the most influential factors on consumer demand is the post-harvest quality of cut flowers. Usage of suitable storage methods that provide the optimum conditions for the cut flowers and increased use of application of post-harvest preservation solutions can also reduce the product losses.
- The ornamental plant retailers should receive vocational education about the flower types and their care, because of the consumers would like to receive more information regarding the products.
- In Yozgat province, there is no occupational organization with ornamental plant retailers. Cooperatives and unions have a strong influence on the economic development of retailers, and they should be established in the province. Through occupational organization, retailers can find to analyze the existing problems and potential solutions and will have a chance to take the necessary steps together.
- The production of ornamental plants in Yozgat province is almost non-existent. The development of ornamental plant production in the region will provide positive contributions for ornamental plant retailers. In order to develop the ornamental plant production in the region, R&D projects and university and municipality supported projects should be developed and applied in the region.

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