Economic Structure of Beekeeping Sector in Erzurum Province

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Abstract

Beekeeping has been developing increasingly all over the world. Since bee products become more widespread, the sector gains importance. The field of beekeeping production has quite important contributions to both enterprises and national economy. Beekeeping provides employment and revenue for the rural population of developing countries thanks to its features such as low operating cost and less need of labor force compared to other production. Although Turkey ecologically has a very favorable nature for beekeeping, unfortunately only a fraction of its potential is used. Moreover, productivity in beekeeping enterprises is very low too. Therefore, these enterprises were examined in terms of socio-economic structure and the factors affecting the productivity were determined via regression analysis. Erzurum province, which has good beekeeping potential but can't utilize the potential, was selected as the research area. The number of the examined enterprises was determined through proportional sampling method, including 80 surveys. According to the study results, it was determined that the beekeeping activity was mostly performed by middle-age farmers. The most significant issues affecting honey production were indicated as "inappropriate climate conditions" and "wintering loss". It was found that the honey productivity was higher in enterprises with more hives, which were members of cooperatives and practicing migratory beekeeping. Therefore, the policies towards increasing the number of commercial enterprises with more hives, inducing migratory beekeeping through cooperatives will escalate the honey production and productivity in the region. As a result, income level of rural population will go up and this will contribute to rural development.

Keywords: Beekeeping, Erzurum, regression analysis, rural development

Erzurum İli Arıcılık Sektörünün Ekonomik Yapısı

Özet

Arıcılık dünyada giderek daha fazla gelişmektedir. Arı ürünlerinin yaygınlaşmasıyla sektörün önemi her geçen gün artmaktadır. Arıcılık hem işletmelere hem de ulusal ekonomiye önemli katkılarda bulunmaktadır. Arıcılık, düşük işletme maliyeti, diğer üretim kollarına kıyasla daha az işgücüne ihtiyaç duyması nedeniyle özellikleriyle gelişmekte olan ülkelerin kırsal nüfusu için önemli istihdam ve gelir sağlamaktadır. Türkiye ekolojik yapısı itibariyle arıcılık için uygun şartlara sahip olmasına rağmen maalesef potansiyelinin yalnızca bir kısmı kullanılmaktadır. Ülkede, arıcılık yapan işletmelerdeki verimlilik de çok düşüktür. Bu amaçla, bu işletmeler sosyo-ekonomik yapı açısından incelenmiş ve verimliliği etkileyen faktörler regresyon analizi ile tespit edilmiştir. Arıcılık potansiyeline sahip ancak potansiyelini kullanamayan Erzurum ili araştırma alanı olarak seçilmiştir. Anket uygulanan işletme sayısı, oransal örnekleme yöntemi ile 80 anket olarak belirlenmiştir. Çalışma sonuçlarına göre, arıcılık faaliyeti çoğunlukla orta yaşlı çiftçiler tarafından gerçekleştirilmektedir. Bal üretimini etkileyen en önemli hususlar "uygun olmayan iklim koşulları" ve "kışlama kaybı" olarak bulunmuştur. Kooperatif üyesi olan ve göçer arıcılık yapan daha fazla kovan bulunan işletmelerde bal verimliliğinin yüksek olduğu tespit edilmiştir. Bu nedenle, kooperatifler vasıtasıyla göçmen arıcılığını teşvik eden ticari işletmeler sayısının artırılmasına yönelik politikalar bölgedeki bal üretimini ve verimliliğini artıracaktır. Sonuç olarak, kırsal nüfusun gelir düzeyi artacak ve bu kırsal kalkınmaya katkıda bulunacaktır.

Anahtar Kelimeler: Arıcılık, Erzurum, regresyon analizi, kırsal kalkınma

Introduction

Beekeeping has an important place in agricultural activities, contributing to plant production, as a cash crop, requiring low capital and independent from field assets (Günbey, 2007; Kızılaslan and Kızılaslan, 2007). Low farm costs, comparatively lower labor requirement, simple storage conditions and valuable market price make beekeeping a worthy business particularly for rural people of most of developing countries (Emir, 2015). Beekeeping, as a sub-branch of livestock farming is an important sector and has great impact on not only humans' life also on all other plants' and creatures' life. The activity which was used to make as a side income resource is now getting started to be a main income resource, doing professionally.

Turkey has advantages of high honey yield, large flora, adequate seasons for flowering all the year round, topographic structure, common fruit species like citrus and almond, industrial crops like sunflower and cotton, summer ranges, meadow and forages, forage crops and legume fields and various plants; chestnut, acacia, lime, eleagnus, eucalyptus, rhododendron etc. Hence, this variety makes Turkey lucky in terms of natural resources. Moreover, having these natural wealth is very substantial in terms of honey variation and quantity (Güler and Demir 2005; Özbek 2002; Tan 1998).

Beekeeping has been one of the most important and common farm activities in Anatolia thanks to geographical conditions (Fıratlı et al. 2000; Karakaya and Kızıloğlu, 2015). There are still problems impact on productivity. Beekeeping will be a boosting sector which plays a significant role in terms of increasing income level of rural area and contributing foreign exchange income by exports, through solving problems (Kumova and Korkmaz, 2000).

Beekeeping has been developing currently all around the World, particularly in parallel with extension of bee products variety, beekeeping sector gains importance. While beekeeping activities are common in U.S.A based on pollination, those are prominent for medicinal proposes in Far-Eastern countries and used mostly for nutrition in Europe (Öztürk, 2013). Millions of colonies in U.S.A. are moved for almond pollination in recent years (Smart et al., 2016; Simone-Finstrom et al., 2016) Hence, beekeepers make high amount of money. In contrast, farmers do not know the significance of pollination, they rent fields to beekeepers and this increase the cost of bee products (Anonymous, 2001).

Turkey ranks the 3.rd place with number of 7 082 732 colonies while taking the 2.nd place with 103 525 tons of honey production in the World. However, Turkey is quite behind of World average in terms of yield per colony. The World average yield per colony is 40.7 kg while it is only 14.7 kg in Turkey (FAO, 2017). Thus, this situation increases unit cost of honey and prevent Turkey to be competitive in the World market.

Beekeeping which is performed by migrating to various regions according to flowering period not depending on stable regions, is named as "migratory beekeeping". There are many reasons for beekeepers to do migratory beekeeping to increase honey production, harvesting honey several times in each year such as flowering period varies by regions, to keep bee colonies from intensive pesticide applied agricultural areas, different climate conditions (Sharma and Bhatia 2001; Genç and Dodoloğlu 2011; Gaga and Esaulov 2016). Extension of migratory beekeeping will decrease the costs by raising yield thus, competitiveness of the country will be grown in the World market.

In recent years, important amount of bee products import process have started like other goods as a result of trade globalization. Despite the fact that imported product are at the level of questionable quality, low prices allow them place in domestic markets. However, this progressing process differs perception of beekeepers and leads individuals and corporates to attempt new bee products. Bee products other than honey is also thought to be gone up but not sufficiently.

Materials and Methods
Material

In this study, the data will be obtained from 80 beekeepers in the center of Erzurum province through questionnaires. While data obtained from questionnaires will consists the primary data, internet resources, national and international literature and related statistical information will consist the secondary data of the study.

Method

Interviews with beekeepers in Erzurum province were set to find out the problems of producers and factors affecting yield, to make up the essential material of the study. Hence, sample size was determined using proportional sampling method (Newbold, 1995; Miran, 2010).

$$n = \frac{Np(1-p)}{(N-1)\sigma_{px}^2 + p(1-p)}$$

n: Sample size

N: Number of beekeepers in Erzurum province

p: Proportion of beekeepers that has sufficient knowledge of beekeeping (rate is determined as 0,5 to get maximum sample size)

σ_{px}^2 : Variance (0,0026)

There are 475 beekeepers who are registered to the union in Erzurum. Sample size was calculated as 80 with 95% confidence interval and 10% error. Sample size is calculated according to population rate for finite populations. However, in case of p rate is unknown, p= 0.5 is assumed to have maximum sample size, moreover, possible errors will be reduced (Miran 2010). Socio-economic structure and staple properties of beekeepers are given through tables. Honey yield per hive and the relationship between factors impact on yield were determined, using Least Squares Method.

Table 1.Hive numbers, honey and honey wax production in Turkey

Years	Number of Hives	Honey (tones)	Honey Wax (tones)	Honey Yield
2005	4590013	82336	4178	17.9
2006	4851683	83842	3484	17.3
2007	4825596	73935	3837	15.3
2008	4888961	81364	4539	16.6
2009	5339224	82003	4385	15.4
2010	5602669	81115	4148	14.5
2011	6011332	94245	4235	15.7
2012	6348009	89162	4222	14.0
2013	6641348	94694	4241	14.3
2014	7082732	103525	4053	14.6
2015	7709636	107665	4750	14.0

Source: TUIK, 2017

Table 2. Hive numbers and production quantity by regions (2015)

Region	Number of Hives	Honey (tones)	Honey wax (tones)
Western Marmara	390598	6634.0	165.9
Western Anatolia	220450	2264.7	102.6
Mediterranean	1313796	19936.3	965.0
Western Black Sea	423808	3245.7	252.6
Eastern Black Sea	1018182	20647.4	342.1
North Eastern Anatolia	414046	5282.6	177.0
Mideast Anatolia	806845	9206.3	694.5
Central Anatolia	376977	5341.3	325.3

Source: TUIK, 2017

Honey sector in Turkey

While number of bee colonies went up from 4.5 million to 7.7 million with increase of 68%, it draws attention that honey quantity raised with less proportion in between 2005-2015. Honey production increase was 31%. Honey yield per colony went down from 17.9 kg to 14.0 kg which equals to 22% fall (Table 1). Although Turkey takes the second rank after China, producing 107665 tons of honey, as for honey yield per colony, Turkey is quite behind of World average. For lifting up honey production and yield per hive, beekeeping is requested to be based on more professional, technical and scientifical methods (Soysal and Gürcan 2005). There is also correlation among yield, colony number and seasonal migration. More than 4 migrations in a season are not recommended to get the best honey (Hoopingarnerve and Sanford, 1991) Owing to low numbers of migratory beekeepers both in the region of the study and Turkey, desired level of honey yield cannot be reached.

Mediterranean, Eastern Black Sea and Middle East Anatolia regions of Turkey have notable share of both hive numbers and honey quantity (Table 2). Besides, beekeeping activities in Central and West Anatolia regions are quite lower. Prominent provinces of Turkey, in terms of honey production are Ordu, Muğla and Adana,

respectively. In addition, Erzurum ranks 11. th place, having 1473.5 tons of honey production and 11.8 kg yield per hive. Because stationary

beekeeping is very common in the province, yield is under the average of Turkey.

Table 3. Provinces by colony numbers, honey production and yield (2015)

Provinces	Number of hives	Honey (tones)	Honey wax (tones)	Honey yield
Ordu	556593	16600.7	91.6	29.8
Muğla	995102	15205.7	892.9	15.3
Adana	481272	9762.6	380.5	20.3
Aydın	268110	4007.4	132.0	14.9
Mersin	262601	3493.1	222.1	13.3
Sivas	200486	3327.5	265.1	16.6
Balıkesir	167252	3212.5	55.1	19.2
Antalya	231980	2947.4	154.2	12.7
İzmir	201102	2809.6	125.7	14.0
Hakkari	166473	1496.0	252.3	9.0
Erzurum	125380	1473.5	65.1	11.8

Source: TUIK, 2017

Result and Discussion
Results of Descriptive Statistics

Surveyed beekeepers declared their main income as of 35% beekeeping, 6.3% agriculture, 43.7% beekeeping with other works and 15% other works. Moreover, 58.8% of surveyed beekeepers express that the most profitable business is beekeeping following, 20% livestock farming and 12.5% dairy farming. The most effective factors of beekeepers to start the business are being family business, pleasure with the business ranked secondly and lack of alternative jobs lastly (Table 4). It shows that government supports do not have an effect on starting the business.

Table 4. Ranking of factors on starting beekeeping business by importance level

Factors	Very Important	So Important	Important	Less Important	No Important	Total
Family business	59.5	10.8	13.5	5.4	10.8	100.0
Recommendation of others	23.8	21.4	14.3	16.7	23.8	100.0
Because of supports	0.0	0.0	21.7	43.5	34.8	100.0
Continuous income-generating	11.6	32.6	37.2	16.3	2.3	100.0
Lack of alternative jobs	25.0	32.5	22.5	7.5	12.5	100.0
Like the job	28.8	37.3	15.3	11.9	6.8	100.0
High income-generating	25.5	23.6	32.7	7.3	10.9	100.0
Others	20.0	20.0	20.0	40.0	0.0	100.0

When surveyed beekeepers are investigated, it is viewed that proportion of producer that has average yield, more than 21 kg is 7.4%. Furthermore, 58.8% of producers gets yield less than 10 kg. In addition, it is remarkable that producer those have high productivity are rather more who is under age of 40. While 23.8% of beekeepers that has less than 10 kg yield of honey are between the age of 51-60, 23.8% of beekeepers that has yield 11-20 kg are under 50 years old (Table 5). Farmer groups of high honey yield have low education level. On the other hand, we can declare that postgraduate beekeepers are not successful at beekeeping, looking at the same table. Membership of beekeepers' union is very common (92.5%) among beekeepers.

Because of the fact that Caucasian bee is specified in this region, beekeepers mostly use Caucasian species (83.5%) in the study area. According to the study of Sezgin and Kara (2011), proportion of Caucasian bee is found as 74.5% in TRA 2 sub-region. In recent years, population of carniol bee species raised and current proportion is 16.3%. The share of caucasian and mongrel caucasian species is 78.6% in research area (Table 6). As beekeepers queen change is researched, it is

observed that frequency of queen change is very often, despite the fact that migratory beekeeping is not very common in the region. Besides, 78.6% of respondents expressed that they change queens within less than 2 years.

Table 5. Relationship between yield per hive and beekeepers' features (%)

Age

Yield (kg/hive)	<40	41-50	51-60	61≥	Total
≤10	10.0	16.2	23.8	8.8	58.8
11-20	11.3	12.5	7.5	2.5	33.8
21≥	3.7	2.5	0.0	1.2	7.4
Total	25.0	31.2	31.3	12.5	100.0

Education level

Yield(kg/hive)	Primary school	Secondary school	High school	University	Total
≤10	30.1	7.5	10.0	11.2	58.8
11-20	8.7	5.0	15.1	5.0	33.8
21≥	3.7	0.0	3.7	0.0	7.4
Total	42.5	12.5	28.8	16.2	100.0

Membership of beekeepers union

Yield(kg/hive)	Non-member	Member	Total
≤10	2.5	56.3	56.8
11-20	2.5	31.3	33.8
21≥	2.5	4.9	7.4
Total	7.5	92.5	100.0

Table 6. Relationship between yield per hive and business properties (%)

Number of hives

Yield (kg/hive)	15	16-50	51-100	101≥	Total
≤10	10.0	13.8	17.5	17.5	58.8
11-20	3.8	6.2	13.8	10.0	33.8
21≥	1.2	0.0	2.4	3.8	7.4
Total	15.0	20.0	33.7	31.3	100.0

Bee species

Yield (kg/hive)	Caucasian+ Cross caucasian	Carniol	Italian	Others	Total
≤10	47.5	10.0	0.0	1.3	58.8
11-20	22.5	6.3	1.3	3.7	33.8
21≥	5.0	0.0	0.0	2.4	7.4
Total	75.0	16.3	1.3	7.4	100.0

Change frequency of queen (Years)

Yield (kg/hive)	≤2	3-4	5≥	Total
≤10	46.3	7.5	5.0	58.8
11-20	26.1	5.2	2.5	33.8
21≥	6.2	1.2	0.0	7.4
Total	78.6	13.9	7.5	100.0

Results of Regression Analysis

While mean age of respondents is 49.8 years, the share of migratory beekeepers is about 5% (Table 7). Mean variable cost of beekeepers per hive varies from 56 TL to 1240 TL. Also, mean yield per hive is under Turkey average with 11.4 kg.

We tried to elucidate the model through 5 independent variables in which yield per hive was determined as dependent variable. Coefficients of variables in the model were found significant. Explanatory indicator of the model, R^2 was calculated as 0.59 (Table 8). Furthermore, Breush-Pagan test was implied whether heteroscedasticity problem which is usually encountered in cross-section data, occurs or not. Owing to having the problem, semi-log model was run and the problem

was solved. Moreover, no quadratic term need was

asserted, applying model specification test.

Table 7. Description of variables and statistics

Variables	Mean	St. Deviation	Min.	Max.
Age (Continuous variable)	49.8	11.080	27	85
Number of hives (if number>-50 =1, others=0)	0.44	0.499	0	1
Beekeeping type (Migratory:1, Stationary:0)	0.05	0.219	0	1
Bee species (Caucasian+ cross caucasian =1, others=0)	0.75	0.436	0	1
Variable cost per hive (TL)	345.9	49.592	56	1240
Yield per hive (kg/hive)	11.4	9.330	2.5	60.0

It was determined that since beekeepers' age raise, honey yield falls. Contrarily, Uzundumlu et al (2011) revealed positive and statistically significant relationship between yield and beekeepers' age. Increase of total hive number leads honey yield to raise. Also, the beekeepers who has more numbers of hives, are working more professionally. Most of the producers who has less number of hives are stationary beekeepers (Table 8). Migratory beekeeping has positive impact on honey yield. As bee species were probed in the study, it was deduced that Caucasian bee species are less productive. Migratory beekeepers rather use carniol species and this species has higher yield. It was determined that variable cost per hive is positively related with yield. Also, as variables of the model were researched, they were found to be significant.

Table 8. Result of regression analysis

Variables	B	St. error	t-value	P value
Constant	2.238	0.244	9.528	0.000***
Age	-0.008	0.004	-1.743	0.086*
Number of hives	0.378	0.094	4.031	0.000***
Beekeeping type	1.191	0.229	5.207	0.000***
Bee species	-0.329	0.107	-3.057	0.000***
Variable cost per hive	0.005	0.001	4.881	0.000***
R^2=0.59	F(5,74) = 21.517 P value) = 0.000	Breush-Pagan Test = 5.197 P value = 0.392	Ramsey Reset Test = 3.461 P value = 0.037	

*: 0.10, **: 0.05, ***: 0,01

Conclusion

Although Erzurum province has adequate flora for beekeeping business, the city is behind the average of the country in terms of production and yield. Migratory beekeeping should be extended to increase the yield in the region.

Beekeeping business is commonly performed by middle-aged people in the province. Producers under the age of 50 get comparatively more yield. Besides, negative relationship has been found between producer age and honey yield in the regression analysis. As number of hives increases, honey yield goes up, too. On the basis, producers who have more hives professionally perform beekeeping, pay more attention to the factors impact on yield. Proportion of beekeepers who are members of union is 92.5%. Membership has a positive link with yield per hive.

Farms which have 101 and more hives have share of 31.3% and more productive than others.

These can be indicated by professional, commercial and migratory beekeeping. Moreover, regression analysis results verify that migratory beekeeping affects honey productivity positively. Underlying reason of this effect is utilization of various flowers in the different regions. On the other hand, beekeepers using carniol species obtain greater honey yield.

As a conclusion, beekeeping is a low capital requiring business and has no marketing problem. Also, beekeeping activities raise plant productivity and bee products are natural medicines. Thus, we should care of beekeeping activities. If beekeeping activities are performed as an alternative job in addition to other farm activities, it will fall down risks by product diversification. Migrant beekeeping needs to be encouraged in order to make trade as a main income source for the development of beekeeping.

References

Anonymous. 2001. DPT Sekizinci Beş Yıllık Kalkınma Planı, Hayvancılık Özel İhtisas Komisyonu Raporu, Ankara (Erişim tarihi 20.01.2012).

Emir, M. 2015. Türkiye'de Arıcıların sosyo-ekonomik yapısı ve üretim etkinliği. Yüksek Lisans Tezi, Ondokuz Mayıs Üniversitesi Fen Bilimleri Enstitüsü Tarım Ekonomisi Anabilim Dalı Doktora Tezi, Samsun.

FAO. 2017. Food and Agriculture Organization of the United Nation Web Page http://www.fao.org/faostat/en/#data/QL (Erişim: 25.01. 2017).

Fıratlı, Ç., Genç, F. Karacaoğlu, M., Gencer, H.V. 2000. Türkiye Arıcılığının Karşılaştırmalı Analizi Sorunlar-Öneriler. Türkiye Ziraat Mühendisliği V. Teknik Kongresi, Ankara, s. 811-825.

Gaga, V.A., Esaulov, V.N. 2016. Innovative Technologies and Modern Facilities in Beekeeping. In IOP Conference Series: Materials Science and Engineering (Vol. 142, No. 1, p. 012022). IOP Publishing.

Genç, F., Dodoloğlu, A. 2011. Arıcılığın Temel Esasları Ders Kitabı. Atatürk Üniversitesi Yayınları No: 931, Ziraat Fakültesi Yayınları: 341, Ders Kitapları Serisi: 88, Erzurum.

Güler, A., Demir, M. 2005. Beekeeping potential in Turkey. Bee World, 86(4): 114-119.

Günbey, V.S. 2007. The Determınatıon of Mıgratory Beekeeping Movements in the Provınce of Van, Graduate College of Natural and Applied Sciences, Animal Science, Ms. Thesis, Van.

Hoopingarner, R., Sanford, M.T. 1991. The Costs of Beekeeping- Trends in Commercial American Bee Journal, 131(11): 709-712.

Karakaya, E., Kızıloğlu, S. 2015. Honey Production in Bingol. Iğdır Univ. J. Inst. Sci. & *Tech*. 5(2): 25-31.

Kızılaslan, H., Kizilaslan, N. 2007. Factors Affecting Honey Production in Apiculture in Turkey. Journal of Applied Sciences Research, 3(10): 983-987.

Kumova, U., Korkmaz, A. 2000. Türkiye Arı Yetiştiriciliğinde Çukurova Bölgesinin Yeri ve Önemi. Hayvansal Üretim. 41: 48-54.

Miran, B. 2010. Temel İstatistik. Ders Kitabı, ISBN: 975-93088-00, İzmir.

Newbold, P. 1995. Statistics for Business and Economics, Prentice-Hall International, New Jersey.

Özbek, H. 2002. Bees and nature. Uludag Bee Journal, 8: 22-25.

Öztürk, F.G. 2013. Beekeeping Sectoron the Structure of Economic in Ordu Province-Region: A Case Study. Ms. Thesis, Atatürk University, Graduate College of Natural and Applied Sciences, Erzurum.

Sezgin, A., Kara, M. 2011. Arıcılıkta Verim Artışı Üzerinde Etkili Olan Faktörlerin Belirlenmesine Yönelik Bir Araştırma: TRA2 Bölgesi Örneği. HR. Ü.Z.F. Dergisi, 15(4): 31-38.

Sharma, R and Bhatia, R. 2001. Economics of stationary and migratory beekeeping in Himachal Pradesh. Agricultural Science Digest, 21(3): 196-197.

Simone-Finstrom, M., Li-Byarlay, H., Huang, M. H., Strand, M.K., Rueppell, O., Tarpy, D.R. 2016. Migratory management and environmental conditions affect lifespan and oxidative stress in honey bees. Scientific Reports, 6.

Smart, M.D., Pettis, J.S., Euliss, N., Spivak, M.S. 2016. Land use in the Northern Great Plains region of the US influences the survival and productivity of honey bee colonies. *Agriculture, Ecosystems & Environment*, 230: 139-149.

Soysal, M.İ., Gürcan, E.K. 2005. Tekirdağ İli Arı Yetiştiriciliği Üzerine Bir Araştırma. Tekirdağ Ziraat Fakültesi Dergisi, 2(2): 161-165.

Tan, A. 1998. Current status of plant genetic resources conservation in Turkey. In International Symposium on In Situ Conservation of Plant Genetic Diversity, Antalya (Turkey), 4-8 Nov 1996. Central Research Institute for Field Crops.

TUIK, 2017. Türkiye İstatistik Kurumu İnternet Sayfası. https://biruni.tuik.gov.tr/hayvancılık app/hayvancilik.zul (Erişim: 24.01. 2017).

Uzundumlu, A., Aksoy, A., Işık, H.B. 2011. The Existing Structure and Fundamental Problems in Beekeeping Enterprises: A Case Bingöl Province. Journal of the Faculty of Agriculture 42(1): 49-55.