THEORY AND RESEARCH IN AGRICULTURE, FORESTRY AND AQUACULTURE SCIENCES II

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Chapter 1

THE DEVELOPMENT OF ORGANIC AGRICULTURE AND AGRICULTURAL SUSTAINABILITY IN TURKEY

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1. INTRODUCTION

Just like in other resources over the world, the resources necessary for agricultural production are not unlimited. Agricultural resources are being depleted due of incorrect practices and usages, primarily including soil. The sustainability of life is directly connected to sustainability in agriculture. Just as Marsh (1997), Ambroise et al. (1998), Legg and Viatte (2001), and Gafsi et al. (2006) specified in their studies, the growing interest in sustainable agriculture is relevant because of the negative impacts of conventional agriculture over environmental quality and the wealth of resources, deterioration in human health, and the clear effects of the desertification of rural areas, especially in developed countries. Fundamentally, agricultural sustainability carries a vital importance for all stakeholders and is a topic that various stakeholders approach with caution.

Today, one of the most dynamically growing markets is the global organic food market, used in the transition to the sustainable development of social orientations and rural areas with national policies and to technologies that ensure the saving of resources. There is no universally accepted definition of "organic food" around the world, but according to food researchers and experts from the International Federation of Organic Agriculture Movements (IFOAM), these are products acquired from organic agriculture. These products do not include GMOs, artificial colors, preservatives, or substances that increase flavor, and insecticides, herbicides, growth hormones, artificial feed additive materials, etc. are not used in organic agriculture (Nechaev et al., 2018). It is necessary not to discuss the issue only in terms of the market economy. The propagation of organic production operations that protect human health and the environment are important for vital sustainability. Although there is a gradually growing market, the organic market is still unable to access all requested levels.

Organic Agriculture includes systems of humane and environmentally friendly production aimed at reestablishing the balance lost as a result of erroneous practices in the ecological system and is fundamentally a form of production that advises using organic and green fertilizers rather than synthetic chemicals and manures, alternation, the preservation of the soil, the increase of plant resistance, and parasites and predators and that adopts as a principle the increase not of amount in production but of the quality of the products (Turhan, 2005). Organic agriculture carries the aim of protecting the environment and human health and is named ecological agriculture, biological agriculture, biodynamic agriculture, alternative agriculture, renewable agriculture, and sustainable agriculture in different countries. Organic agricultural production and marketing is a monitorable, recorded, and transparent process that has unique international rules, and independent certification institutions and inspectors control and certify or-

ganic products at all stages of this process (Demiryürek, 2011).

Organic agriculture is a form of production that does not harm other living beings that live in the soil, air, water, environment, and nature and that, accordingly, provides for agricultural sustainability because it doesn't use or controls the use of chemical drugs or fertilizers. Sustainable agriculture is expressed as the provision of economic sustainability for agricultural businesses by protecting the natural resources in agricultural production (soil, water, and biodiversity). The concept of sustainable agriculture is not just the general long-term preservation of natural resources and the guarantee of efficiencies, but it also expresses a balanced agricultural system in economic, social, and ecological terms (Demiryürek, 2011).

In agricultural production, which reached the point of harming the environment and people, agricultural methods that use intense inputs don't only increase costs but also bring along with them consequences like water and soil pollution, residues of agricultural drugs in foods, plant diseases, and pests gaining resistance to chemicals (Anonymous, 2016). It is thought that organic agriculture will create a sustainability that will create medium- and long-term ecological balance, will protect and improve the soil in many regards, will prevent soil pollution caused by chemical fertilizers and drugs, will reduce the agricultural chemical need in the soil by decreasing the use of unrenewable energy, will protect biological diversity, will prevent genetic modifications, and will create numerous other ecological contributions (Yürüdür et al., 2010).

The purpose of sustainability, which is necessary for the imperative of feeding a growing global population, is at the center of organic production and is one of the most important elements that determine the acceptability of a shared framework in terms of the rules, production practices, and used inputs (Bostan et al., 2019, s.2).

A developed system of agriculture must be able to prevent climate change and hydrogeological deterioration, to preserve plant and animal biological diversity, and to consider public health. From this perspective, agriculture can play an important role in the development of an economic model that aims for sustainability and the production of consumption goods (Mercati, 2016).

Sustainability can generally be separated into two fundamental strategies. The first is to determine the different strategies of management expected to generally be sustainable, such as systems of organic agricultural, and the second is to formulate alternative systems of management assumed to ensure a system of sustainability defined under certain conditions (e.g. preserving soil health specified with parameters for soil microbial biomass and activity) (Wiren-Lehr, 1999).

Agricultural development must be ensured and food demand in the economy must be met in the most suitable manner, agriculturally unsuitable terrain must be forested to protect from erosion and desertification in order to prevent the environmentally negative impacts of modern input combination, weight must be given to training programs for farmers to prevent the out-of-purpose use of agricultural terrain, to protect natural wealth, and to bring the out-of-purpose use of terrain in agriculture to a suitable level, the use of hormones must be brought under control, and developments in agricultural technology must be evaluated within an awareness of the environment (Anonymous, 2016).

The increase of environmental pollution and awareness around the world forces countries at the national and international level to take a series of measures and to make regulations for the development of organic agriculture. In order for environmentally friendly, organic agriculture to settle as a sustainable and preferred system of agriculture, producers must promote and encourage this system, and, in addition to these, greater profits must be ensured compared with conventional agriculture. Otherwise, producers will be unable to adopt and will not maintain this system (Kızılaslan and Olgun, 2012).

Organic agriculture represents a school of thought in the range of sustainable agriculture and constitutes an interesting example, because organic foods are the sole products of sustainable agriculture, which has a market identity and property of knowing the consumer. In addition to this, systems of organic food production are an important step toward sustainability not just in environmental terms but also regarding self-confidence and the preservation of rural society in farms. However, if large agricultural corporations don't make significant changes in their organizations and behaviors, the loss of the properties of organic foods with which sustainability is consistent is probable (Macrae et al., 1993).

The concerns of people on the topics of environmental awareness and health guide them to consume natural products, and, accordingly, the demand for organic problems quickly increases. The increase in demand in turn causes an increase in the volume of trade for organic agricultural products around the world, and countries provide the producer with various support to increase and develop the production of organic agricultural products to obtain a greater share of this market. For the purpose of producers in Turkey adopting organic agriculture and guiding organic production, low-interest loans and direct income support, support for the protection of environmentally agricultural terrain, support for the conduct of good agricultural practices and soil analyses, support for exports, and support such as the leasing of public lands to investors who commit to investing in organic agriculture and employing at least 10 people for a period of 10 years are provided.

The purpose of this study is to evaluate organic agriculture in terms of agricultural sustainability and to develop recommendations to increase and propagate applicability in terms of producers by examining the development in Turkey for organic agricultural, thought to preserve the health of the environment and people.

2. MATERIALS AND METHODS

This study is based on the literature and utilized data from the Turkish Ministry of Agriculture and Forestry, various national and international reports and articles, and the internet regarding this issue. The data was compiled and interpreted as a method in accordance with the purpose of the study from statistics regarding organic agriculture that were published by the Ministry of Agriculture and Forestry (2019). In order to evaluate the issue of sustainability in agriculture, the development of organic agricultural production and the support provided to organic production in Turkey were studied, and various recommendations were developed based on organic agriculture in terms of the provision of sustainability.

3. TURKEY AND ORGANIC AGRICULTURE

3.1. Crop production:

Organic agriculture in Turkey in line with demand from European countries began as export-oriented since the 1980s. Exports started with traditional products such as raisins, dried apricots and dried figs and production continued with 8 products until the 1990s. In Turkey, just as around the world, organic agriculture markets are constantly expanding for reasons such as the propagation of environmental awareness, agricultural sustainability, and health concerns. The change of consumer preferences ensured an increase in the diversity of organic products (Bahsi, 2020).

Table 1 provides the development of organic plant production in Turkey. The varieties of organic products, of which there were only eight in Turkey in the 1980s, reached 150 in the year 2002 and 213 in the year 2018. The increase in the diversity of organic products and the expansion of the volume of production also carry economic value.

Table 1. Turkey organic agriculture crop production data (transition process included)

Years	Number of Products	Number of Farmers	Farming Area(ha)	Natural Collection Area(ha)	Total Production Area(ha)	Produce Amount(ton)
2002	150	12,428	57,365	32,462	89,827	310,125
2003	179	14,798	73,368	40,253	113,621	323,981
2004	174	12,751	108,598	100,975	209,573	377,616

2005	205	14,401	93,134	110,677	203,811	421,934
2006	203	14,256	100,275	92,514	192,789	458,095
2007	201	16,276	124,263	50,020	174,283	568,128
2008	247	14,926	109,387	57,496	166,883	530,224
2009	212	35,565	325,831	175,810	501,641	983,715
2010	216	42,097	383,782	126,251	510,033	1,343,737
2011	225	42,460	442,581	172,037	614,618	1,659,543
2012	204	54,635	523,627	179,282	702,909	1,750,126
2013	213	60,797	461,395	307,619	769,014	1,620,466
2014	208	71,472	491,977	350,239	842,216	1,642,235
2015	197	69,967	486,069	29,199	515,268	1,829,291
2016	225	67,878	489,671	34,106	523,778	2,473,600
2017	214	75,067	513,981	22,148	543,033	2,406,606
2018	213	79,563	540,000	86,885	626,885	2,371,612

Source: Ministry of Agriculture and Forestry (tarimorman.gov.tr)

In 2002, approximately 12428 producers carried out aquaculture in 57365 hectares of land. In 2018, organic farming is carried out by 79563 producers on an area of 540000 hectares. While 310 125 tons of production was made in 2002, it increased to 2371612 tons in 2018, including transition products and products collected from nature. The number of organic products in Turkey between the years of 2002-2018 by 2.2%, the number of organic producers 12.3%, 12.9% organic production areas, the amount of organic production increased by 13.6%. According to data from 2017, the share of area under organic farming in the total agricultural area in Turkey is 1.4%. When the studies (Demiryürek, 2004) conducted are examined, it has been determined that the economic factors (premium, price and market guarantee) are the most effective motivation factors for the breeders to switch to ecological agriculture. Inclusion of organic agricultural production in support since 2005 also has an impact on the developments of organic agriculture sector in Turkey (Bahsi, 2020).

Top 10 cities with the maximum production in terms of organic agriculture amount with selected cities in Turkey are shown in Table 2. The ranking of the cities with the maximum organic production vary by years. While in 2002, Balıkesir was the city having the maximum organic production with 73,440 tons, in 2017 and 2018, Aydın ranks as the first with organic production of 360,228 and 352,639 tons. In 2002, total organic production share of Balıkesir was approximately 23.7%, Şanlıurfa 15.3%, Aydın 7.4%, İzmir 6.3%, Manisa 5.4%, Kastamonu 5.4%, Isparta 5.4%, Kütahya 4.4%, Kahramanmaraş 3.9%, Erzurum 3.3%. In Balıkesir, to-

mato and olive oil are produced organically. In Balıkesir's total organic production, tomato has the share of 99.8%. In 2012, the city with the maximum organic Production was Van (16.7%). Other cities following Van in order: Erzurum (10.6%), Ağrı (9.5%), Aydın (7.6%), Kars (7.2%), Muş (5.7%), Şanlıurfa (4.4%), Malatya (3.6%), İzmir (3.3%) and Manisa (3.2%). In Van, clover (60%) and wheat (21%) are the products with the highest share. In Van, while 60% of the organic production is made up of organically farmed pruducts, 40% is made up of transition process products. In 2017 and 2018, the city with the maximum organic production was Aydın. In 2017, cities with the maximum organic production were Aydın (14.96%), Van (10.8%), Manisa (10.8%), Niğde (7.8%), Erzurum (6.2%), Kars (5.2%), Ağrı (4.8%), İzmir (3.5%), Şanlıurfa (3.3%) and Muş (3.2%). In 2017, Aydın's most produced products were olive (56%), fig (26%), apple (6%) and chestnut (3%). Products such as apple, pear, plum, fig and pomegranate are obtained with the way of collecting from nature. But, these products do not have a large share (3.6%) in total organic production. 80% of the total organic production in Aydın is composed of farm products and 20% consists of transition products. In 2018, the cities with the maximum production were Aydın (14.9%), Manisa (9.3%), Van (7%), Niğde (6.9%), Erzurum (5.4%), Kars (4.9%), Ağrı (4.8%), İzmir (3.7%), Şanlıurfa (3.6%) and Muş (3.6%). In 2018, olive (36%), fig (24%), apple (14%), pomegranate (9%) and chestnut (3.6%) were the most produced products in Aydın. The share of the products collected from nature in organic products in Aydın's organic agricultural production is 6.8%.While the share of farm products was approximately 84% in 2018, the share of transition process products was approximately 16%.

Table 2. Top 10 cities with the highest organic production (collecting from natüre and transition process included)

2002		2012		2017		2018	
Province	Produce Amount (ton)	Province	Produce Amount (ton)	Province	Produce Amount (ton)	Province	Produce Amount (ton)
Balıkesir	73,440	Van	292,755	Aydın	360,228	Aydın	352,639
Şanlıurfa	47,332	Erzurum	185,854	Van	259,147	Manisa	220,293
Aydın	22,985	Ağrı	166,192	Manisa	259,142	Van	166,784
İzmir	19,447	Aydın	132,824	Niğde	186,973	Niğde	163,447
Manisa	16,770	Kars	125,455	Erzurum	149,233	Erzurum	129,026
Kastamonu	16,669	Muş	100,433	Kars	123,997	Kars	115,796
Isparta	16,655	Şanlıurfa	76,198	Ağrı	115,173	Ağrı	112,928
Kütahya	13,612	Malatya	62,443	İzmir	84,723	İzmir	87,244

Kahramanmaraş	12,163	İzmir	57,325	Şanlıurfa	79,651	Şanlıurfa	85,567
Erzurum	10,123	Manisa	55,708	Muş	77,691	Muş	85,081

**Compiled from the statistics of Ministry of Agriculture and Forestry*

The number of organic farmers in Turkey in general tends to a constant increase. Especially since 2009, this increase has been higher. When the cities with the highest number of organic producers in selected years are evaluated: while Erzurum took the first place with 1,734 producers in 2002, Van with 11,882 producers in 2012, and Aydın with 13,588 and 14,388 producers in 2017 and 2018 ranked first (Table 3). Among the total number of farmers in 2002, Erzurum 13.95%, Aydın 11.3%, Kastamonu 10.5%, İzmir 10%, Manisa 8.3%, Çankırı 5.7%, Afyon 5.5%, Konya 4.4%, Trabzon has a share of 3.9% and Isparta has a share of 3.8%. In 2012, the top 10 cities with the highest number of farmers were Van (39.3%), Aydın (19.2%), Erzurum (13.4%), Kars (12.9%), Muş (10.9%), Rize (10.6%), Ağrı (10.2%), Manisa (6.4%), Izmir (5.3%) and Zonguldak (4.4%). In terms of the number of organic farmers in 2017, cities are ordered as follows: Aydın 18.1%, Rize 13.6%, Van 7.4%, Manisa 5.5%, Kars 4.8%, İzmir 4.6%, Erzurum 3.4%, Adıyaman% 3.3%, Ordu 3.2% and Muş 3.1%. In 2018, Aydın (18.1%), Rize (13.5%), Van (5.8%), İzmir (4.7%), Kastamonu (4.5%), Mardin (3.6%), Ordu (3.5%), Artvin (3.5%), Adıyaman (3.4%), Muş (3%) were the top 10 organic farmers.

Table 3. Top 10 provinces with the highest number of organic producers (including collection and transition from nature)

2002		2012		2017		2018	
Province	**Number of farmers**	**Province**	**Number of farmers**	**Province**	**Number of farmers**	**Province**	**Number of farmers**
Erzurum	1,734	Van	11,882	Aydın	13,588	Aydın	14,388
Aydın	1,406	Aydın	5,790	Rize	10,225	Rize	10,711
Kastamonu	1,305	Erzurum	4,055	Van	5,541	Van	4,595
İzmir	1,247	Kars	3,888	Manisa	4,143	İzmir	3,707
Manisa	1,032	Muş	3,289	Kars	3,593	Kastamonu	3,578
Çankırı	702	Rize	3,202	İzmir	3,416	Mardin	2,857
Afyon	684	Ağrı	3,087	Erzurum	2,540	Ordu	2,794
Konya:	552	Manisa	1,931	Adıyaman	2,495	Artvin	2,754
Trabzon	479	İzmir	1,608	Ordu	2,367	Adıyaman	2,718
Isparta	476	Zonguldak	1,316	Muş	2,342	Muş	2,403

** Compiled from the statistics of the Ministry of Agriculture and Forestry.*

Provinces having a maximum field of organic production in Turkey is given in table 4. In 2002, it has Şanlıurfa 22.8%, Antalya 14.7%, Aydın 9.7%, İzmir 8.4%, Manisa 8.1%, Muğla 8%, Mersin 4.7%, Malatya 2.6%, Burdur 2.6%, Tokat 2.1% shares in organic production areas. The provinces with the highest organic production area in 2012 were Van (33.4%), Kastamonu (26.1%), Ağrı (19.4%), Erzurum (17.3%), Kars (16.3%), Bitlis (16.2%), Muş (13.9%), Adana (12.7%), Aydın (11.2%) and Şanlıurfa (6.2%) are listed in the table. In terms of organic production areas, Aydın ranked first with 13% in 2017, followed by Van (12.99%), Kars (9.9%), Ağrı (7.8%), Muş (6.6%) and Erzurum, respectively (6.5%), Manisa (4.1%), İzmir (4.1%), Şanlıurfa (2.6%) and Sivas (2.4%). In 2018, it has Aydın 11.8%, Van 9.8%, Kayseri 8.6%, Kastamonu 8.1%, Ağrı 6.4%, Muş 5.7%, Erzurum 5.3%, İzmir 3.9%, Şanlıurfa% 3.4, Mardin 2.97% shares in organic production areas.

Table 4. Top 10 provinces with the highest organic production area (including collection and transition from nature)

2002		2012		2017		2018	
Province	**Production area (ha)**	**Province**	**Production area (ha)**	**Province**	**Production area (ha)**	**Province**	**Production area (ha)**
Şanlıurfa	20,493	Van	101,403	Aydın	70,815	Aydın	73,933
Antalya	13,224	Kastamonu	79,456	Van	70,589	Van	61,293
Aydın	8,739	Ağrı	58,918	Kars	53,550	Kayseri	53,889
İzmir	7,546	Erzurum	52,606	Ağrı	42,350	Kastamonu	50,983
Manisa	7,285	Kars	49,493	Muş	35,802	Ağrı	40,180
Muğla	7,198	Bitlis	49,129	Erzurum	35,009	Muş	35,633
Mersin	4,233	Muş	42,127	Manisa	22,255	Erzurum	33,346
Malatya	2,363	Adana	38,488	İzmir	22,046	İzmir	24,654
Burdur	2,355	Aydın	34,077	Şanlıurfa	14,125	Şanlıurfa	21,759
Tokat	1,929	Şanlıurfa	18,883	Sivas	13,008	Mardin	18,623

** Compiled from the statistics of the Ministry of Agriculture and Forestry.*

In addition to external demand, domestic demand has been continuously increasing in recent years due to reasons such as health concerns and the development of environmental awareness (Bahsi, 2020). Including wild collection products (such as blackberries, rosehip, thyme, centaury, hawthorn, a blend of powdered thyme grass and raspberries) in Turkey in 2018, a total of 213 kinds of organic products are produced. In addition, some cultivated products also grow wild in nature and Turkey has an important potential at the point of collection and evaluation of these products as organic (Bahsi, 2020). 9.6% of the total production in Turkey is com-

posed of organic wild collection products. Table 5 shows the products that have the highest share in total organic production (including the process of collection and transition from nature). Olive is the product having the highest production amount with 213% share among 213 organic products. Approximately 21% of the total organic olive production consists of transition products. The provinces where olive is produced the most are Aydın (47.7%) and Kilis (22.9%). Wheat is in the second place with 10.8% share and the provinces where the highest production is made are Van (22.5%), Muş (20.6%) and Ağrı (16.3%). Apple is the third with 10.4% share. The provinces where it is grown most are Niğde (44%) and Aydın (22.9%). 38.2% of the apples are collected from nature.

Table 5. Products produced the most in Turkey, in 2018

Product	Production Quantity (Ton)	Collection from nature (ton)	Transition Production (Tons)	Total Production (Ton)	Share in Total Production (%)
Olive	213,369		56,059	269,428	11.4
Wheat	195,131		61,261	256,392	10.8
Apple	98,136	94,659	54,971	247,766	10.4
Grape	111,362	1,040	64,668	177,070	7.5
Clover	133,377		38,904	172,281	7.3
Fig	86,585	3,900	24,795	115,280	4.9
Apricot	58,805		29,441	88,246	3.7
Esparsette	67,957		19,776	87,733	3.7
Barley	56,337		18,522	74,859	3.2
Pomegranate	54,038	5,120	13,813	72,971	3.1

** Compiled from the statistics of the Ministry of Agriculture and Forestry.*

3.2 Animal Production:

The development of organic farming in Turkey, but not as fast as crop production and shows fluctuations over the years the number of farmers engaged in organic farming. All entries must be organic to organic farming, the plant must be suitable for the welfare of animals, organic reasons such as lack of meadows and pastures organic farming makes it difficult and costly in Turkey (Dalbeyler and Işın). The number of farmers engaged in organic farming in Turkey, while in 2018 this number reached in 2004, 5,177 farmers. The number of farmers engaged in beekeeping increased from 256 to 455. In 2018, approximately 68% of the farmers engaged in organic farming produce broiler and ovary chickens, while 20% of them are bovine and about 12% of them are sheep (Bahsi, 2020). The province with the highest number of producers in animal husbandry is Ordu with 28 producers (19%). Ordu is followed by Çanakkale (18%) and Sakarya

(10%) respectively. The leading province in terms of number of producers in beekeeping with 47 producers (14%) is Artvin. The provinces of Bayburt (9%) and Elazığ (8%) follow Artvin.

The development of organic animal products over the years is shown in Table 6. Although red meat production varies depending on the years, white meat production started after 2010 and was realized as 1,261 tons in 2018 despite the slight changes compared to the years. Çanakkale was the province with the highest red meat production in 2018, while Elazığ was the province with the highest white meat production. Total organic milk production was realized as 12,884 tons in 2018 and the province where organic milk production is highest is Manisa with 7,538 tons of milk. Production of organic cheese, yogurt, butter and cream / cream is not regular production on a yearly basis. In 2018, 15 tons of cheese, 1 ton of butter and 7 tons of cream / cream were produced. There is no production of organic yogurt. Egg, which is another organic animal product, is a product whose production increases regularly between 2004-2018. Sakarya is the province with the highest production with 17% share in organic egg production, followed by Samsun and Manisa. In terms of organic bee production, Van was the leading province with 72.1 tons (14.6%), followed by Aydın (10.8%), Artvin (7.5%) and Mersin (7.2%) respectively. It is.

Table 6. Development of organic animal products in Turkey by years

Years	Red meat (ton)	Milk (tons)	Cheese (ton)	Yogurt (ton)	Butter (ton)	Cream / Cream (ton)	White meat (ton)	Eggs (pieces)	Bee products (ton)
2004	450	504	396	52	-	-	-	92,500	737
2005	0	1,350	5	-	-	-	-	270,000	573
2006	12	2,875	-	-	-	-	-	241,940	640
2008	554	8,711	-	-	-	-	-	4,424,000	181
2009	377	12,994	-	-	-	-	-	11,767,400	207
2010	6,753	11,605	-	-	-	-	50	17,889,808	208
2011	646	14,794	-	-	-	-	713	26,236,920	221
2012	460	17,627	-	-	-	-	210	36,105,556	517
2013	3,940	54,781	-	-	-	-	1,030	48,040,778	344
2014	284	15,510	11	-	1	-	1,823	64,898,912	280
2015	475	19,739	1	3	-	-	2,130	58,938,769	675
2016	123	21,431	375	-	7	-	1,486	147,600,367	349
2017	86	15,109	3	-	-	-	1,266	161,254,080	393
2018	427	12,884	15	-	1	7	1,261	174,675,362	495

** Compiled from the statistics of the ministry of Agriculture and Forestry*

3.3. Organic Agriculture Supports:

Text of the introduction. In order to ensure sustainability in organic agriculture, one of the important issues in the orientation and adoption of farmers to organic agriculture is support. support organic agriculture in Turkey have been initiated for crop production in 2005 and in 2011 were included in livestock support. In order for organic farmers to benefit from the supports, they must be registered in the Farmer Registration System and the Organic Agriculture Information System. Government support given to organic farmers in Turkey area-based payments, contract manufacturing, leasing of organic farming for treasure land, low-interest investments and business loans, support for the protection of the environment for agricultural land, state can be listed as supports for the rustic arrangements (Bahsi, 2020).

From one year to support organic production in Turkey has increased the support is examined (Table 7). In 2018, organic farming supports were organized into 4 categories. Scope of support; The first category (Fruit-Vegetable and Medicinal-Itri Plants) products found in 100 TL / da, the second category products (Pistachio and Olives) 70 TL / da, the third category (field crops with high economic value) 30 TL / da products, the fourth category (Other products and fallow) products are 10 TL / da. In addition, organic beekeeping support is provided as 10 TL per bee hive.

Table 7. Organic plant and animal production support payment in Turkey by years

Years	Number of Producers	Supported Area (da)	1 decare area Support Amount (TL)	Total Amount (TL)
2006	1,042	43,758	3	131 thousand
2007	1,536	117,188	3	352 thousand
2008	1,615	130,746	5	654 thousand
2009	5,467	368,582	18	6.3 Million
2010	4,976	351,825	20	7.1 Million
2011	23,575	2,423,983	25	60.6 Million
2012*	28,090	2,711,899	25	68.1 Million
2013*	27,085	2,515,068	Fruits and vegetables 35 Field crops 10	38 Million
2014*	32,576	2,966,847	Fruits and vegetables 70 Field crops 10	69.3 Million
2015*	39,078	3,247,585	Fruits and vegetables 70 Field crops 10	88.7 Million
2016*	27,842	2,522,631	Fruits and vegetables 70 Field crops 10	58.8 Million
2017*	47,786	3,570,203	4 Category 10-100)	130.2 Million
2018*	51,669	3,761,290	4 Category 10-100)	143.9 Million

**Including organic animal production support*

Source: Ministry of Agriculture and Forestry

Note 1: The payments of 2006-2007-2008 have been paid in addition to DGD.

4. CONCLUSION AND DISCUSSION

The main function of agriculture in the period from the existence of humanity to this time is the continuation of vital activities. In the course of time, mankind, which has been carrying out these activities with hunting and gathering, has started to realize agricultural production with the establishment of settled life. Due to the increase in crop and animal production, agricultural products have become a subject of trade in time and this process has expanded and developed until today. It is of great importance that agricultural activities are sustainable in order for communities to survive. In this context, the aim of organic farming practices is to protect the health of living things and the environment, as well as to ensure the optimization and protection of natural resource use and to ensure agricultural sustainability while realizing these. Although these issues are included in the basic philosophy of organic agriculture, there are many reasons for application. These can be listed as providing soil fertility, saving energy, preventing soil and genetic resource erosion, protecting water resources and quality, producing healthy products with high nutritional quality. Although sustainability is a global concept, a farm constitutes only a small subsystem that interacts with environmental systems in various ways and is the main actor in contributing to the realization of sustainable development (Passel et al., 2007, p.150).

With an average of 2.9 million producers and a market size of 97 billion dollars, organic agriculture has grown by 102.6% and 105.3% in terms of organic agriculture, especially in the last decade when sustainability is on the agenda. Turkey's climate and soil characteristics, is an advantageous position for organic farming in terms of biodiversity. Turkey number of items in over a 16-year period from 2002-2018, 42%, manufacturer number of about 540%, production area is about 598%, the total amount of organic production was increased approximately 665%. Organic farming, despite the fact that the world has shown significant improvements in the overall share of organic farming in the total agricultural land is only 1.4% in the world and Turkey (Bahsi, 2020).

According to data from the Ministry of Agriculture and Forestry has begun to organic markets in Turkey founded in 2006 and has increased over time. According to the current situation; Although there are a total of 21 organic markets in Istanbul, Ankara, Izmir, Bursa, Adana, Eskisehir, Konya, Balikesir, Samsun, Kayseri and Izmit, it is thought that consumers do not have sufficient numbers to reach organic products and producers to market their products. These markets need to be increased and easily accessible for both producers and consumers. Dissemination of organic

agriculture, which is important for sustainable agriculture, also depends on market conditions. Although the level of organic agriculture, which is one of the forms of sustainable agriculture, is not considered sufficient for the sustainability of agriculture despite all these developments, it is claimed by some sections that organic agriculture will not be enough to feed the growing world population.

To ensure sustainability in agriculture:

- Increasing the activities (informing and dissemination activities) to be made in order to spread organic agriculture among producers,
- Extending and increasing the scope of supports,
- Organizing the producers of organic products in order to gain advantage in the market,
- Conducting and disseminating social promotion activities in order to attract the attention of producers and consumers to organic agriculture,
- Giving credit to people and enterprises operating in the field of organic agriculture under attractive and favorable conditions by credit institutions,
- Providing necessary trainings starting from preschool period in order to raise awareness of organic product in individuals who form society
- Encouraging and supporting scientific studies related to organic agriculture (projects, congresses, scientific research, etc.)
- Organic agriculture needs to be emphasized in agricultural development plans.

In order to expand the organic farming activities carried out within the framework of sustainable agriculture and at the same time to increase the share of the product range and production amounts in order to increase the share of the agricultural sector, which has an important economic value in the world, it is necessary to implement these recommendations in order to increase the consumption amount in terms of live and environmental health. is of great importance

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Chapter 2

RISK ANALYSIS IN FOREST NURSERIES

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1. Introduction

With the developments in the field of ergonomics and legal regulations in the world, for both works that are done to be properly done and workers to be able to work in safe conditions, developing approaches to prevent work accidents and occupational diseases has gained importance. For this, it is resorted to take precautions that will ensure elimination or minimization of risks carried by works. In the literature, it was stated that estimating and minimizing the size of the risk may only be possible with a good risk analysis (Atılgan, 2008).

The success of work to be done in the field of occupational health and safety may be possible by taking on the topic in an approach that includes integrity and continuity. In work life, the main purposes in provision of occupational health and safety may be listed as protecting employees, providing the safety of production and providing the safety of the firm. Being able to apply the principle of protecting employees which is one of the most important ones of these purposes is dependent on revealing the risk levels of negative factors caused by various reasons such as the working environment, work that is being done, material and equipment that are used and taking the necessary precautions for these risks (Unver, 2013).

Nowadays, with the increase in the importance paid to occupational safety, many legal regulations made in the world have included decisions related to occupational safety. In the European Union's (EU) framework directive numbered 89/391/EEC in Occupational Health and Safety, employers have been held responsible for preventing occupational risks that employees will be exposed to at the workplace, protecting their health and safety, informing employees on these issues and educating them (Council Directive, 1989). Additionally, this directive also recommends every state to develop their specific methodologies suitable for their legislation for risk assessment (Stanković et al., 2013). Similarly, in the agreements of the International Labor Organization (ILO) numbered 155 and 161, employees have been held responsible for conducting risk assessment at workplaces in all lines of work (ILO, 1981; ILO, 1985).

Today, forests are pushed back to mountainous areas due to negativities such as misuse of land, irresponsible urbanization and overutilization, and their productivity decreases. In terms of both providing the sustainability of the existence of forests and utilization of forests and increasing the productivity of forests, some of the most effective activities are afforestation activities. Increasing productive forest areas and achieving their sustainability may only be possible by well-planned afforestation work (Unver-Okan, 2018). The success of afforestation activities which are economically very expensive is dependent on the use of healthy saplings

from origins that are suitable for the ecology of the area where afforestation will be carried out.

Activities like forestry and agriculture that are carried out in a nature-dependent and labor-intensive manner are works that have high risks in terms of occupational health and safety. Forestry works are generally defined as a combination of natural and material risks that threaten the health and safety of forest workers (Poschen, 1998). While the loss of time and money that could occur at workplaces as a result of work accidents or occupational diseases may be reversed, it is not possible to reverse the deaths of employees or serious injuries. This situation may affect not only the employees exposed to accidents or occupational diseases but also these employees' families, social environments and the psychological structures of other employees working at the workplace negatively (Kaya, 2016). For this reason, the issues of taking precautions by assessing workplace, planning the workflow in a way to preserve the right of employees to live healthily, working employees at works suitable for their size and capabilities and minimizing risks by taking the necessary precautions have become prominent.

During works carried out in forest nurseries where saplings that are used in afforestation work are grown, workers are exposed to various dangers. Therefore, it is important to conduct a risk analysis in forest nurseries and reveal the potential risks.

2. Forest Nurseries

Nursery is a name given to lands with low slope values containing open and enclosed spaces where saplings that are needed to be planted at other places for a certain purpose are produced (Alkan and Divrik, 2019). Saplings that are required in afforestation work in forestry are obtained from forest nurseries that are found close to afforestation sites. Forest nurseries are establishments with multidimensional functions in the ecological, economic and social aspects. They have functions in the ecological aspect in terms of providing saplings with a suitable origin to the ecological properties of afforestation sites, in the economic aspect in terms of contributing to the increase in forest productivity and in the social aspect in terms of providing employment for forest villagers. Forest nurseries consist mostly of open areas where sowing and plantation activities are carried out and to a lesser extent of enclosed areas containing administrative buildings, carparks, storage areas or greenhouses. Open areas in forest nurseries consist of plotted seedbed for sowing or planting saplings to be produced based on their species, age and origins (Figure 1).

Figure 1. *Bird's-eye view of a forest nursery in Eskişehir province from Google Earth*

In Turkey, production of saplings that are used in activities of afforestation, rehabilitation and replanting of burnt forest areas is carried out at 131 forest nurseries established over an area of 3,264 ha and with a capacity of 322.2 million units/year (Anonymous, 2018). Forest nurseries are areas with different sizes where production is carried out throughout the entire year or in certain seasons, and usually the saplings of local species are produced. Nurseries are classified into 3 main groups based on their operation time, size and altitudes (Figure 2).

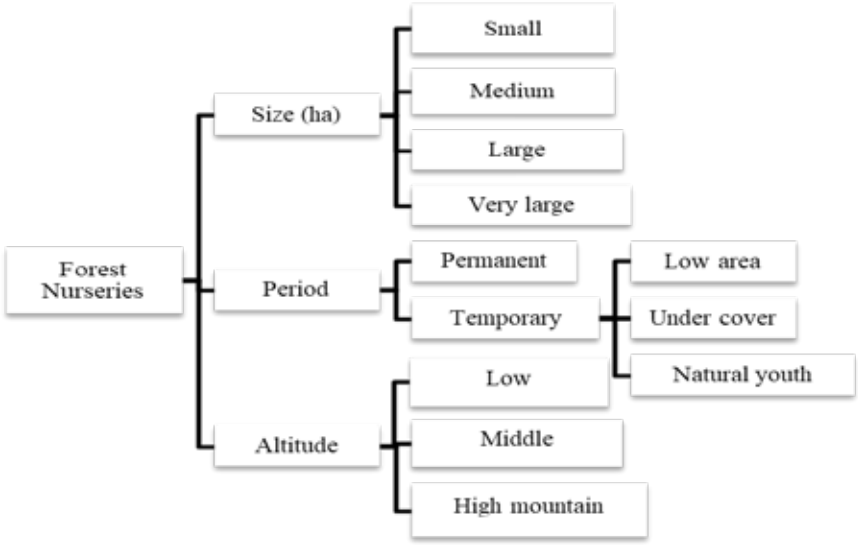

Figure 2. *Forest nursery classes (Gultekin, 2014)*

While forest nurseries are categorized as small (1-5 ha), medium (6-20 ha), large (21-100 ha) and very large (>100 ha) based on their area, they are categorized as permanent and temporary nurseries based on their operation time. Permanent forest nurseries are establishments that may be at different sizes and provide year-long service. Nurseries that are only used for growing saplings at certain times of the year and closed at other times are known as temporary nurseries. These nurseries may be found in open spaces, under cover or in natural regeneration areas (Tolunay and Cavusoglu, 2015). One of the most important ecological parameters for the species and yield of plants that are grown is altitude. Forest nurseries are categorized into 3 classes as low (0-800 m), medium (801-1500 m) and high mountainous (1501-2000 m) areas based on altitude (Gultekın, 2014).

A very few of workers working at forest nurseries are in the permanent worker status, and most are seasonal workers. A large proportion of seasonal workers consists of female workers that are supplied from the region of the nurseries and work mostly to contribute to their household economy (Kaya, 2016).

2.1. Main Works in Forest Nurseries

Works done in forest nurseries consist of various activities carried out consecutively or simultaneously at certain times. The main works are divided into five main classes as sowing-planting, maintenance, lifting-packing, carrying-storage and loading (Figure 3).

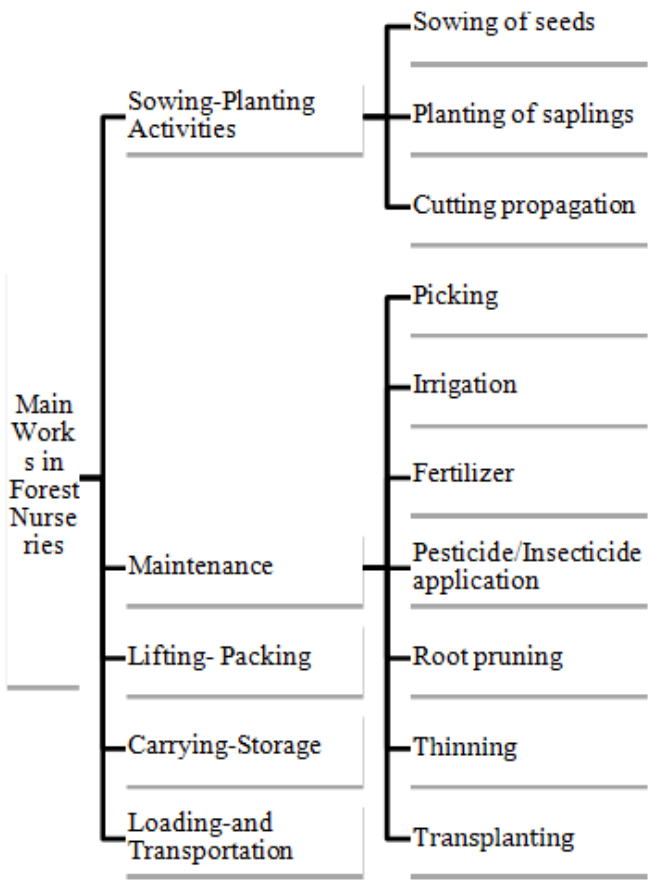

Figure 3. *The main works done in forest nurseries*

2.1.1. Sowing-Planting Activities

Before sowing and planting activities are carried out, firstly the soil is prepared by soil levelling, drainage, soil processing and improvement activities. Afterwards, the filling material to be used is prepared, and seeds and saplings are checked. In soil processing activities, mainly machines that process the soil by over turning (e.g., moldboard plow, reversible moldboard plow, disc plow), those that process it without over turning (e.g., cultivator, graham plow, subsoiler), those that process the surface by mixing (e.g., rotary tillers, rotavator, disc harrow, gob disk) and hoeing machines are used. In these activities, while mixing and motorized sieves are used in preparation of the covering material, in preparation of seedbed, seedbed-making machines, seedbed path clearers, small channeling or rubber-tired channeling machines are used (Figure 4).

Figure 4. *Preparation of planting seedbeds (Foto: G. Erdem)*

Sowing and planting works are performed in three different forms as into pots, polyethylene bags or seedbed in open space. While seed sowing works among these activities are carried out with a sowing roller or sowing machine, laying out covering material is carried out with material layer machines and compression rollers (Acar et al., 2015) (Figure 5).

(a) (b)

Figure 5. (a) *Planting in pots with machine (Photo: T. Ozturk), (b) on pillows with hand (Kaya, 2016)*

Cutting propagation technique; it can be defined as the technique of creating a new plant with the stem, root, leaf part taken from the main plant to be produced and called steel. Growing with cutting propagation is the simplest, cheapest and fastest production technique for many ornamental plants, which is done outdoors or indoors such as greenhouses (Urgenc, 1992).

Figure 6. *Cutting propagation in the nursery (Kaya, 2016)*

2.1.2. Maintenance Activities

These are activities such as weeding, irrigation, fertilizer application, pesticide application, root pruning, thinning and transplanting that are conducted for the sowed or planted saplings to grow healthily (Unver-Okan et al., 2017). Weeding that emerges among saplings on seedbeds are usually performed by human labor. While doing this work, workers work in positions of crouching, bending and reaching for long durations.

While irrigation is performed usually with water engines, pesticide application works to protect saplings from diseases or bugs are achieved with a pulverizer (Figure 7).

Figure 7. *Maintenance activities in forest nurseries (Photo: T. Ozturk)*

Fertilizer or organic substance dispensers are used in fertilizer application activities that are carried out to increase the productivity of growth environments. Root pruning works to be applied in grown

individuals are performed with horizontal or vertical root pruning blades (Kaya, 2016). While workers work in crouching and bending positions while performing this work, they also work under significant risks due to the blades they have to use.

2.1.3. Lifting and Packing Activities

These include works of lifting saplings that have reached a desired age from the soil and packing them to be transported to storage or delivery. While saplings are lifted with a sapling lifter machine, packing mostly takes place by human labor (Figure 8).

Figure 8. *Lifting of saplings activity (Photo: T. Ozturk)*

Packing may be performed in the form of packing multiple saplings based on their species and heights, while it may be in the form of packing single saplings. During packing workers work for long durations standing up or in bending and reaching positions while sitting in small stools.

2.1.4. Carrying and Storage Activities

Until saplings that are prepared into tubes or lifted from their seedbeds are sold, they are kept in warehouses where conditions that would not harm their vitality are provided. Carrying of saplings to other locations inside the nursery or to warehouses usually takes place by human labor in arms or by using wheelbarrows (Figure 9).

Figure 9. *Carrying and storage of saplings (Kaya, 2016)*

2.1.5. Loading and Transportation Activities

These involve works of loading saplings lifted from seedbeds or grown in tubes onto shipping vehicles and transporting them to sale locations. Saplings are either directly put into vehicles that will carry them such as trucks, tractors or trailers or loaded onto shipping vehicles after they are put into multiple crates. Loading is performed by human labor or forklifts (Figure 10).

Figure 10. *Loading and transportation activities of saplings (Photo: T. Ozturk)*

During works performed in forest nurseries, significant musculoskeletal system problems may occur in workers especially due to incorrect working postures.

3. Risk Assessment and Risk Analysis

The main purposes of work carried out on occupational health and safety are protecting employees, contributing to establishment of a safe working environment, achieving an increase in work productivity and providing opportunities for employee's work lives to continue (Bayılmış,

2013). For this purpose, it is important to carry out risk assessment as one of the main tools of occupational health and safety in all sectors (Marhavilas and Koulouriotis, 2008). Risk assessment is the process of assessing risks originating from potential dangers and involves taking into account the sufficiency of existing precautions and deciding on whether or not these risks are on an acceptable level (Laitinen et al., 2012). Risk assessment is performed by following the steps of defining possible dangers, determining risks and conducting risk analysis, comparing risk control measures, documentation and updating the work that has been conducted (Regulation No. 28512, 2012).

All factors, situations and objects that have a potential to create a negative effect may be expressed as potential dangers. While defining dangers as the first step of risk assessment, information is collected on the work environment, employees, work material, machinery and methods used. For the purpose of determining these dangers' type, quantity, exposure times and levels of employees to these dangers, all controls, measurements, examinations and research are conducted (Regulation No. 28512, 2012). The dangers that are determined are recorded by also considering the provisions included in the relevant legislation. Work accidents and occupational diseases occurring at similar workplaces may also be assessed in collecting this information.

In the simplest words, risk involves negative effects that could be experienced in the case of exposure to a certain danger. Sub-risks that are determined at a workplace are collected under main risk groups such as physical, chemical and biological risks based on the situations they originate from. Risk analysis, which is the second stage of risk assessment, is defined as examination of the probability and outcomes of each sub-risk (Cruze Netro et al., 2018). Risk analysis is the process of predicting the magnitude of the severity and probability of a danger before it emerges (Ozkılıç, 2008). This way, it may be achieved to minimize the damages to be induced on employees, the workplace, equipment/machines used and the environment in relation to work activities.

Risk analysis is carried out in the form of calculating risk level by determining the severity and probabilities of potential dangers in performing a work and taking risks under control. In risk analysis work, firstly the workplace and the work process are thoroughly observed, and information is collected on the physical conditions of the work area, workplace design, work material, method used, workflow, properties of works that are performed, characteristics of the equipment/machines used and those of the employees. By using these information and data, dangers that may pose a risk for the line of work that is being assessed are revealed. The probability of dangers to emerge and the damage they will induce in case

of emergence provide significant contributions in determining the severity of the harm, damage or injuries they may provide. A report prepared by GDF (2015) emphasized that, in risk analysis work, mainly factors like the number of individuals exposed to the danger, time of exposure to the danger, protection provided by personal protective equipment and unsafe behaviors should be taken into account.

There are several risk analysis methods that make assessments based on different parameters and may be collected under three classes as qualitative, quantitative and mixed methods. While risk is calculated with numerical methods by using the obtained data in quantitative techniques, it is calculated in qualitative methods by mathematically and/or logically analyzing descriptive values given to factors such as the probability of occurrence, severity and frequency of danger. Mixed methods are those that include both qualitative and quantitative approaches (Ceylan and Başhelvacı, 2011). Risk levels are determined by assessing the statuses of the parameters included in the content of the methods used. By ranking dangers based on the risk levels, precautions that will eliminate the risk or reduce its level are determined. GDF (2015) listed the precautions that may be taken according to risk analysis results as eliminating the risk at its source, replacing a dangerous method with one that is less dangerous, preferring collective protection measures rather than personal protective measures, applying engineering precautions and utilizing ergonomic approaches. Risk mitigation is a process where the magnitude of the risk is reduced to make the risk acceptable by minimizing the probability and/or effect of the risk (Meulbroek, 2002).

3.1. Risk Analysis in Forestry

Forestry activities, which are in the class of “heavy and difficult works”, are carried out in the forest ecosystem which is a living being that has a unique balance with living and inanimate elements. For this reason, during the conduct of forestry activities, there are many risks that may originate from both the workplace and the nature of the work in question (Unver, 2013). Forestry activities are different to other sectors as they are carried out in open air, with different working areas and tree species and using different tools or machines.

Forest workers in Turkey are people who have generally learned and gained experience with the work they do by trial-and-error or the see-and-learn method. This situation leads to negative effects on occupational health and safety in the workers and an increased risk of work accidents (Acar and Unver, 2008, Gumus and Turk, 2012). Engur (2011) stated that employing workers who are well-trained, apply basic knowledge and are experienced will not only preserve the labor but also reduce economic and ecological losses. Bilici et al. (2015) assessed the need for risk analysis

based on problems encountered after forest fires and working environment conditions. As a result of the study, they determined that there were risky gasses and particles in the environment after forest fires as opposed to the case in normal harvesting work conditions. They emphasized that risk analysis work absolutely needs to be conducted to predict the negativities that may be caused by this situation beforehand and reduce their effects.

According to occupational health and safety legislations, most forestry activities are in the class of dangerous works (Communique No. 28509, 2012). This is why it is highly important to conduct necessary studies that will contribute to provision of workplace safety for all stages of forestry activities that are carried out under different working conditions. In the forestry sector, there are studies mostly on risk analysis in harvesting (Poschen, 1998; Gokbayrak, 2005; Akay and Yenilmez, 2007; Enez, 2008; Unver, 2013; Sayın et al., 2014; Unver-Okan et al., 2017; Ergenc, 2018) and partially on risk analysis in forest warehouses (Fidan, 2017; Unver-Okan and Acar, 2015). However, there are not enough studies specifically assessing occupational health and safety in forest nurseries (Meyer et al., 1997).

3.1.1. Risk Analysis in Forest Nurseries

Forest nurseries, where saplings that are very important for achieving sustainability of forestry are produced, carry some unique and specific risks in terms of their physical conditions, seed or sapling production works that are carried out, devices/mechanization tools used in insecticides and herbicides. While works of shoot, sapling and seed growing in forest nurseries are considered as “low-danger” works in the workplace danger categorization of the Law No. 6331 on Workplace Health and Safety, works where machines (plow, disc harrow, cultivator, sowing machine, etc.) used in nurseries are included in the class of “dangerous” works (Communique No. 28509, 2012). Eliminating or minimizing these dangers may only be possible by inspecting works conducted in forest nurseries and working conditions in detail.

Regarding assessment of workers in forest nurseries, there are a few studies determining the ergonomic risks related to the working postures of female workers in forest nurseries (Kaya, 2016) and examining how the Law on Occupational Health and Safety in Turkey is perceived by forest nursery workers (Inanc and Agyürek, 2019). However, there are not enough studies that have revealed all dangers workers may be exposed to in a multidimensional sense by assessing all works that are carried out in forest nurseries in open or enclosed spaces and with human or machine labor.

3.1.2. Potential Dangers and Risks in Forest Nurseries

Forest nurseries cover various works that are performed in both open spaces and enclosed spaces. Additionally, while some part of the works that are performed are labor-intensive, some are carried out by various hand tools or machines. Forest nursery works, which show differences to other forestry activities in these aspects, should be taken on and assessed amongst each other. For this reason, in this book chapter, it is aimed to determine the dangers and risks that need to be taken into consideration in the risk analysis of forest nurseries. For this purpose, in forest nurseries with different characteristics, observations were made separately for all physical conditions, workplace designs, works conducted, and tools and machines used. By considering the observations that were made and the parameters used in risk analysis studies in the literature, potential dangers and risks were determined by accounting for the work environment (open area / enclosed area), works carried out and sources of power that are used (human labor / mechanization) (Table 1).

Table 1. Major risks in forest nurseries

Main Risks	Dangerous	Sub-Risks
Physical	Messy workplace	Movement difficulties, bumping around, loss of attention, tension, traffic accident
	Ground disturbance and insufficient drainage facility	Falling due to tripping or slipping, difficulty in moving, fatigue, loss of attention, overturning of the vehicle or hitting a worker
	Cold	Shivering, cold, body spasm, decreased hand skills, musculoskeletal diseases, itching, facial paralysis, sleepiness, slow respiratory and circulatory, cardiac arrhythmia, tiredness, loss of concentration
	Hot	Sweating, increased fluid and electrolyte loss, heat stroke, dizziness, blood pressure, visual impairment, fatigue, distractibility, loss of attention, coordination disorder
	Wind	Burns on the skin, dust in the eyes, chills
	Moisture	Dyspnea, body wetness, chills, restlessness
	Light	Worker falling or crush into something, traffic accident, blurred vision, eye fatigue, headache, tension, tiredness
	Dust	Loss of attention due to eye contact, eye burning, difficulty breathing

Chemical	Contact with fuel / oil	Poisoning, skin problems
	Smoking during refueling	Fire, glare
	Oil/fuel dripping on hot engine	Flare, flammability, injury, skin burning
	Inhaling exhaust gas	Poisoning, upper respiratory tract or lung disorders, loss of attention, eye burning
	Herbicide or insecticide inhalation / contact	Poisoning, breathing problems, skin disease
	Contact with fertilizers	Skin disease, poisoning
Biological	Insect bite	Allergy, exposure to insect or disease, death
	Poisonous plants	Poisoning, allergies
	Pollen	Allergy, burning eyes, sneezing, itching, runny nose, swelling of the body, loss of attention
	Lack of hygiene	Exposure to infectious diseases, poisoning
Psychological	Speediness	Accident, injury, loss of limb, death due to misconduct
	Carelessness	Crash, bruising, injury, loss of limbs, death
	Lack of motivation	Work accident, injury, restlessness, tension, rebellion
	Tiredness	Burnout syndrome, pain in limbs, musculoskeletal diseases
	Stress	Depression, boredom, trouble adjusting
	Monotony	Loss of attention, restlessness, fatigue, weariness
Organization	Incorrect planning of break and working times	Fatigue, weariness, pain in limbs, increased probability of work accidents musculoskeletal diseases, carelessness
	Incorrect workflow	increased probability of work accidents, injury
	Inadequate protective equipment	Injuries to limbs such as hands, eyes, ears, face, etc., weathering in open areas, poisoning, anxiety of feeling insecure.
	Missing first aid measure	Loss of limb, death, anxiety in workers as a result of not timely first aid to the injured
	Untrained operator/worker	As a result of any accident; injury, occupational illness, loss or death of limbs, tension
	Operator/worker dimensions or skills are not suitable for the work	Overstrain, fatigue, loss of attention, rebellion, loss of self-esteem, tension, excitement, psychological pressure, embarrassment, injury as a result of hitting or overturning, death
	Incorrect working positions, (standing for a long time, leaning in the wrong position, lying down or sitting)	Back, waist, shoulder, leg-leg pain, musculoskeletal disease, varicosis, fatigue, loss of work enthusiasm, stress caused by strain,
	Non-staff person	Increased risk of accidents

Technical	Vibration	Numbness in touch, circulatory disorders, loss of strength in arm muscles, damage to joints and internal organs, loss of sensitivity in nerves, white finger disease, loss of balance
	Noise	Loss of attention, restlessness, irritability, loss of balance, irritability, hearing loss, headache, tiredness
	carrying heavy load	Skeletal-muscular system disorders, fatigue, joint injuries, slipped disc, herniated disc, back and shoulder pain, breathing and circulation difficulties
	Incorrect stowing	Injuries, limb injuries or deaths as a result of the overturning of seedlings in stacked pots or boxes
	Loading	Falling of the load and collision, wrong working posture, musculoskeletal system disorders
	Wrong or insufficient use of tools / machines	Stress, fatigue, traffic accident, hand-arm-leg injury
	Maintenance of tools and machines	Stress, fatigue, increased risk of accidents
	Machines crashing the worker or somewhere, machine overturning	Loss of limb, injury, death, machine damage
	Climbing over the three-point connection	Falling, compression of limbs, injury, injury, limb loss
	Incorrect equipment connections or connecting rod settings	Injury or death as a result of the equipment crashing the worker, injury or death of the operator due to the machine falling as a result of loss of balance
	Weeds gathering around the exhaust pipe	Fire as a result of flame, accident as a result of the operator's panic, injuries to workers or minor burns
	Improper tire pressure or wheel spacing	Operator injury, loss of limb, death as a result of the machine falling over or crashing a ground
	Inadequate thermal comfort conditions in cabins or enclosed areas	Depression, carelessness, fatigue, accident

As a result of the assessments and observations that were made, 45 sub-risks that forest nursery workers could be exposed to were determined. These sub-risks were categorized in six main risk groups as physical, chemical, biological, psychological, organization and technical risks.

The physical risks that were determined as a result of examinations made in forest nurseries and the literature review mostly involved dangers with the origins of climate conditions, ground properties and the design of the work environment. As there are works carried out in both open and enclosed spaces in forest nurseries, it is needed to assess these risks separately for open and enclosed spaces. In enclosed spaces such as warehouses, greenhouses and tubed sapling preparation rooms, there is no danger related to wind, dust or precipitation. Alternative systems that will

eliminate or minimize risks such as lighting, humidity, heating/cooling, slippery ground and the design of the workplace besides these may be used. However, as it is not possible to intervene with sub-risks originating from the climate such as hot/cold, precipitation, wind and humidity in works performed in spaces open to weather conditions, only precautions that may reduce the level of risk such as the use of personal protective equipment and clothing suitable for climate conditions may be taken. In open spaces, deteriorations may occur in the ground originating from precipitation, sunlight, soil properties or tracks of heavy mechanization vehicles. While a rough or slippery ground may lead workers to slip, fall or have difficulty in moving, it also carries the risk of tremors or vehicle accidents for operators inside cabins. Completely eliminating this danger is not possible, but installing a good drainage system in the nursery, applying maintenance of drainage facilities periodically and after intense precipitation and using safety shoes are among precautions that may be taken. The source of lighting in open spaces is the sun, and people can work as long as there is sunlight, but when it starts to get darker, situations like difficulty in seeing and perceiving and strain in the eyes may occur. For this, inside the nursery, lighting systems with techniques that will provide the best lighting based on the works carried out may be installed. This way, both risks caused by hurrying to complete the work in sunlight and health problems caused by lack of sufficient lighting may be prevented.

Chemical dangers in forest nurseries are usually herbicides or pesticides used to protect saplings from bugs and fungi, chemical-containing fertilizers used to increase yield, fuels/oils of mechanization tools and the exhaust gasses of these vehicles. Fuel/oil supplies to semi-mechanized hand power tools are carried out in the working area during the work in nurseries. Smoking or usage of lighters by the operators and workers or dripping fuel/oil on the hot engine may lead to flame, fires or explosions. This is why it is important to train operators about the usage of mechanization tools, their maintenance, fuel/oil supply and the risks that the work carries. Besides this, including warning signs inside the nursery, applying a punishment/reward system with frequent inspections or making the use of personal protective equipment compulsory may be recommended. Especially in works with the possibility of direct contact with chemicals, care should be paid to suitable mask, face shield and glove usage.

The main works in forest nurseries consist of activities such as sowing seeds into seedbeds, sapling planting and maintenance activities to obtain healthy saplings such as weeding, transplantation and thinning which are carried out in open air. During these activities, workers may be exposed to various health problems in relation to various insects coming to plants biting them and direct contact with plants. Being stung by different insects like

wasps/bees may lead to significant outcomes such as attacks, allergies or even death in especially those that are sensitive to these insects. Moreover, as a result of transmission of various infections or diseases to workers from biting/stinging insects, difficulty in working for a long time, different health problems or even death may occur. To have information on insects, animals and pollen that workers may be exposed to, it is needed to make an inventory of plants, insects and animal species that breed or are bred in the forest nurseries or around them. By applying health screenings to workers who will work in the nursery before hiring and at certain intervals, the plant and insect species to which they may have allergies should be determined. Depending on their sensitivity rates, workers should either not be employed at these nurseries or worked in enclosed spaces where they would be far from pollen and insects. It should be made compulsory to use personal protective equipment that will protect workers from pollen and insect bites/stings especially in pollen seasons, and this should be inspected. Additionally, first aid training should be given to workers on especially how to treat insect bites based on the species of insect, and a complete first aid kit should be available at the nursery. Poisonous plants that are contacted during collection of weeds may create great risks for the health of workers. Thus, it should be made compulsory for workers to use personal protective equipment suitable for seasonal climate, especially including gloves. Workers in forest nurseries work constantly in contact with natural materials such as soil and dust and chemical materials like herbicides, pesticides, fertilizers and fuel/oil. It carries great importance to achieve hygiene in working environments where works in which such dirt exposure occurs are carried out. Additionally, keeping dining areas and common-use toilets clean is important in terms of preventing the spread of contagious diseases among crowded worker groups.

The timing of maintenance interventions to be made varies based on the species of the saplings grown in forest nurseries, and these are works that need to be completed in limited timelines. Especially in works performed in open air, due to dependence on sunlight, hurrying to complete the work, stress, fatigue, and attention loss due to these may occur. Furthermore, doing the same thing by having the same working posture for long durations may lead to monotonicity and lack of motivation. These psychological dangers increase the risk of the occurrence of work accidents and occupational diseases in workers and may lead to physical injuries, psychological disorders such as depression, burnout and various damages like death. An idea may be obtained about the psychological state of workers by observing their productivity, adaptation in the workplace, dialogues with their colleagues or managers and reactions. Determining the negativities in the psychological state of workers beforehand will allow prevention of both psychological occupational diseases and physical

injuries. Giving seminars that will provide psychological support for workers at certain intervals, making periodical psychological health assessments and including rewarding and appreciative activities will contribute to minimization of these damages.

At workplaces like forest nurseries where multiple workers work together, the correct implementation of work organization is important in terms of achieving occupational health and safety. Otherwise, dangers like faulty workflows, unsuitable working hours-break intervals-interval lengths, usage of inadequate protective equipment, lack of sufficient first aid material, hiring of untrained workers, work overload and inappropriate worker delegation may be encountered. Additionally, the improper implementation of the workflow may lead to psychological pressure and fatigue among workers. As a result of these dangers, work accidents, occupational diseases, musculoskeletal diseases, injuries and death may occur. For prevention of such situations, the most effective working and break times may be determined through studying every single line of work on the site. The workflow may be properly planned by individuals who are experts and experienced in terms of the works to be performed. Moreover, during the hiring process, workers should be given tasks that are the most suitable for based on their physical, psychological and educational statuses. In a work organization, the presence of third persons unrelated to the work on work sites may create significant risks for both the workers and the third persons. The presence of unrelated third persons on the site may be prevented by either warning signs or a good work management. During work, standing up for a long time, bending, reaching or sitting in the wrong position, the size of the worker or use of stools or counters at unsuitable dimensions may lead to significant musculoskeletal system disorders. This situation may be ergonomically assessed with methods like the Reba, Rula, Owas and Niosh methods by observing works thoroughly and detecting incorrect working postures. Incorrect working positions may be reduced by usage of portable and adjustable stools or counters and usage of portable hand tools that can perform wedding, digging and sapling lifting without requiring the worker to bend.

Every line of work has a unique technique based on the method used or the source of power/labor. A part of the works performed in forest nurseries are performed by human labor, while some are carried out with mechanization tools. This is why works performed by human labor and those performed with machines were separately assessed, and potential dangers were revealed. The risks created especially by semi-mechanized and fully mechanized tools carry great importance as their outcomes may be more severe. First of all, usage of the correct technique or machine based on the characteristics of the work that is performed and its weight is highly important in terms of occupational health and safety. While some of the risks posed by machines have direct effects such as injury, loss of limbs, becoming unable to work

or death, dangers like vibration and noise show their effects as occupational diseases as a result of long-term exposure. Maintenance of fully mechanized tools used in forest nurseries, their tire pressure adjustment, correctness of equipment connections and cleaning of the surroundings of exhaust pipes are effective in preventing significant work accidents. All maintenance of tools must be performed before their usage season and periodically. In the cabin sections of machines that are used, both thermal and easy movement comfort should be provided for the operator. Otherwise, the possibility of accidents may increase due to getting cold, sweating, getting nervous or the pressure of not being able to move comfortably. Due to the operator's lack of experience, training or irregularities in the machine or the ground, vehicle accidents like running over a worker or object or tipping may occur. The factors that pose the most danger in works performed by human labor are work accidents and diseases that workers are exposed to as a result of incorrect working postures practiced due to lack of training, loading by hand or carrying heavy loads. Therefore, training workers and operators about the work they perform, the tool/machine they use, and the risks of the work is important in terms of achieving workplace health and safety.

4. Conclusions

One of the most basic processes that need to be followed for eliminating or minimizing negativities that may occur as a result of work accidents and occupational diseases such as death, incapacitation or injury is risk analysis. A noticeable reduction in tangible and intangible losses related to these exposures is dependent on revealing dangers with a correct risk analysis and raising consciousness and awareness among workers based on these analyses.

In this book chapter, main dangers and risks that workers may be exposed to were presented by considering both works performed with human labor and those performed with machine power at open and enclosed spaces in forest nurseries.

Forest nurseries have different characteristics due to reasons like the differences in the physical conditions of the region they are in, land structures, works performed, species of plants that are grown and machines/tools that are used. For this reason, the risks that exist in nurseries with different characteristics show differences. By taking the table of dangers and risks that was specified for forest nurseries in the scope of this study, main dangers and sub-risks may be presented for each forest nursery. The risks specified in the scope of the study provide an infrastructure for risk analysis studies to be applied for both works that are performed with human labor and those that are performed with machine power in forest nurseries. Additionally, by applying the precautions stated for these risks in the study, it may be achieved to improve the occupational health and safety in forest nurseries.

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Chapter 3

INFLUENCE OF SOIL TILLAGE PRACTICES ON CO_2 EMISSION

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INTRODUCTION

It is known that global warming and related negative effects have been one of the most important environmental problems in recent years. Especially in the 1870s, which was accepted as the second half of the Industrial Revolution, there was a continuous increase in the concentration of greenhouse gases (GHG) in the atmosphere by introducing coal, iron, steel, electricity, petroleum and chemicals into the production process. This increase resulting from human activities causes the natural balance of the climate system to gradually deteriorate. 80% of the poorest group receiving the lowest share of income distribution in the world is living in rural areas with small scale agriculture and animal husbandry. Climate change-induced precipitation and soil degradation pressure on natural resources can force these vulnerable groups to migrate, triggering instability and bringing security risks (Anonymous, 2018c).

United Nations Framework Convention on Climate Change (UNFCCC) defined the greenhouse gasses (GHG) in the atmosphere as (Anonymous, 2008):

- CO_2 (Carbon dioxide)
- CH_4 (Methane)
- N_2O (Nitrous oxide)
- HFCs (Hydrofluorocarbons)
- PFCs (Perfluorocarbons)
- SF_6 (Sulfur hexafluoride)

Carbon dioxide (CO_2) is a gas that is increasing in the atmosphere day by day due to the consumption of fossil fuels, deforestation, rapid population growth, industrial activities, transportation and increasing the consumption tendency in the societies with 82% being the main responsible for global warming and directly related to energy consumption. According to World Meteorological Organization (WMO) report, Geneva, 22 November 2018, while the current CO_2 concentration in the world is 278 ppm before the industrial revolution (before 1750), this value is stated as 405.5 ppm in 2017 data. (Anonymous, 2019). The GHG emission distribution of Turkey for the years 1990 and 2017 are given in Figure 1 (Anonymous, 2018a).

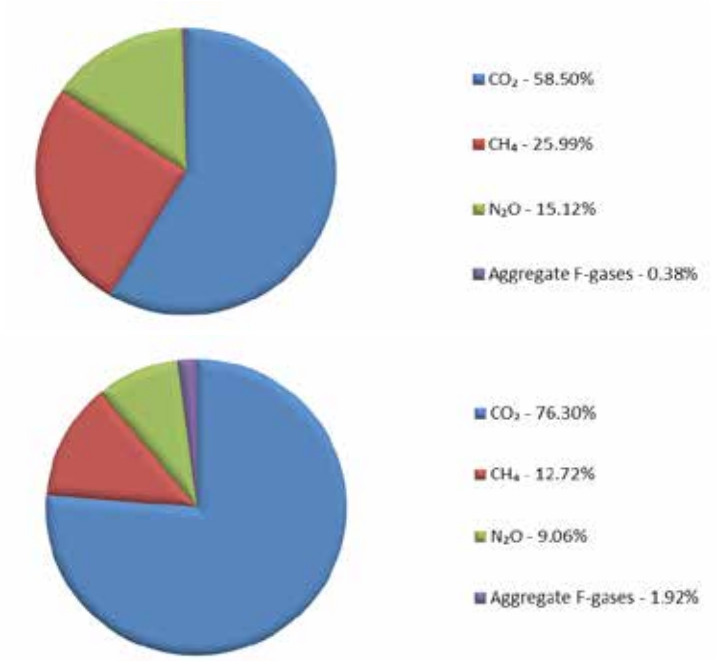

Figure 1. *GHG emissions in 1990 and 2017 in Turkey (Anonymous, 2018a)*

As is seen in Figure 1, the percentage of CO_2 emission was increased while the percentage of CH_4 and N_2O emissions decreased in a 27-year period.

When the amount of global CO_2 emitted to the atmosphere in 2013 is analyzed by sectors in Figure 2, it is seen that the highest share belongs to the amount of CO_2 released by energy production and agricultural activities, respectively (Anonymous, 2018b).

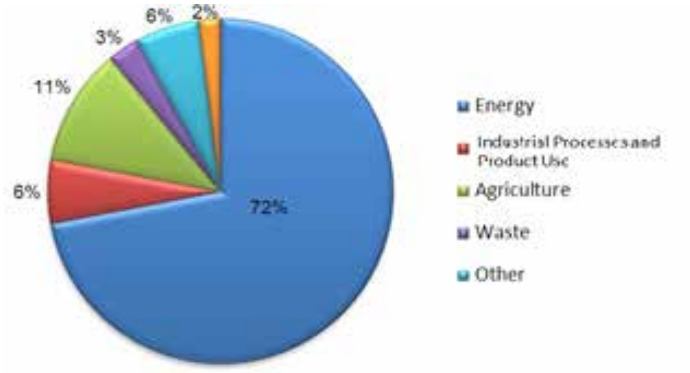

Figure 2. *CO_2 emissions in the world by sector in 2013 (Anonymous, 2018b)*

In Turkey, the amount of GHG emissions by sector in 2017 is shown in Figure 3 (Anonymous, 2018a).

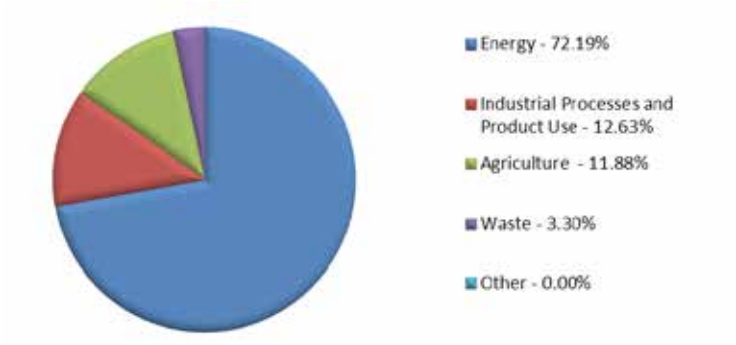

Figure 3. *CO_2 emissions in Turkey by sector in 2017 (Anonymous, 2018a)*

Turkey attended the Kyoto Protocol on 05.02.2009 by accepting in the Grand National. Article-2 of the Protocol emphasizes the need to promote sustainable agricultural methods in the light of climate change approaches in order to promote sustainable development and to achieve emission limitation and reduction. And 3.4-Article covers the improvement of the management of agricultural land (Anonymous, 2008).

Research on this topic focuses on the comparison of different management strategies in terms of Carbon (C) improvement in order to fulfill the commitments of the countries. In this context, with the developing environmental awareness, sustainable use of natural resources has come to the forefront today. For this purpose, while taking the necessary measures to increase the production obtained from the unit area, it is also essential to prevent future inefficiencies of natural production resources and the environment and to ensure economic sustainability.

GHG from Agricultural Activities

Although the agricultural activities vary, the Kyoto Protocol lists the greenhouse gas emission sources in agriculture as follows (Anonymous, 2008):

- Enteric fermentation
- Manure management
- Rice cultivation
- Agricultural soils
- Prescribed burning of savannas
- Field burning of agricultural residues
- Other

Soil cultivation practices in agricultural production activities directly or indirectly cause CO_2 emissions. Direct emissions are caused by fossil fuels consumed during tillage and indirect emissions are generated by CO_2 gas released from the soil to the atmosphere after tillage.

CO_2 Emission from Fossil Fuels

Fuel combustion emissions constitutes the main part of Turkish anthropogenic GHG emissions. Total emissions from the energy sector for 2015 were 340 Mt CO_{2q} and 99% of that amount is related to fuel combustion. Contribution of agriculture/forestry/fishing sector to fuel consumption emissions is 2.9% (Anonymous, 2018c). Today, the tractor is used as a power source in many applications such as seed bed preparation, weed control, harvesting and post-harvest processes in the agricultural production process and it is indispensable for soil cultivation applications. It is known that tillage practices are one of the most fuel consuming factors in agricultural activities. Especially intensive soil tillage applications increase the consumption of diesel fuel, which is a fossil fuel, and consequently increase GHG emissions to the atmosphere. If it is considered that the tractors older 25 years comprised the 45% of the tractor park in Turkey (Anonymous, 2019b), it can be predicted that fuel consumption and associated CO_2 emissions will increase further. For every 2.5 cm increase in moldboard plowing depth, about 0.140 l da^{-1} more diesel fuel is consumed (Helsel, 2007). The fuel consumption of a standard tractor is 4.56-4.82 l ha^{-1} at a working depth of 10 cm and 9.32-9.52 l ha^{-1} at a working depth of 20 cm when working with chisel (Koga et al., 2003). The amount of CO_{2eq} emissions resulting from the combustion of 1 liter of diesel is stated as 2.688 kg (Murphy et al., 2004; Baran and Eren, 2008). In Table 1, the average amount of diesel fuel consumption including the cultivation areas of some important agricultural products in Turkey in 2018 can be seen. Also the fuel consumption of these products before cultivation and planting processes and the GHG emissions are stated as CO_{2eq} emission amount.

Table 1. *GHG emissions due to average fuel consumption values in the production of important agricultural products in Turkey*

Crop	Cultivated area (da)	Fuel consumption (l da^{-1})	CO_{2eq} (million ton)
Wheat	84900000	6.54	1.493
Barley	36498000	4.98	0.489
Cotton	5907000	20.76	0.330
Sunflower	5854000	7.50	0.118
Corn	5360000	11.88	0.171
Sugar beet	3256995	12.18	0.107
Potato	1593480	23.28	0.100

The amount of fuel consumed by the tractor in soil cultivation applications varies depending on the depth of cultivation, the structure of the soil, the speed of the tractor and the equipment used (Rashid et al., 2013). There may also be differences in the amount of emissions depending on the tractor used and the quality of the fuel (Al-lwayzy, 2012). It is reported that tractors that have completed their economic life consume 30% more fuel and pollute the air more than 10 times a year compared to the new ones by using them in agricultural activities (Özgüven et al., 2010). No-tillage and reduced tillage applications contribute to both energy saving and CO_2 emission reduction with the need for less fuel consumption. Frye (1984), stated that a shift of 20 kg ha^{-1} of C per year could be prevented by switching from the conventional tillage using moldboard plough to the no-tillage method. Table 2 shows equivalent C emissions due to fuel consumption in some soil tillage equipment (Lal, 2004).

Table 2. *Equivalent C emissions due to fuel consumption in some tillage equipment (Lal, 2004).*

Tillage Operation	Equivalent carbon emission (kg CE ha^{-1})	
	Range	Mean±SD
Moldboard plug	13.4-20.1	15.2±4.1
Chisel	4.5-11.1	7.9±2.3
Heavy tandem disking	4.6-11.2	8.3±2.5
Standard tandem disking	4.0-7.1	5.8±1.7
Sub-soiler	8.5-14.1	11.3±2.8
Rotary hoeing	1.2-2.9	2.0±0.9

As is seen in Table 2, the highest equivalent C emission amount is determined by tillage plow with average 15.2 kg CE ha^{-1} and the lowest equivalent C emission amount occurs with rototiller application with 2.0 kg CE ha^{-1} on average.

CO_2 Emission from Soil Tillage Applications

Global warming, which is associated with the amount of CO_2 gas in the atmosphere, has made it necessary to minimize its emissions. 1400-1500 Gt of C, which corresponds to approximately twice the amount of C in the atmosphere, is found in the world's soil. Agricultural soils have a major role in C storage as organic matter in the soil. Carbon content of agricultural land is 170 Gt (Rastogi et al., 2007). Holding C in soil increases the infiltration, decreases the wind and water erosion, minimizes the compaction, increase the soil quality, reduces the flux of CO_2 (Reicosky, 2001). Soil C dynamics is important both in terms of sustainability and indirectly affecting climate change. There is always a standard respiration in soil. Plant roots and organisms consume O_2 for respiration and produce

CO_2. This respiration is 0.5-10.0 mg CO_2 m^{-2} days as CO_2 release in field soil (Haktanır and Arcak, 1997).

In this context, CO_2 emission is the final degradation product of soil organic matter spreading to the atmosphere and is significantly affected by soil tillage applications. (West and Marland, 2002; Barut et al., 2011, Yerli et al., 2019). Breaking down soil aggregates, mixing soil and organic particles, improving infiltration and water-holding capacity and thereby increasing CO_2 production are some of the few things tillage causes. On the other hand reduced tillage is reported to reduce emission of CO_2 due to less ploughing of soil and keeping the soil organic C unexposed (Rastogi, 2002). When the long term studies are examined, it is seen that more CO_2 is emitted into the atmosphere as a result of soil loosening and increasing biological oxidation in intensive soil cultivation activities (especially plow cultivation) (Reicosky, 2001; Alluvionea et al., 2009; Santos et al., 2019). Intensive tillage oxidizes 30-50% of C in soil. Conventional tillage is a soil tillage system where most of the residues are buried in the soil, leaving less than 15% residues on the soil surface after planting. Conservation tillage method is a tillage system in which at least 30% of the soil surface is covered with plant residues after planting or in the critical erosion period (Köller, 2003).

It is known that average short-term CO_2 emissions are 30-50% higher in conventional soil tillage applications based on using plough than in conservation tillage (Reicosky, 1997; Al-Kaisi and Yin, 2005; Brye et al., 2006; Barut et al., 2014). Also in long term experiments higher CO_2 emissions were determined in conventional tillage treatments (Curtin et al., 2000, Ussuri and Lal, 2009). Reicosky (2002), investigated the effect of plow cultivation on soil CO_2 emissions over a three-month period in western Minnesota. Some of the trial plots were plowed and the other part was left without plowing. When the obtained values were examined, CO_2 emission was measured as 100 g m^{-2} per hour in plowed plots and this value was less than 0.9 g m^{-2} in untilled parcels. In the following 85 days, the cumulative CO_2 emissions were 2.4 times higher than plots treated with plow than untilled parcels.

Sustainable soil management is one of the main objectives to reduce and prevent environmental impacts of agricultural activities and physical, chemical and biological degradation of soils. As the soil residues are deposited more naturally on the soil by conservation soil tillage, C remains on the soil surface and slowly turns into soil organic matter. Increasing the retention of C in the soil improves soil quality, reduces C emissions and improves environmental quality.

So et al. (1999), calculated that the transition to a conservation soil tillage system could reduce the annual CO_2 emission of 9.4 Mtons to 4.3

Mtons even 50% of the approximately 47 million ha of land cultivated in Australia every year. In addition, they stated that there would be an additional CO_2 emission reduction of 0.43 Mton in every 5% area where a conservation soil tillage system would be introduced. Sperow (2003) stated that 47 Mton C could be kept in the soil if no tillage agriculture is applied in 129 million ha of land processed in the USA every year. In the same study, if 50% of the cultivated areas were applied with no tillage method and the other 50% with conservation tillage method, it was calculated that the amount of C that can be kept in the soil would be 37 Mton. Applying CA even on 30% of the total area of arable land in the EU-27, translates to 0.77 t C ha^{-1} yr^{-1} in reduced CO_2 emissions, as well as 44.2 l ha^{-1} in reduced fuel consumption (Kertész and Madarász, 2014). With annual CO_2 emissions, China is among the countries most responsible for global warming. It is emphasized that if the ratio of soil surface covered with residues is increased from 25% to 50% in the areas where agricultural production is carried out and 50% of the cultivated areas are switched to no tillage methods, approximately 2.4 billion tons C can be kept in the soil (Yan et al., 2007).

CONCLUSION

Humanity is faced with a world problem where global warming and climate change restrict the living conditions, drought is becoming more pronounced and desertification is accelerating. Climate change due to the increase in the amount of GHG in the atmosphere and agricultural production activities interact with each other. The adoption of appropriate methods and policies to reduce CO_2 and CO_{2eq} emissions from agricultural production is crucial to agricultural sustainability. The amount of GHG emitted to the atmosphere as a result of soil tillage practices in agricultural activities is considerable. Adoption of appropriate methods and policies to reduce emissions from tillage practices is crucial for agricultural and environmental sustainability.

Any tillage method is not suitable for all soil and climatic conditions. It will be useful to compare the conservation soil tillage systems which can be an alternative to conventional tillage systems in different soil conditions, different product patterns on an environmentally compatible and economical basis on a regional basis.

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Chapter 4

THE IMPORTANCE OF ORGANIC AGRICULTURE AND AGRO TOURISM IN THE COVID-19 PANDEMIC

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INTRODUCTION

COVID-19, which started in December 2019 in Wuhan, China and became a pandemic, It had an incredible impact on all sides of the world. The first to come to mind from the areas it affects are health, education, nutrition, medicine, trade and economy. In addition, people had to live in isolation due to the epidemic and the epidemic affected also people's psychology (Ongan et. al, 2020). The Covid-19 outbreak has created changes in people's daily lives around the world. The pandemic that has begun to reshape people's preferences for healthy eating, It has already begun to have significant consequences for the organic food industry (URL 1).

Especially during the pandemic, the fact that people have to keep their immune system strong, avoid foods with high preservative content and feed with products rich in antioxidants has brought organic products to the point of search. Food is an important part of getting proper nutrients in the body and hence deserves vital attention to develop proper immune system in the body. Organic farming is the solution for it (Kumar, 2020).

In addition, being in the open air, which is one of the most important ways of protection from Covid-19, has made open spaces very attractive. In case people prefer Agro-tourism; It has the advantage of both spending time in the open area and easy access to healthy and fresh products. In addition, agricultural tourism helps to support local family farms, visitors have the opportunity to learn about a less hectic lifestyle in harmony with nature. Likewise, farmers have the opportunity to sell their products first hand

Agriculture and tourism complement each other in terms of common features. The relationship of the agriculture and tourism sector with each other, the rapid consumption of resources, and the longing for natural life by people have revealed agricultural tourism, which integrates agriculture and tourism (Özkan, et. al, 2020). Due to the pandemic, people now want to go to gardens and farms; organic product trend has increased much more after the global outbreak.

Purpose of the study; To emphasize the importance of organic agriculture and agro-tourism areas in the covid-19 pandemic.

ORGANIC AGRICULTURE

With the rapid population growth and the increasing food requirement, the ecological damage caused by the widespread use of chemical inputs has led to an increase in the demand for organic products. The main reason for this is that organic production is an alternative form of production that aims not only increasing the amount but also producing quality and healthy

products as in conventional agriculture (Ayla et. al, 2017).

The main purpose of organic agriculture; To make sustainable production without polluting the water and air by protecting the health of human, animal, plant and environment. In this way, while producing healthier and more reliable production, it will be possible to protect basic elements such as soil, water and air for years without damaging them (Atak et. al, 2014).

The principle aims of organic agriculture to produce quality and sufficient food.

To interact with natural systems in a constructive and life-enhancing way.

To consider the social and ecological impact of the organic production and processing system.

Maintaining and improving the agricultural system, especially biological cycles involving micro-organisms and soil

developing sustainable water ecosystem (Rigby et. al, 2001)

Using the soil sustainably

Growing healthy products

Not polluting the nature with pesticides

Supporting biodiversity

Using local varieties to keep local seeds alive

Organic production not only protects the environment and health, but also reduces global warming by 37%. It preserves quality and extinction in the processed product. It also preserves biological diversity. Organic agriculture supports many sectors in the form of quality raw materials or sales of their products. These sectors are indicated in table 1 (Ünal, 2006).

Table 1. Non-Food Sectors Supported by Organic Agriculture

Sectors Supported by Organic Agriculture
Agro tourism
Green hotel management
Restaurants
Local Branded Products (Local products)
Health tourism
Catering services
Textile
Cosmetic
Forestry

It is a proven fact that organic farming has many environmental benefits compared to traditional agriculture. Studies have shown that it reduces soil erosion, the use of pesticides, less energy is consumed during organic cultivation and reduces agricultural greenhouse gas emissions, increases soil fertility (Seufert, 2012). In shortly, Organic principles are biodiversity, integration, sustainability, natural plant nutrition, natural pest management, and integrity (Figure 1) (Rana, 2016).

Organic food production has varied qualified benefits for human health, and more application of these production methods than in coventional agriculture, e.g., in integrated pest control, would therefore most likely benefit human health (Mie et. al, 2017).

Figure 1. *Princible of Organic Farming (Rana, 2016).*

WHY ORGANIC AGRICULTURE IN THE COVID-19

During the Covid-19 pandemic, people have to keep their immune system strong, stay away from foods with high preservative content and feed with products rich in antioxidants. This status has caused the people to the point of seeking organic products.

Epidemiological and experimental studies point to the importance of immune system, infection and dietary interventions in the nutrition triangle (Acar Tek et. al, 2020). From most of the comparative studies, it appears that food from organic production can bring beneficial effects in the prevention of the obesity, diabetes, cancer, atherosclerosis and allergies diseases (Rembialkowska, 2016). Moreover, animal studies published in recent years indicated increased immune parameters in organically fed laboratory animals (Huber et. al, 2017).

The report, prepared by Ecovia Intelligence, a research, consulting and education company with international experience in organic and related product industries, states that people's turning to more natural foods to strengthen their immune systems against the virus has brought a significant increase in sales in the global organic food market (URL 1).

Especially in the covid-19 pandemic, people should be aware of the need to strengthen their immune systems and should make an effort to reach organic products. And also most studies explanation that organic consumption is closely linked to other health and lifestyle indicators, e.g., consumers often have lower body-mass index (BMI), have higher education and income, are more physically active and have healthier diets than those who do not or seldom use organic food (Brantsæter et. al, 2017).

Scientific publications comparing organic and conventional systems, it was reported that the organic crops contained on average 6% more vitamin C in relation to the conventional crops and it has significant difference (Rembialkowska, 2016). During the Covid-19 pandemic, the recommendations of doctors are to increase vitamin C consumption. Because in the researches; It has been established that vitamin C deficiency causes deterioration immune activation and higher susceptibility to infections. A study has shown that vitamin C can alleviate or prevent infections caused by bacteria, viruses and protozoa (Acar Tek et. al, 2020) Many studies have shown that consumption of organic food reduces the risk of pesticide exposure (Rock et. al, 2017) (Figure 2)

The coronavirus pandemic has led to an increase in demand for organic and sustainable foods. Retailers around the world are experiencing large sales increases for organic products (URL 1).

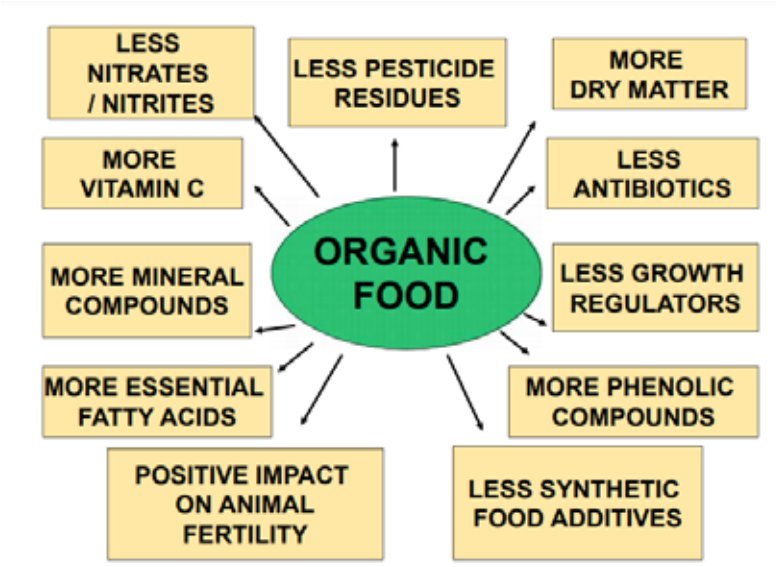

Figure 2. Composition of the organic food is profitable for health (URL 2)

AGRO- TOURISM

Agritourism began to develop in the 1990s due to an increased demand for new culture of travel, in the case of which tourists preferred inexpensive holidays close to nature. Agriculture and tourism supplement each other in terms of common features. The relationship of the two sectors with each other, people's longing for natural life and the increasing consumption of resources have created agro-tourism by integrating agriculture and tourism.

Agro-tourism is a way of sustainable tourist development and multi-activity in rural areas through which the visitor has the opportunity to agricultural occupations, local products, get aware with agricultural areas, traditional food and the daily life of the rural people, as well as the cultural elements and traditions (Kumbhar, 2009). Farmers have expanded their recreational opportunities to include accommodation services since the beginning of the 20th century (Wojcieszak-Zbierska et. al, 2020; Civelek et. al, 2014).

Agro-tourism is the practice of attracting visitors to an area used basically for agricultural purposes. It attracts tourists to rural communities for a form of recreation that follows the growing trend of tourism that is both relaxation and educational (Mahaliyanaarachchi, 2014).

Although agricultural tourism (agrotourism) is often used to describe all tourism activities (e.g. festivals, museums, handicraft exhibitions and other cultural events and activities) in rural areas, it is either related to the

agricultural environment or tourism products directly linked to agricultural products or includes camping, educational visits, meals, recreational activities, and activities related to the sale of farm produce or handicrafts. In general, the concept of agricultural tourism includes activities that enable farm owners to present their experiences on agricultural production and products to their guests. Farmers' markets, old and / or new farms, roadside stalls, farmhouse accommodation and local food and beverage tasting, recreation and rural recognition activities are the main components of agricultural tourism (URL 3).

Among the features of Agrotourism can be said:

1. It includes accommodation at the owners' home.

2. It involves the whole family of farmers, whose customs and traditions are preserved.

3. It allows customers to have away from crowds and to be in nature assisted by friendly people.

4. Provides the opportunity to spend time in nature

5. Provides the opportunity to eat natural foods in a fresh way.

6. Teaches how to reach natural nutrients

Agro tourism goes well beyond a mere offer of services in a rural setting (López et. al, 2006).

According to Ciornei (2011), agro tourism is an innovative concept that combines agriculture and tourism activities, providing employment and additional income for farmers. Agricultural tourism, also known as agro-tourism, has emerged in areas where agricultural activities are carried out and have natural attractions (İlban et. al, 2018).

Agri tourism is an important way of modify agriculture and rural areas. In addition, it is a part of the idea of sustainable and multifunctional agriculture. It enables the use of production resources in the rural areas and creates an additional source of income for both farmers and the local community (Wojcieszak-Zbierska et. al, 2020;)

WHY AGRO-TOURISM IN THE COVID-19

The isolation process experienced due to the Covid-19 Pandemic has brought ecotourism to the fore. Isolated days have made mountain tourism, plateau tourism, agricultural tourism and rural tourism attractive to people and the interest in these holidays has increased.

As people's interest in nature increases with the pandemic, the interest

in types of nature based tourism such as plateau tourism, rural tourism, eco-tourism and small scale accommodation establishments will increase even more, there will be travels in numbers with fewer groups, transportation vehicles will serve as the same size but low capacity (Altınay Özdemir, 2020; Kıvılcım, 2020).

Agro tourism has opportunities such as educational experiences, outdoor activities, accommodation, direct agricultural sales and entertainment. These opportunities are very important for both farmers and tourists. These opportunities include activities that tourists do in the countryside. It also offers income-generating opportunities for farmers (Demirezen, 2020).

Figure 2. An example of an agro tourism holiday with a mask in Covid-19 pandemic (URL4).

As seen in Figure 2, people are turning to green areas that are not crowded and where they can breathe comfortably in the pandemic. Especially families with children have difficulties keeping the children at home during the curfews. For this reason, he wants to be away from the crowd and to be comfortable in nature with his children. They prefer agro tourism where they can be fed with fresh products, especially organic products.

Having to live isolation in the pandemic especially affected children very much. During this period, children face the danger of becoming asocial. For this; If families prefer both open space and agro tourism with

their children, it will provide socialization for their children (Figure 3).

Today, with the pandemic, the importance of natural products and rural life has been understood more. Agro tourism has started to be discussed and researched more. In addition, when people prefer agro tourism during their holidays, they have the opportunity to communicate with people living in nature, so they have the opportunity to access natural products after their holidays.

Figure 3. An example of the growing interest in agro tourism (URL 5)

CONCLUSIONS

As a result, organic agriculture and agro tourism, which support biodiversity and are a part of sustainability, have started to attract people's attention in recent years. Especially as the level of awareness and income increases, people's interest in organic agriculture for healthy nutrition increases. In addition, with the search for different holiday alternatives, agro tourism attracts the attention of people.

According to the researches, the interest in agro tourism is especially striking for people whose average age is between 35-54 and who want to rest their soul in the silence and green of nature by getting tired of the sea and sand holiday. With the Covid-19 pandemic has started, people's has increase interest in organic agriculture and agro tourism. With the beginning of the Covid-19 pandemic, people have to strengthen their immune systems and stay away from people. This situation; it has pushed them to seek agro tourism where they can find healthy products and be distant from people.

In this study recommend that;

1.People can be prefer organic products for healthy nutrition.

2. They can be prefer organic products because they do not pollute the nature,

3. They can be prefer agro tourism which it allows them to see of green in nature

4. They can be prefer agro tourism as it supports the farmer on site and provides additional income.

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Chapter 5

BALCONY VEGETABLE GROWING IN THE COVID-19 PANDEMIC

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INTRODUCTION

The Covid-19 outbreak has swept the world and created a social crisis due to its transition from person to person. People had to be alone to avoid disease. With this crisis across the world, gardening has been an important means to provide food security, economic relief and mental and physical wellbeing (Hannah et. al, 2020).

People are experiencing uncertain and quite difficult days during the Covid-19 epidemic. The benefits of plants (psychological, health, economic, productive) in this period of forced isolation can be of key importance (Sofo, 2020). The fact that people have to spend more time in their homes during the pandemic brings up the desire to spend time with plants.

Especially people over the age of 65 cannot to go outside their homes for a long time and are squeeze in their homes. People need physical and mental satisfaction as they have to live isolated in urban areas. By causing the tendency to the plant; there are many reasons such as psychological relaxation, having a pleasant time, and moving the body. In the cities, people grow vegetables according to the conditions of their own balconies, eliminating their longing for green, and gaining psychological relaxation and healthy nutrition.

Considering that by 2030, two-thirds of the world's population will urbanize and 41 megacities will emerge, balcony vegetable growing; It sounds very nice as the space where the city people can relax and breathe in the difficult urban life. Also, the low carbon footprint and the greater transparency of food production mirror the modern urban lifestyle and make urban agriculture particularly interesting (Eigenbrod et. al, 2015). Against the occasional disruptions in the food supply chain caused by the Covid-19 epidemic, growing vegetables on the balcony means being prepared for these disruptions (Lal, 2020).

Beyond these, balcony vegetable growing provides an opportunity for children to get to know vegetables and to have a healthy and pleasant time with their parents. In recent years, children have been raised in isolation from nature and their conditions are very suitable for digital addiction. Balcony vegetable cultivation gives an opportunity children giving labor to plants and love it.

The purpose of this study; Firstly, during the Covid-19 pandemic, it proposes that people living in cities should examine the sunny and shady hours and wind conditions of their balconies and determine the climatic data of the balcony. Then providing technical information that to determine that the vegetable alternatives they can grow and the suitable containers

according to the root structures of the vegetables they choose and about maintenance conditions.

CLIMATIC FEATURES REQUIRED ON THE BALCONY FOR CULTIVATION

Sunlight

Light is indispensable for Plants. Sunlight demand of vegetables is quite high. Especially some vegetables (e.g tomatoes) require up to ten hours of sunlight a day. Some leafy vegetables can tolerate partial sun, but root crops and fruit-bearing varieties like tomatoes, peppers, cucumbers, and eggplant prefer full sun. Plants should receive six or more hours of sunlight during the day.

Before starting cultivation, the light exposure and time intervals of the balcony should be observed and take the necessary notes. For the plants you want to grow; In cases where sunlight demand is high, this plant should be placed on the part of the balcony that receives the most sun. Then, ıt should be placed gradually according to the sun demand and shade demand (Germain, et.al., 2008, Carey, 2009).

For growing vegetables on the balcony, the different aspects of the balconies make a big difference. Care should be taken to choose the appropriate plant type according to the length of the lighting period and the lighting intensity (Sun et. Al., 2015).

Plant and flower diversity creates positive ecological and aesthetic effects. In addition, these plants are involved in oxygen production through photosynthesis and evaporation. It may be too much to think that every terrace or balcony will be green, but considering one of the two balconies is green, the city would be green enough to slow down climate changes. From another point of view, the efficient greening of the balconies of buildings is an important link in realizing the low-carbon green buildings concept. Green spaces contribute to the provision of ecosystem services in urban areas. They filter air, reduce pollution, cool temperatures, attenuate noise, etc. (Mladenovıć et, al., 2017).

Environmental Factors

When growing plants on a balcony, it’s important to think about two things. The first is wind. The second factor is how much sunlight your space gets throughout the day. If your balcony doesn’t have a tree next to it or a neighbouring building, you may get excessive sunlight, especially if you’re south-facing or west-facing. For situations like this, generally recommends planting heat-tolerant crops like okra, bush beans, rosemary, thyme and lavender (URL 1).

Although the cost of growing vegetables outdoors is low, some areas are not suitable for food production. (Eigenbrod et, al. 2015). Heavy metal concentration of vegetables grown in urban areas is related to the area where the plants are grown. When plants are cultivated nearby pollution sources (e.g., main roads), risks of heavy metal accumulation is increased (for example; about 1.5-fold when vegetables are grown 10 m from the road as compared to 60 m away) (Antisari, et, al., 2015).

In other words, as the balcony where vegetables are grown moves away from the main road, the risk of heavy metal carrying of the grown vegetables decreases. If the balcony is closer than 60 m to the main road, then it should be benefited from the visual and psychological aspects of balcony cultivation by cultivating ornamental plants on the balcony.

Required Equipment

There is no need for heavy soil digging and processing tools for balcony vegetable growing. Instead, a quality hand fork to stir the soil and aerate the roots, plantuvar for planting seedlings, pruning shears for pruning and picking, containers in various sizes and shapes (Whittingham, 2015).

Containers can be temporary or permanent, expensive or free. For example, bushel baskets, drums, gallon cans or wooden boxes. The size of the container will vary according to the crop selection and space available (Traunfeld, 2006, Masabni, 2009). The fact that its pot is cheap, its shape is beautiful, and it is easy to find are among the properties sought for balcony vegetable growing.

Proper containers include plastic pots; wooden baskets; plastic, metal or wooden buckets; milk cartons – even plastic bags and recycled cardboard boxes. If necessary, drill holes along sides near the bottom and put a ½ inch layer of coarse gravel in the bottom of each container for proper drainage (Kopsell, 2018, Jauron, 2013).

Plastic containers; they are light, retain moisture well and You can choose the color according to your plant because they are colored and you can create a visual appearance on your balcony with plastic containers. Large plastic can are cut and drain holes are made at the bottom, making them very suitable for plants with large roots (such as tomatoes). One of the most important issues in balcony vegetable growing is that the vegetable growing container should be at least 40 centimeters deep (Oldenburg et. al, 2012).

Table 1. *Round Pots Suitable For Vegetable Types*

Deep-Rooting	Medium-Rooting	Shallow-Rooting
		
Artichoke Asparagus Bean Lima Parsnip Squash Sweet Potato Tomato	Bean Beet Carrot Chard Cucumber Eggplant Mustard Pea Pepper Turnip	Broccoli Cabbage Celery Chicory Garlic Leek Lettuce Onion Parsley Radish Spinach

Table 2. *Examples of horizontal pots suitable for vegetable types*

Deep-Rooting	Medium-Rooting	Shallow-Rooting
		
Bean Sweet potato	Corrot Parsley Mint	Garlic Lettuce Onion Radish

Properties of the soil to be used in pots

The growing media must provide physical support, water and nutrients for the plants, in order to grow healthy plants. well-drained soil should be used. Soilless mixes are well suited for balcony vegetable and may be composed of sawdust, perlite, or vermiculite. These are not contain of disease and weed seeds, hold moisture and nutrients at the same time drain

well and are lightweight. Soilless mixes can also be prepared by mixing horticultural grade vermiculite, limestone, superphosphate and garden fertilizer (Masabni, 2009).

Recommended soil blends ingredients:

- 25% garden soil + 75% compost
- 25% soil-less mix + 25% garden soil + 50% compost
- 25% garden soil + 75% soil-less mix
- 50% soil-less mix + 50% compost (URL 2)

Fertilization

There are two types of fertilizers: slow-releasıng fertılızers and water soluble. Both are needed for container vegetable growing success. slow-releasıng fertılızer is added at planting time, and should be thoroughly incorporated into the soil mix. Look for a complete, balanced type such as a 10-10-10 formulation. Water soluble fertilizers are added in the middle of the growing season. This additional fertilizer is needed because most potting mixes don't retain nutrients very well (Demboski et. al, 2015, URL 3).

if slow-release natural fertilizers are given several times during growing season, plants grow gradually. Sometimes, the application of organic manure and compost to soil helps to boost the activity of micro-organisms (Bal et. al, 2020, Koske, 2007). In fact, organic fertilization is very ideal for balcony vegetable growing.

VEGETABLES SUITABLE FOR BALCONY GARDEN

One of the most important issues to know when deciding on the plants to be grown on the balcony is the root structure of the vegetable. If the balcony is suitable for this, plants with broad root structure can be grown in large containers. In cases where it is not suitable, cultivation can be started by choosing the shallow rooted plants that can grow in smaller containers (Masabni, 2009). Especially chard, mint and parsley are vegetables that are always ready to use on the balcony, as they are vegetables that continue as they are collected. Vegetables that are ideally suited for growing in containers include tomatoes, peppers, eggplant, green onions, beans, lettuce, squash, radishes and parsley. For example, as the growing outer leaves of the chard are harvested, the leaves from the inside continue to grow and soon harvest.

Some Suitable Vegetables;

Tomato: Tomatoes are one of the easiest one to grow in a balcony. If a balcony receives abundant sunlight for at least 6 hours, tomatoes can

be grown. Grown from seedling. If the aerial space is limited, a dwarf or determinate tomato variety can be chosen. Besides, cherry tomatoes can also be grown, as it is said to be nutritionally richer than the normal tomato and also fetches good yield (Bal et. al, 2020).

Cucumber; It is not suitable for a small balcony due to its large leaves. Grown from seedling. When irrigated regularly after fruit set, it can be harvested quickly.

Pepper; They are very suitable plants for the balcony. In addition to all types of pepper being suitable of balcony, especially ornamental peppers are more suitable for visuality. Grown from seedling. In addition, the thin peppers for breakfast can be indispensable for breakfast tables because they are harvested in a short time. Pepper is an advantageous plant for balcony cultivation, as it can live a little longer in cool weather on the balcony.

Figure 1. Some vegetables for balcony vegetable growing 1. Lettuce, 2. pepper,3. Tomato (URL 4, URL 5)

Green Onion- Green Garlic; Green onion and green garlic can be produced in a short time by planting shallots and separating the garlic cloves. Besides, it is one of the plants that can be grown on the balcony in all seasons.

Lettuce; It is a vegetable that is desired to be consumed fresh but loses its freshness quickly. Grown from seedling. It is one of the ideal plants for balcony cultivation that can be found fresh at any time. It may be possible to have a lettuce plant on the balcony for a longer time by allowing the plant to continue to grow by detaching the lettuce from the outer leaves as much as the kitchen needs.

Radish; Radish can be grown in medium to even small-sized pots. Grown from seed. Especially small varieties early maturing variety can be picked as soon as in 23-27 days after the germination. Since it comes to harvest in a very short time, it is one of the plants that can be grown on the

balcony for a longer time by gradual planting (Bal et. al, 2020).

Parsley; grown from seed. The germination of seeds can take 15-20 days, irrigation is very important during the seed germination period and sprinkler irrigation is required. When the plants have 2-3 leaves, it can be done irrigation with flood irrigation. Irrigation is done according to seasonal conditions, but parsley is extremely water sensitive. if the water is too much, the plants turn yellow. Its root structure is suitable for growing in horizontal pots. Parsley is an indispensable plant in balcony vegetable growing, as fresh parsley is always needed in the kitchen (URL 6).

Chard; It is grown from seed. It should be kept in light shade in summer and under the sun in other months. Chard likes water, but if you water too much, the roots may rot. As chard leaves are collected, its leaves grow again and continues to give product for a long time. You can collect the chard that you will use in your meals from your balcony.

Mint; It is great of importance in terms of oils and especially menthol and tannins it contains in the medicinal and aromatic plants class. The mint plant has abundant fringe roots. Its main root is in rhizome structure. Mint is usually produced with steel. Mint generally develops well in semi-shade and cool areas. As the vegetables usually require sun, mint is an ideal plant for the shade place of the balcony. Needs water during the growing season (Ellialtıoğlu et. al. 2007).

Figure 2. Some vegetables for balcony vegetable growing 4. Mint, 5. Radish, 6. Parsley (URL5, URL6)

Maintenance Work

The key to a successful container garden is to nurture your plants with water and weekly fertilizer to encourage a bountiful harvest. Remember that containers dry out faster than a garden bed and will need to be monitored daily. The easiest way to determine watering needs is to stick your index finger about 2 inches down into the soil. If it feels dry y, it is time to water (URL7 ; URL 8)

Adequate sun exposure should be provided. The color of the plant must be controlled. Lightening of color and poor growth in overshadow vegetables is a symptom. When these controls are made regularly, as soon as the weak growth is noticed in the plant, the plant can be taken to a sunny place. Pruning your plants helps to thin out dead or dying branches, provides more sunlight and nutrients to get to the plant, and provides fuller and tastier vegetables because the plants are not working as hard. Some researchers suggest that it's also important to give liquid fertilizers specific to the plants being grown and fertilizing every two to three weeks. For fruiting plants, they recommends a phosphorus fertilizer, and for leafy greens a nitrogen-rich option like fish emulsion (Leigh, 2012).

THE EFFECT OF BALCONY VEGETABLE GROWING ON HUMAN PSYCHOLOGY

During the Covid-19 pandemic, people feel negative emotions such as fear, anxiety, depression and loneliness on days when they have to spend time at home. Nature's calming, healing properties and many positive effects on human beings are an accepted fact. Balcony vegetable growing supports people psychologically during the pandemic. Spending a certain time of the day on the balcony dealing with vegetables, helps the human body to move and remain calm. Vegetables' unique colors, textures and scents allow people to relax by providing sensory stimulation (Kaplan et. al., 1989; Marcus et. al., 1999).

Vegetables also give a sense of energy and have a calming effect with their unique flower colors (yellow, blue and purple etc.) (Bulut et. al, 2006; Whitehouse et. al, 2001). Beautiful and pleasant smells are an element that lowers blood pressure, slows breathing, and reduces pain and anxiety. Growing aromatic and fragrant vegetables such as mint and parsley on balconies also benefits in this sense (Yücel 2013; Sakıcı et. al, 2013).

For buildings in metropolitan cities, balcony gardens provide green spaces by creating attractive views. At the same time, by creating a natural environment for people, it allows all family members to live in green (Yener & Akdeniz, 2019; Bal et. al, 2020). In this context, it will be ensured that the people who stay at their homes during the pandemic grow vegetables on the balcony, and the process will be passed in a positive way.

CONCLUSION

In the covid pandemic, people are going through very difficult times. In these difficult days, different alternative are required for people to have a pleasant time at home. The best example of this alternativ is balcony vegetable growing.

When the benefits of growing vegetables on the balcony are summarized;

1. When plants are cultivated on the balcony, the building looks more lively and beautiful.

2. Healthier nutrition is provided by balcony vegetable growing.

3. When not going out during the pandemic, the necessary greenery for the kitchen can be provided.

4. Body movement is ensured while balcony vegetable growing.

5. Mental relaxation and relief from stress while doing balcony vegetable growing.

6. Children spend time growing vegetables on the balcony with their families, its move away them from the digital world and It is ensured that they learn vegetables by actually growing them, not in digital games.

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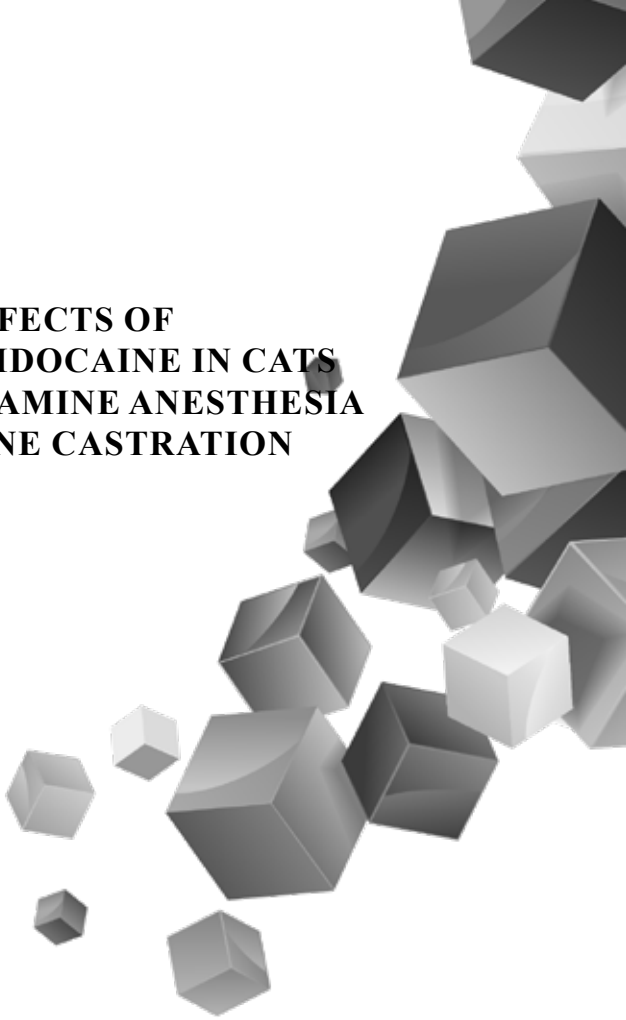
Chapter 6

INTRAOPERATIVE EFFECTS OF INTRATESTICULAR LIDOCAINE IN CATS WITH XYLASINE-KETAMINE ANESTHESIA UNDERGOING ROUTINE CASTRATION



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Introduction

Castration is assumed to be a moderately painful operation and is one the most commonly applied surgeries in the veterinary medicine.[1,2] It has been noticed that only 30% of veterinarians applied analgesic drugs to cats undergoing elective castration.[1] Virtually all the analgesia was given systemic, with 50% used only an opioid, 27% prefered only a nonsteroidal antiinflammatory drug and 23% used combined analgesics.[1]

The applied of local anaesthetics has been presented to have utilities on systemic analgesia in medicine.[3] Various articles have reported that the application of lidocaine both into the spermatic cord and testes reduces nocifensive responses and pain associated with castration in horses[4], piglets[5], lambs[6], calves[7], and dogs[2].

No research has evaluated the consequence of intratesticular lidocaine administration in xylazine-ketamine anesthesia regime for routine castration of cats. This study was carried out to compare the effects of lidocaine by intratesticularly on perioperative nocifensive reply in elective castration of cats under xylazine-ketamine anesthesia technique experiencing elective castration.

Materials and Methods

Eight cats between 0.5 and 3.5 years of age received for planned castration were suitable for inclusion. Cats appreciated to be healthy upon clinical examination by the senior researcher were joined (Association of American Anesthesiologists' classification I or II). Exception criteria covered offensive temperament, previous adverse reaction to nonsteroidal antiinflamatory drugs (NSAIDs), and extreme anxiety. All cats had their body condition score recorded (BCS), body weight (BW), and age. All cats were operated as day-patients, received before 08.30 hours and send to local shalter in the evening at the same day. Cats were fasted 18 hours before surgery, but the water was adlibitum. The experimental procedure was authorized by the local ethics committee (approval number: 2014-12).

Cats were incidentally included to experimental group: a xylasine-ketamine. All cats were premedicated with xylasine (2 mg kg^{-1}, IM, Alfazine, Egevet). After 15 minutes ketamine (10 mg kg^{-1}, IM, Alfamin, Turkey) was administrated in group. Serum physiologic solution (Izotonik NaCl; Eczacıbaşı) was administered IV (10 mL kg^{-1}, IV, ph) during surgery.

Also to clinical following, the electrocardiogram (ECG), respiration frequency (*f*R), pulse oximetry (SPO_2), blood pressure (BP), heart rate (HR), and rectal temperature (RT) were determined continually by GTE9003E multi-parameter monitor (Guoteng; China). Data were recorded at every time points.

The primary experimental readings (*f*R HR, BP, SPO_2, and RT) were made before premedication. This time was considered to be baseline. Cats were primed for prescrotal technique in a ordinary aseptic preparation, which joined ready of the scrotal skin. The closed scrotal castration technique was used. Cats applied a tardy administration of 1 mg kg^{-1} lidocaine %2 (Lidokaine; Himfarm) into the left testis utilizing a hypodermic needle (Bıçakçılar; Turkey) and appropriately dimensioned injector. The lidocaine administration was discontinue if happened firm and swollen within the testis was nominatively aforethought to be extreme by palpation of finger. The left testis was removed 5 minutes after the lidocaine injection. The lidocaine was not administrated in right testis, which is removed before the left testis, in each group. Right testis was the control group.

Appropriate anaesthetic depth was made certain all through anaesthesia by constant appraisal of palpebral reflex, eye position, and jaw tone. Experimental measurements (*f*R, HR, BP, RT, and SPO_2) for statistical evaluation were determined at five time points during anesthesia ensuings; T0 was baseline, T1 was subsequently the start of the surgery, T2 and T3 were next the clamping of left and right tuniculus spermaticus, in orderly, and T4 was at the end of the operation. Carprofen was administered (4 mg kg^{-1}, IV, Rimadyl, Pfizer) to all cats after the operation for rescue analgesia.

Independent Samples and Paired Samples tests were utilized to evaluation the differences among the experimental groups. Regularly disseminated data were existed as mean±SE. The SPSS pocked program (Version 12.0; SPSS) was utilized for statistical analysis.

Results

The demografik informations and baseline values are given in the group with related to BW, age, BCS and T0 measurements of HR, *f*R, BP, SPO_2, and RT (Table 1).

*f*R values were significantly increase than T0 at T1 and T2, whereas *f*R value at T3 and T4 was importantly lower than at T1 and T2 ($p < 0.05$ for all collation) in the group (Table 2).

Two cat's *f*R and HR values were increased by 20% in group following the ligation procedure (T2 time point). No cat's *f*R and HR values were increased by 20% in group at T3 time point (Table 2).

A number of harmful effects such as haemorrhage, haematoma, and a spot of blood were discovered following intratesticular injection, but not one were considered of any clinical importance. Although no increase in haemorrhage at the operation area was observed, a spot of blood on the scrotum and administration was not stopped because of extreme

intratesticular pressure after injection in all patients and slight haemorrhage and/or haematoma formation within the testis or tunica in 2 of 8 (25%) of applied testes were seemed.

Discussion

The application of intratesticular lidocaine decreased the nociceptive stimulation of cats happened castration in this study cases. There was reduced nociceptive stimulation in left testes in group after primary incision which is expecting as intratesticular lidocaine is improbable to desensitize skin of scrotum. Further rise in nociceptive stimulations happened in the control group (right testes) after retraction of the testicles (T2 and T3). This advice that intratesticular lidocaine is enough efficient at locking up nocifensive replies (at T2 time point) under xylazine-ketamine anesthesia.

These effects propese that intratesticular lidocaine is a receivable application of pain management in cats with anesthesied xylazine-ketamine undergoing elective castration and should be considered as an adjunct to standard anesthetic practice. More studies are necessary before any long term usefulness can be recognized.

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Table 1. *Animal data and baseline (T0) physiological variables for group (n=8).*

Patient variable	XYZ-KET group
Age (years)	1,7±0,8
Bodyweight (kg)	3.5±0.2
Body condition score	2.8±0.3
Baseline heart rate (beats/minute)	106.6±20.4
Baseline respiratory rate (breaths/ min)	11.8±1.3
Baseline blood pressure (mmHg)	121.4±1.4
Baseline SPO_2 (mmHg)	92.0±1.2
Baseline rectal temperature (mmHg)	38.7±0.2

SPO_2: Oxygen saturation

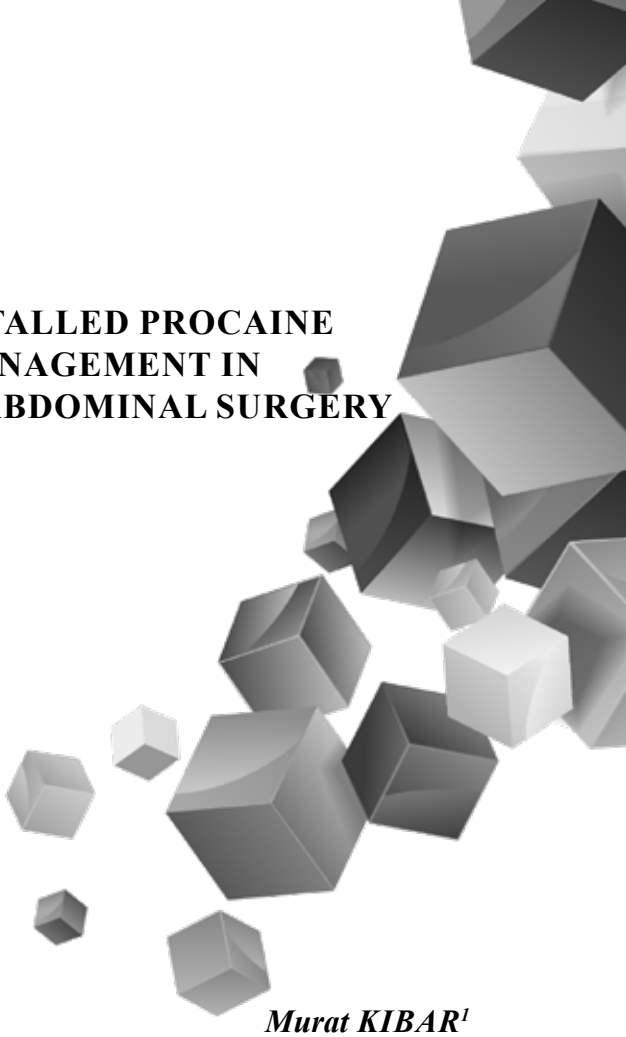
Table 2. *Distribution of intraoperative monitoring values in cats (Mean±SE, n=8).*

Parameters/Groups	T0	T1	T2	T3	T4
O_2 SAT (%)	92.0±1.2[a]	93.7±0.8[a]	94.0±0.7[a]	94.1±1.0[a]	95.2±1.1[b]
Respiration rate	11.8±1.3[a]	15.2±0.8[b]	14.7±0.9[b]	11.0±0.8[a,c]	12.5±0.8[a]
Heart rate	106.6±20.4	117.7±18.4	131.2±18.1	96.4±6.3	97.1±7.0
Blood pres. *(sistolic)*	143.0±4.3	149.7±8.5	147.2±9.3	146.0±2.85	145.0±2.7
Blood pres. *(mean)*	121.4±1.4	119.2±10.7	112.4±14.7	114.6±8.3	122.5±3.2
Blood pres. *(diastolic)*	106.2±6.1	105.0±11.7	90.5±22.2	101.0±7.1	101.0±9.2

[abc] means with different superscripts within one row differ significantly ($p < 0.05$)

Chapter 7

COMPARISON OF INSTALLED PROCAINE IMPACTS ON PAIN MANAGEMENT IN DOGS UNDERGOING ABDOMINAL SURGERY



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Introduction

Ovariohysterectomy (OVH) is one of the most commonly performed surgeries in general practice and is considered to be a moderately painful procedure (Hewson et. al., 2006; McMillan et. al., 2012). Anesthetic techniques for sterilization range from local anesthesia to neuraxial or general anesthesia (Visalyaputra et. al., 1999).

Procaine is a local anaesthetic of the ester type which is rapidly hydrolyzed in the plasma (Tereda et. al., 1996, Fuliaş et. al., 2013). Pharmaceutical administration forms usually contain 0.25 to 0.5% procaine for infiltration anaesthesia, 0.5 to 2.0% for peripheral nerve block and 10% for spinal block (Fuliaş et. al., 2013).

Although previously investigated for intraoperative pain relief (Visalyaputra et. al., 1999, Ortega et. al., 2011), use of local anesthetics have not been compared for postoperative pain relief in animals undergoing elective OVH. Animals requiring OVH procedure constitute the most common type of clinical case referred to veterinary clinics. Because it is so common, the present study includes this type of procedure so that the result may be useful for small animal practitioners. The objective of the reseach was to evaluate the analgesic level of installed intraperitoneal procaine during the perioperative and postoperative periods in dogs undergoing abdominal surgery.

Materials and methods

Eight sexually intact female dogs (weiging between 6.0 and 19 kg, and from 9 months to 7 years in age) referred for the OVH procedure from a dog care house at during 2 months were included in the study. For each dog, age, body weight, ASA physical status, sexual cixlus, and duration of operation were recorded. All dogs were discharged 24 hours after the operation.

Dogs were premedicated with xylazine IM, 2 mg/kg. Anesthesia was induced 15 min after xylazine, using ketamine (10 mg/kg IM). Either the right or left cephalic vein was cannulated using a 20 or 22 G over-the-needle catheter (Bıçakçılar, Turkey) for the performing of the subsequent blood sampling. Electrocardiogram, non-invasive blood pressure (BP), respiratory rate (RR), pulse oximetry, rectal temperature and heart rate (HR), were monitored (Guoteng Co Ltd, China) continuously throughout the anesthesia.

All surgeries were made by the one ginecolog with helping from 5th class students. The dogs were haphazardly included with eight dogs in group. During the surgery the P group applied intraperitoneal instillation of procaine 0.2% (3.5 mg/kg). To receive the procaine intraperitoneally,

sterile injectors (23 G) were used. The local anesthetic was received over the regio of uterine stump, broad ligament, and ovaries. Procaine was received at same time in other ways so that it would effect the cranial, caudal, right and left sides of the abdomen. The P group applied intraperitoneal instillation of procaine 0.2% (3.5 mg/kg) and the CN applied 1.75 ml/kg of intraperitoneal 0.9% NaCl in a same method. The duration of operation was accepted as the time elapsed between the first incision and the last suture.

During the research, pre and postoperative pain was evaluated at T0 and then at 0.5, 1, 2, 3, 8, and 24 hours after the surgery. The same researcher, who was blind of the dogs' group including, assigned the pain behaviors of all dogs using the short form of the Glascow Composite Measure Pain Scale (CMPS-SF) (Reid et. al., 2007). A total pain score was calculated for each time point. To control the severity of postoperative pain, if a dog was levelled CMPS-SF > 6, IV carprofen IM was planned to give as a rescue anelgesic.

Heparinized blood samples (4 ml) were provided from the indwelling catheter into sephalic vein. Blood samples tested for plasma glucose were centrifuged at 1500 g for 10 minutes at room temperature' the plasma was removed, and the blood samples were stored at -80 °C in labled Eppendorf tubes, and then evaluated for glucose levels at the end of the research by a commercial laboratory using a BA-88A Semi-Auto Chemistry Analyzer (Mindray, China).

ANOVA and Tukey's multiple range tests were used to assess the differences between the groups. The SPSS software program (Version 12.0, SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The study protocol was approved by the local ethics committee (approval number: 2014-12).

Results

Subjects from the three groups were similar in age (2.50 ± 0.7 years in group P and 2.38 ± 0.2 years in the control group) and body weight (group P, 11.62 ± 1.13 kg and control group, 10.00 ± 0.71 kg). There were no significant differences, and it was thus obvious that the dogs had been placed in the different experiment groups by chance. The duration of surgery was 25-30 min. All dogs were classified as having ASA physical status I. During the study, the stages of the sexual cycle in dogs were determined as follows:10 dogs in anoestrus, 3 dogs in prooestrus, 2 dog in dioestrus, and 1 dog in metoestrus.

There were no important differences between the experimental groups taking intraoperative monitoring values (mean ± SE). All of these values were within the respective reference ranges for anesthetized dogs (Table

1). Mean (± SE) systolic, mean, and diastolic BP values increased 20% in the control group following the ligation procedure (Table 1, T2 time point). All of the dogs woke from the anesthesia normally and without complications. With the exception of subjects receiving trimetoprim + sulfonamide, all were received as a single dose.

There were important differences (P<0,05) in CMPS-SF among the experimental groups. In the preoperative period, all animals had a CMPS-SF score of 0. Group P had importantly less CMPS-SF scores than the control group, at the 0.5, 1, 2, 3, 8, and 24 hour postoperative periods (Table 2). The highest and lowest CMPS-SF values were determined at 0.5 h (5.75 ± 0.28) and 24 h after surgey (3.88±0.65) in group P. Likewise, the highest and lowest CMPS-SF values were determined at 0.5 h (8.88 ± 0.54) and 24 h after surgey (6.88 ± 0.48) in the control group. The CMPS-SF scores were >6 for the 8 and 2 dogs in group C and group P, respectively. Therefore rescue analgesic was used in these dogs.

Table 3 demonstrates the mean (±SE) plasma glucose levels at time points. Glucose levels piked at 8 h in group P and the control group. Glucose levels differed significantly at 8 h for group P when measured against the control group (P<0.05). Thus, the glucose concentration reduced more quickly in group P than in the control group. Only the consentartes at the 3 and 8 h time points were importantlyly (P<0.05) higher than the baseline value in the control group. In other words, after 24 h, the glucose values were near T0 levels in the control group, while the valuess were not importantly high for group P. The levels for the 3, 8, and 24 h time point not importantly (P>0.05) differ from the T0 level in group P.

Discussion

Though procaine is unlikely as a first-line analgesic drug for use in animals after surgical procedures, our finding show that these drugs should be noted as reliable and well-tolerated analgesics when administered. Administering intraperitoneal installation of procaine was shown to provide a smilarly significant and safe effect in comforting intraoperative and postoperative pain and biochemical stress responses within 3 h. In conclusion, installation of procaine obtained satisfied analgesia, and it could be used for pain management intraoperatively and after abdominal surgery procedures such as OVH in dogs.

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Table 1: *Distribution of intraoperative monitoring values in dogs (Mean±SE).*

Parameters/ Groups		T1 (5 min)	T2 (10 min)	T3 (15 min)	T4 (20 min)	T5 (25 min)	T6 (30 min)
O2 SAT (%)	Control	90.13±1.46	91.63±1.53	87.25±1.78	88.88±1.50	90.25±1.79	89.43±2.09
	Procain	91.38±0.96	93.50±1.21	91.50±1.32	91.38±0.75	92.38±0.80	92.50±0.87
Respiration rate	Control	14.50±1.65	13.88±0.48	14.00±1.12	14.63±0.71	14.00±1.04	14.43±0.84
	Procain	11.63±0.38	12.75±0.73	12.13±0.93	13.00±1.19	13.00±1.05	13.25±0.70
Heart rate	Control	77.88±6.56	87.38±7.34	83.63±7.97	74.13±6.73	68.38±8.77	75.14±14.07
	Procain	79.63±10.17	69.88±8.39	102.50±7.98	92.25±10.04	87.75±9.90	94.50±6.67
Pulsation *(sistolic)*	Control	124.13±6.19	168.88±10.33	160.13±10.09	158.25±9.84	147.25±7.91	141.43±7.67
	Procain	137.00±5.28	142.63±8.10	148.38±7.93	143.25±6.87	142.50±7.23	145.00±5.97
Pulsation *(mean)*	Control	107.13±6.22	144.25±10.80	140.13±9.72	134.63±10.06	126.38±8.38	123.43±7.98
	Procain	121.75±7.62	129.13±6.58	132.63±6.20	125.25±5.35	127.75±6.48	127.88±5.66
Pulsation *(diastolic)*	Control	93.00±4.68	126.88±7.78	120.25±7.54	118.75±7.32	110.50±5.90	106.00±5.81
	Procain	109.88±6.56	113.75±5.80	116.38±6.20	117.25±6.93	115.50±5.86	115.88±5.39

Table 2: *Mean CMPS-SF scores from each groups of dogs at each time point (Mean±SE).*

Groups	Postoperative					
	30 min	1.hr	2.hr	3.hr	8.hr	24.hr
Control (n=8)	8,.88±0.54 ^{A}	8.50±0.58 ^{A}	8.00±0.44 ^{A}	7.00±0.53 ^{A}	7.00±0.41 ^{A}	6.88±0.48 ^{A}
Procain (n=8)	5.75±0.28 ^{B}	5.63±0.23 ^{B}	5.05±0.36 ^{B}	4.78±0.63 ^{AB}	4.28±0.55 ^{C}	3.88±0.65 ^{B}

^{abc} means with different superscripts within one row differ significantly ($p < 0.05$)

^{ABC} Different letters in the column indicate the significant differences ($P < 0.05$)

Table 3: *Plasma glucose levels (means±SE) taken from dogs treated with installed procaine (n=8) or serum physiologic (control, n=8). Samples were obtained at baseline and 3, 8, and 24 h following operation.*

Groups	Before operation (0.hr)	After operation		
		3.hr	8.hr	24.hr
Control (n=8)	56.25 ± 12.95 ^{aA}	166.57 ± 25.39^{bA}	192.17 ± 24.62^{bA}	89.71 ± 16.10 ^{aA}
Procain (n=8)	75.67 ± 6.21 ^{A}	82.83 ± 23.07 ^{B}	96.20 ± 20.10 ^{B}	87.43 ± 20.14 ^{A}

^{abc} means with different superscripts within one row differ significantly ($p<0.05$)

^{ABC} Different letters in the column indicate the significant differences ($P< 0.05$)

Chapter 8

ASSOCIATION RULE ALGORITHMS USED IN AGRICULTURE

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1. INTRODUCTION

Data mining is a set of data analysis techniques that enable us to solve problems and make inferences about the future by obtaining undiscovered useful information from large volumes of data. It is the process of revealing valid, reliable and useful patterns from raw, unprocessed data in databases using computer programs. Thus, thanks to the meaningful patterns obtained, the existing problems are eliminated and the problems may arise in the future are predicted (Fayyad et al., 1996; Hand et al., 2001).

Data mining models are grouped as descriptive and predictive models. Predictive models try to conclude these models by creating a model from the available data collections. Descriptive models assist in decision making and provide the extraction of patterns. The most well-known descriptive models are association rule analysis, cluster analysis, sequence pattern analysis (Han and Kamber, 2011).

There are many association rule algorithms used in agriculture. Slimani and Lazzez (2014) discussed these algorithms extensively in their studies and examined the performance of them. Parveen, Shankari, Jayanthi (2020) used the Apriori algorithm to recommend bactericides to farmers in their study. Thus, by obtaining better bactericides, they provide profit from agriculture. Again, a similar study was made by Kamalesh et al. (2017). Through the association rules they obtained from the Apriori algorithm, they helped farmers find solutions to their problems by questioning the land type, crop, and disease-related pests.

2. ASSOCIATION RULE ANALYSIS

Association rule analysis is one of the most used concepts in machine learning, industry, agriculture, social sciences, and especially in business areas. It is very useful in marketing the products by being used to discover the relationships between the products purchased by the customers in the business field. Not only in the field of business, but also in other areas, certain rules help establish relationships and solve problems.

Association rule analysis has disadvantages as well as benefits such as definition, prediction, association, rule creation and problem-solving. Sometimes the formation of rules that are not very interesting, not getting a result from these rules causes low algorithm performance and time loss. In this section, the basics of association rule analysis are addressed, and methods of obtaining few and useful rules are explained (Moreno et al., 2005).

The methods of discovering association rules have been revealed by Agrawal and Swami (1993). These methods are very effective and enable to obtain unknown and invisible models from very large data sets. The

basis of these methods is to find relationships between different items (Patel and Patel, 2014).

Association rule analysis refers to the situations where items are together. It examines the occurrence of data items in datasets. Association rule analysis is best known as market basket analysis. To better understand the logic behind the rule, the example of market basket analysis will be used (Goh and Ang, 2007).

In the market basket analysis, purchasing and coexistence of the products purchased by the customers are examined. In Table 1, each row refers to a customer transaction. In other words, there are products that the customer bought together in the market. Each of them refers to the transaction ID (TID) transaction number for the customer, in other words, its tag. Thus, it aims to increase sales by determining the products purchased by the customers, providing customer relationship management and marketing promotions of the operator.

Table 1. Grocery basket transactions

TID	İtems
1	Napkin, Milk
2	Bread, Milk, Cheese
3	Tea, Egg, Milk, Cheese, Sugar
4	Tea, Sugar, Napkin
5	Tea, Milk, Biscuit, Sugar

Association rule analysis, based on these purchased products in Table 1, reveals the relationships between products, rules, frequent itemsets. For example; If there is a rule like {tea} $\Longrightarrow$ {sugar}, that rule means that many customers who buy tea also bought sugar. Obtaining these rules allows the operator to bring these products side by side and increase sales and profit rates (Tan et al., 2005). However, besides the benefits of market basket analysis, there are also disadvantages. For example, if the database is too large, discovering the rules can be quite costly. There are also downsides, such as the discovery of many rules and many of these rules are not worthwhile rules.

2.1. BASIC CONCEPT AND DEFINITIONS

The basic logic of the association rule is to discover interesting structures and correlations in large datasets. The concepts of support and trust are used to determine the relationships and rules between their items and to evaluate the structures between them. User-defined support and confidence thresholds are determined, and these rules with support and confidence values greater than the threshold value are considered.

Let $I = i_1, i_2, \ldots, i_m$ be a set of items. Let us denote each transaction where $T = \{t_1, t_2, \ldots, t_n\}$ including $T \subseteq I$. Let D be the transaction database. TID indicates the identity of each transaction. If the transaction T contains the item X, it is $X \subseteq T$. Association rules are defined as $X \Longrightarrow Y$ as $X, Y \Longrightarrow T$ ve $X \cap Y = \emptyset$. The support value of the $X \Longrightarrow Y$ rule is S, and this value indicates the percentage of transactions in D containing $X \cup Y$. In the association rule $X \Longrightarrow Y$, X is the premise Y means the result of the rule. If the confidence value of the $X \Longrightarrow Y$ rule is C, this value is expressed by dividing the transactions containing X by the number of transactions involving X and Y together. The support for item X is denoted by S (X) and represents the ratio of the number of transactions containing the X item and It is indicated by

$$S(X) = \frac{|T_x|}{|D|}$$

The support value of the association rule $X \Longrightarrow Y$ is expressed as,

$$S(X \Longrightarrow Y) = \frac{|T_x \cap T_y|}{|D|}$$

The trust value of association rules refers to the correlation between items. The confidence value of the $X \Longrightarrow Y$ rule is shown as C($X \Longrightarrow Y$). It is also defined as the measure of the power of the rule. The trust value of the association rules indicates the ratio of the transactions involving X and Y together to the number of transactions involving X. If the confidence value of the association rule $X \Longrightarrow Y$ is 87%, it means that the transactions containing this X also include Y. The confidence value of the $X \Longrightarrow Y$ rule is denoted as an;

$$C(X \Longrightarrow Y) = \frac{|T_x \cap T_Y|}{|T_X|}$$

Association rules are implemented in two steps. Obtaining frequent itemsets and finding associations from these item sets. If the minimum support value (minsup) and minimum confidence value (minconf) of the X ⟹Y rule are greater than the user-defined minimum support and minimum confidence values, this rule is known as the notable rule, common rule. So if the X ⟹Y rule is the common rule, expressed as,

$$S(X \Longrightarrow Y) \geq minsup$$
$$C(X \Longrightarrow Y) \geq minconf$$

(Slimani ve Lazzez, 2014). Another criterion used to determine association rules is lift value. Lift value is used instead of trust value. The lift value is a very strong rule-setting criterion, unlike the simplest one compared to other rule-setting criteria. It is used instead of trust value. It determines the relationship between the premise and result items. Lift value,

$$Lift = \frac{S(X \cup Y)}{S(X)S(Y)}$$

There are 3 possibilities for the lift value. A lift value greater than 1 indicates a positive correlation, a negative correlation if it is less than 1, and equal to 1 indicates that the correlation is independent (Hussein et al., 2015).

3. ASSOCİATİON RULE ALGORITHMS

3.1. AIS algorithm

It was first developed in 1993 by Agrawal, Imielinski and Swami to find common items. It focuses on improving the quality of the database. The AIS algorithm generates rules whose result item consists of one item. For example, it creates rules in the form of $X \cap Y \Longrightarrow Z$. However, it does not constitute rules in the form of $Z \Longrightarrow X \cap Y$.

The AIS algorithm scans the database again each time and tries to find common items. The most important constraint is that it scans the database many times to find common items, re-read the operations at each scan, count the items and put them in letter order (Silahtaroğlu, 2008).

After scanning the database multiple times, the AIS algorithm detects common items in the previous operation and determines a common set of items in the next operation. In each scan, the commonly identified item is combined with existing item sets and candidate sets are created. When creating candidate clusters, the common item should be the last in letter order. This way the scanning process continues until no common items are found. Figure 1 shows an example of the AIS algorithm.

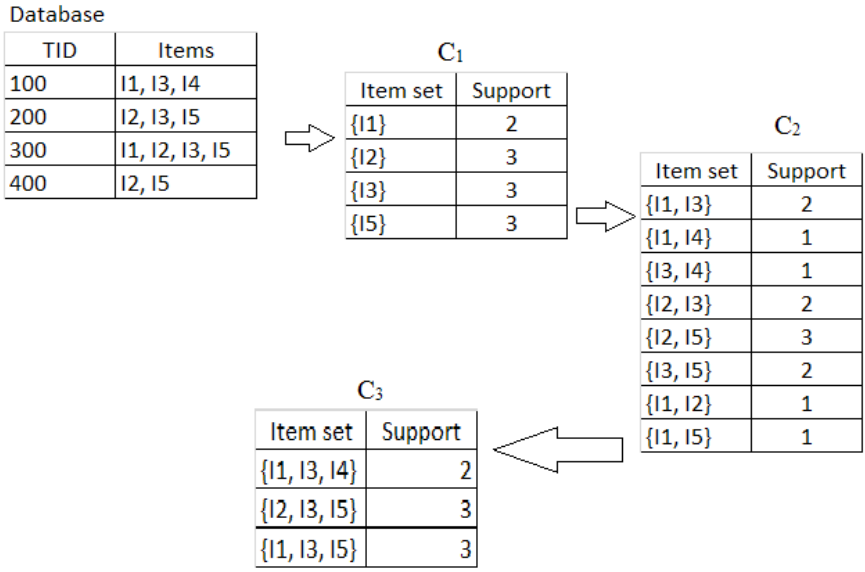

Figure 1. Example of AIS algorithm

3.2. SETM algorithm

It was introduced by Houtsma and Swami in 1995 after the AIS algorithm. As the SETM algorithm scans the database, candidate itemsets are created. Candidate item sets are created as in the AIS algorithm. The difference in the AIS algorithm is that each transaction has a TID (Transaction ID) transaction record. Figure 2 shows an example of the SETM algorithm. (Kumbhare and Chobe, 2014; Khurana and Sharma, 2013).

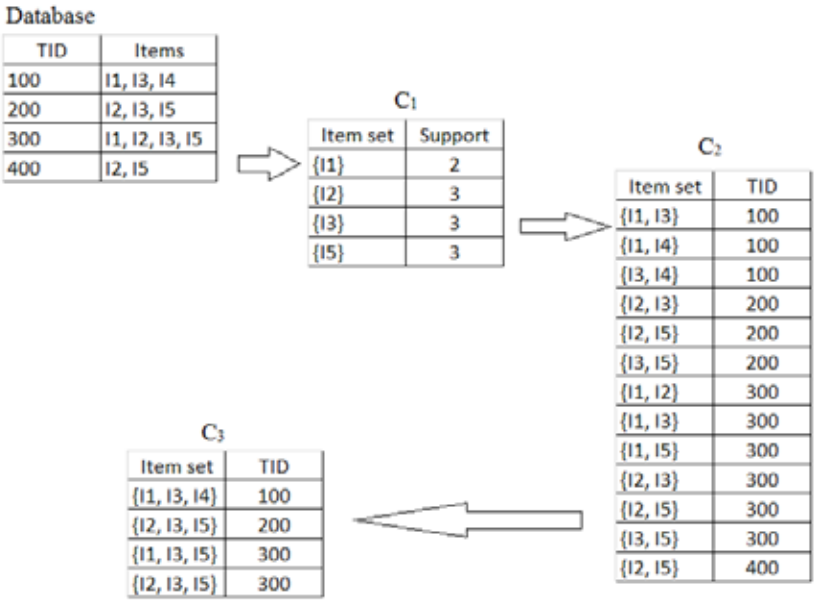

Figure 2. Example of SETM algorithm

3.3. Apriori Algorithm

The Apriori algorithm is widely used in agriculture and many other fields. The Apriori algorithm is frequently used in association rule analysis. It is a more efficient algorithm than AIS and SETM algorithm in terms of performance (Khan and Sing, 2014). It tries to find common items on a level basis.

The algorithm uses the k. item to find the set k + 1. In the first scan, he finds 1-item common clusters that provide the support value. The next scan continues, using common items from the first scan until no new items are found. The difference of the Apriori algorithm from other algorithms is that the subsets of the common item set found in each scan are also common items. Besides the advantage of the Apriori algorithm, it has 2 important disadvantages. The first is that it is a very complex common item finding process, so it takes a lot of space. Second, it scans the database over and over. Pseudo-code belong to the Apriori algorithm was summarized in Table 2 (Kumbhare and Chobe, 2014).

Table 2. Pseudo-codes of Apriori algorithm;

C: Candidate itemset of size k
L: Frequent itemset of size k
Join Step: Ck is generated by joining Lk-1 with itself
Prune Step: Any (k-1) itemset that is not frequent cannot be a subset of a frequent k-itemset
Pseudo-code: Ck: Candidate itemset of size k
Lk: Frequent itemset of size k
L1={frequent items};
for (k=1; Lk !=∅; k++)
Ck+1=Candidates generated from Lk;
For each transaction t in database do
İncrement the count of all candidates in Ck+1
That are contained in t
Lk+1=candidates in Ck+1 with min_support
End
Return $U_k L_k$;

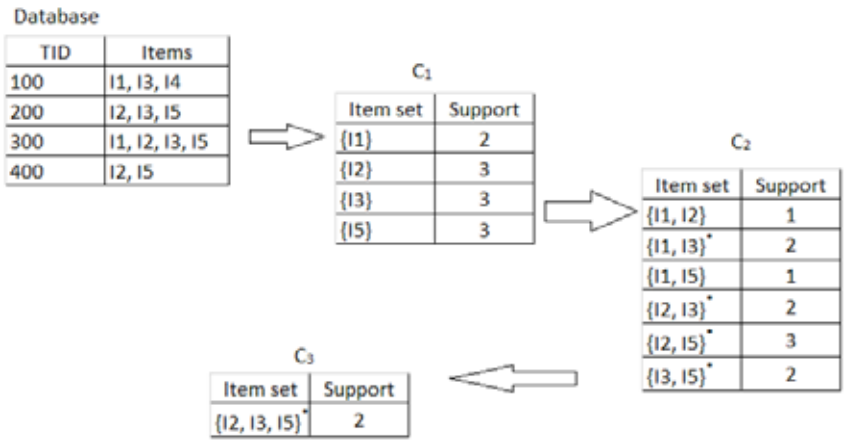

Figure 3. Example of Apriori algorithm

First, it scans the database for single item clusters that provide the support value and determines the candidate cluster Ck. Then, the items that provide the support value in Ck determine the candidate set Fk. This process is continued until no candidate cluster is found (Han ve Kamber, 2001; Kumbare ve Chobe, 2014).

3.4. AprioriTid Algorithm

The feature that distinguishes the AprioriTid algorithm from the Apriori algorithm is that it does not use the database after the first pass. It uses the coding of the candidate itemsets used in the previous transition for this purpose. In subsequent passes, the database becomes smaller than its current size due to coding, resulting in a lot of reading savings. The working principle is to use the coding of candidate itemsets in the first pass and try to find other candidate itemsets. The $\overline{C_k}$ the set used for his purpose consists of the existing k-item X_k with the TID number in each transaction and is shown as $< TID, \{X_k\} >$. Membership of ($\overline{C_k}$) corresponding to t operation $< t.TID, \{c \in C_k | c \; is \; present \; in \; t\} >$. If an operation does not contain the candidate itemset with any k items. C_k does not have that action. This means that the number of records in $\overline{C_k}$ is much smaller than the number of transactions in the database. The application of the functioning of the AprioriTid algorithm is shown in Figure 3.

The Apriori and AprioriTid algorithms generate candidate itemsets using the items they found in the previous pass. The sub-item sets of the item sets with the logic on which the algorithms are based are also candidate items. Therefore, candidate itemsets with k items can be said to consist of candidate itemsets with k-1 items. If the subsets of one of the candidate itemsets with k items are not also the candidate item set, then this item set is not considered. Figure 4 shows an example of the AprioriTid algorithm. (Agrawal and Srikant, 1994; Zhi-Chao Li, et al., 2005).

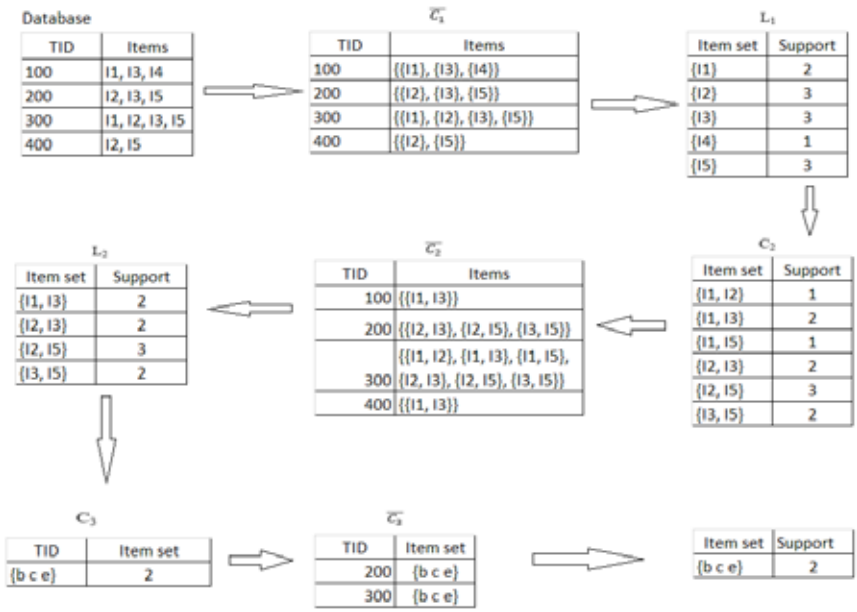

Figure 4. Example of AprioriTid algorithm

3.5. FP-Growth Algorithm

It is one of the fastest and most popular algorithms for common items. It is an algorithm that is effective in large data sets. It preprocesses the data before finding common item sets. Creates a tree-like database and does not identify candidate sets to find common item sets (Borgelt, 2005; Chouhan et al., 2016).

Working of the algorithm according to the tree structure provides a smaller data structure from large databases. Thus, the database is scanned less, reducing the cost. Besides, this situation eliminates the situation of producing a large number of candidate clusters (Kotsiantis and Kanellopoulos, 2006).

The working principle of the Fp-Growth algorithm is similar to the Apriori algorithm. Subsets of common item sets, such as in the Apriori algorithm, are also common sets. Fp-growth algorithm is a more advanced version of the Apriori algorithm and provides better performance (Khan and Singh, 2014; Kumbhare and Chobe, 2014).

The Fp-Growth algorithm builds the database Fp-tree structure with two passes and discovers common items. Primarily determines the support value and scans the database. Removes uncommon items. It lists common items in descending order of support values. In the second transition, a tree structure is created (Özdoğan et al., 2009).

As can be seen from the table, it first calculates the support values of the items with 1 item. Then it sorts according to the support value and builds the tree structure. Transactions are read one by one. In the first process, the item with the highest support value is placed in the tree structure expressed as root. Then the second transaction is read and items with a high support value are added to the nodes. By reading all transactions, the tree structure is created as in the table 3. Figure 5 shows an example of the Fp-Growth algorithm (Kumbhare and Chobe, 2014).

Table 3. Fp-growth Algorithm pseudo-code

```
Algorithm: FP Growth
Mining Frequent Patterns with Fp-growth by pattern fragment growth is;

  Input: a FP-tree constructed with the above-mentioned algorithm;
            D – transaction database;
            s – minimum support threshold.
     Output: The complete set of frequent patterns.
      Method:
call FP-growth (FP-tree, null).
Procedure FP-growth (Tree, A)
{
          if Tree contains a single path P
                then for each combination (denoted as B) of the nodes in the path P do

                generate pattern B ∪ A with support=minimum support of nodes in B

              else for each ai in the header of the Tree do
              {
                   generate pattern B = ai ∪ A with support = ai.support;
                   construct B's conditional pattern base and B's conditional FP-tree
                   TreeB;
                   if TreeB ≠ Ø
                          then call FP-growth (TreeB, B)
               }
} (Györödi et al., 2004).
```

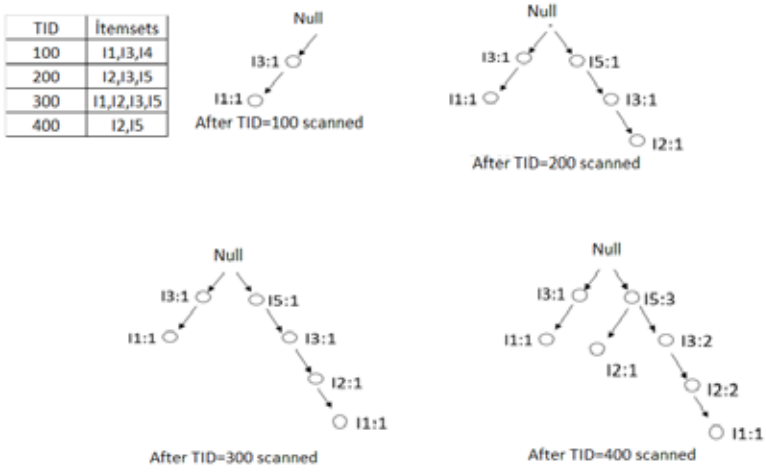

Figure 5. Example of Fp-Growth algorithm

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Chapter 9

COMPARISON OF SUSTAINABILITY AND PROFITABILITY OF ORKÖY'S BEEKEEPING LOANS PRACTICES OF BEEKEEPING ENTERPRISES

(CASE STUDY: FOREST VILLAGES IN ELAZIĞ PROVINCE AND THE WESTERN MEDITERRANEAN REGION)

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1. INTRODUCTION

Forest villagers are an important unit of the rural areas in Turkey. If the villages in rural areas are categorised according to settlement areas, it is possible to divide these into two groups as mountain and forest villages and villages on the plains. The villages on the plains have a more fertile land, the land is less partitioned and it has the advantage of a larger average area. When evaluated in this light, the forest villages comprise of enterprises which have marginal agricultural areas (Coşgun, 2005).

There is a population of 7.3 million living in approximately 21,600 forest villages within the forest areas and forest boundaries. Considering that the population of rural areas was 20.8 million in the 2007 Census, it can be seen that 1 in every 3 villages are forest villages. Close to 55% of rural villages are forest villages (Coşgun, 2005). Therefore, any intervention to rural areas directly impact on forest villages.

The main sources of income of mountain and forest village enterprises are agriculture and husbandry, as it is for villages in the plains; thus, making forest villages a location of importance. Although mountain and forest villages have limited opportunities in comparison with villages in the plains, they are subject to the same market conditions and marketing conditions. For this reason, these are the villages with the most limited opportunities in Turkey in terms of social-economic conditions. One way to ensure successful developments in rural areas is to make investments for the mountain and forest villagers. In this regards, forest villages and villagers are very important for the development of Turkey. Thus, rural areas have been perceived as more and more important since the 1960's. This perception includes placing more importance on forest villages.

The establishment of the General Directorate of Forests and Village Affairs (ORKÖY) and its provision of services is a reflection of the rural development approach of the governments in power in the 1960's. One of the ministries founded by the 28th Government, the İnönü Government in power between 1963-1965, was the "Ministry of Village Affairs". With the transition to a planned system, the Ministry (which was established in 1963) carried out work aimed towards the rural sectors and also the forest villages. Together with the establishment of the General Directorate of Forests and Village Affairs in 1970, the activities aimed to the forest villages gained quality. Activities for the regulation of public-forest relations especially found a niche in the forestry sector (Coşgun, 2008). This was strengthened with the establishment of the Ministry of Forestry in 1973 and the founding of the General Directorate of ORKÖY. Since the 45 past years, the Ministry of Forestry and the General Directorate of ORKÖY continues to carry out its responsibilities within a variety of different organisational structures. Today, the "Departments" within the

General Directorate of ORKÖY continues to carry out its activities and responsibilities. The ORKÖY continues to provide social and economic support to forest villages by means of cooperative and individual loans.

The main function of ORKÖY is to regulate the public-forest relations with the aim of reducing the pressure of forest villagers on forests. Since its establishment, the organisation has provided social and/or economic related support. Projects implemented as cooperative or individual loans have varied according to the economic political processes at the national level. In the scope of this process, research conducted by Directorates of Forestry Research and Faculties of Forestry of universities (including other faculties), have sought to regulate public-forest relations, to determine the characteristics of rural communities, to assess the place of forest villagers in society and to ascertain socio-economic situations (Sakman, 1974; DPT, 1970; DPT, 1971). The organisation of forest engineers have open to discussion the policies for forest villagers. The activities of ORKÖY have been assessed in general terms with the aim to shed light on the processes so far (OMO, 1974). The early practices/activities of ORKÖY, up to the 1980's, have been reviewed and data was attempted to be produced to contribute to the field studies and actions of ORKÖY on the basis of a variety of examples of field studies (Anıl, 1973; Duruöz, 1975; Duruöz et al., 1976).

The 1980's comprises the second phase of the ORKÖY. In this period, studies concerning forest villages increased and it was aimed to contribute to the activities of ORKÖEY by conducting studies regarding the urbanisation and forest-village relationships were conducted by taking samples of the population in the scope of the socio-economic structures of forest villages were conducted, evaluations regarding the development of forest villages were made and, in regards to the ORKÖY district development plans, studies were conducted to determine the optimum enterprise plans by carrying out linear programming techniques for the forest villages-agricultural enterprises economic analysis for the districts (Geray & Acun, 1980; Acun, 1983; Taraklı, 1982). Important data for ORKÖY was determined regarding the impact of energy consumption by forest villagers (İstanbullu, 1978). The 1960-1980 period was reviewed with an attempt to determine the levels of Village, Town and City Social Transformation. By the end of the second phase of ORKÖY since its establishment, The ORKÖY activities were investigated and new ORKÖY models were discussed concerning the activities for the development of forest villages and the future of ORKÖY (Akşit, 1985; Çağlar, 1986).

The third phase of ORKÖY is the period of the 1990's where a variety of studies were conducted on the activities of ORKÖY. The socio-economic problems of forest villages were determined and recommendations for

district or regional level solutions for the development of the forest villagers were developed (Özkurt, 1998; Coşgun, 2005). The global concept of Social Forestry was discussed and new opportunities for ORKÖY were considered (Tolunay, 1992; Tolunay, 1998; Tolunay et al, 2007). During this period, the reflection of the ORKÖY plans and implementations on the forest villagers were investigated (Gümüş, 1993). Especially the level of use of firewood by forest villagers and its impact on the forest ecosystem and its impact on the socio-economic situation of forest villagers were determined. By doing so, the ORKÖY practices were evaluated in a different light (Türker & Toksoy, 1992; Türker, 1992).

In the fourth phase of ORKÖY, two main areas of activity of ORKÖY were given emphasis. The first of these was to establish the measures and criteria to be used in the scope of individual and cooperative loan provisions (Coşgun et al., 2007; Coşgun et al., 2009; Alkan et al, 2005; Alkan & Demir, 2013; Tolunay et al., 2002). The second was the studies to evaluate the impact of the ORKÖY projects implemented to date on the forest villagers (Sayılı et al, 2002; Tolunay & Korkmaz, 2005; Uzun, 2008; Önal, 2010; Önal & Bekiroğlu, 2011; Ay & Tolunay, 2012; Okutucu et al., 2012; Korkmaz & Alkan, 2014; Coşgun et al., 2015, Coşgun & Güler, 2015).

It can be seen in the National Forestry Programme that there is priority given to ORKÖY and forest villagers. The priority areas in the National Forestry Programme are: i) legislation to be developed concerning the principles and procedures regarding the development services for forest villagers, ii) development of the capacity of forest villagers in regards to organisation, production, marketing, iii) realisation of joint initiatives and activities by related groups to strengthen the allocation of public resources for rural development programmes for disadvantaged mountain and forest villages. In addition, the second area of priority was identified as: i) determining the contributions, problems and development needs for the preservation forests, forest-village relationships and development of forest villagers in light of the policies, strategies and practices of past forest organisations, ii) with the aim of improving the struggle and life conditions of forest villagers, to determine the opportunities and conditions of wide spreading appropriate integrated-holistic rural development models (Eastern Anatolian Basin Development Project, etc.) (Anon, 2004).

One of the examples of ORKÖY's economic support by provision of individual loans is the "Professional Beekeeping Loan". This practice continues to be implemented since the establishment of ORKÖY. The ORKÖY Professional Beekeeping Loan practice was evaluated in two phases. The first phase is the sustainability of the ORKÖY beekeeping loan practice. The second phase is the impact of the ORKÖY Professional

loan practice on the socio-economic structure of the forest villagers taking advantage of this loan. An evaluation study of the beekeeping loans of the ORKÖY General Directorate was discussed in the **Evaluation Report of the Questionnaire Administered regarding the Beekeeping Loans of the ORKÖY General Directorate** (Fıratlı, 2003). From this study, it is understood that, between the years 1991-2000, a total loan amount of 627.7 Billion TRY and 920.7 Thousand USD with a low interest rate was provided to 5,740 forest villagers in 60 provinces from the resources of the Fund Budget (FB), Rural Development Projects (KKP) and the Eastern Anatolian Water Basin Rehabilitation Project (DASHRP). No significant problem was experienced in the loan provision or repayment stages. It is stated that the repayments are continuing without problem, and the remaining amount to be repaid in Turkish Lira is 317.8 billion and as of 2003, the loans provided in USD have not yet started to be repaid (Fıratlı, 2003). In the investigation conducted in this study, it was found that 2,176 producers had no bee hives following the use of the loan and the notification that there were 63,451 empty hives was evaluated as these persons did not continue their beekeeping activities. As the number of empty hives existing before the utilisation of the loan is not known, it is not possible to measure the impact of the loans in this regard. It was seen that the questions and responses regarding production were not correct. Responses to the questionnaire item "Amount of annual honey production" were between 0-800kg; some beekeepers responded with colony yield and some with beekeeping yield. Due to the inconsistency of the responses, it was not possible to estimate the averages. Correct responses were not obtained concerning the location of wintering, whether they conducted travelling beekeeping, whether they developed swarms and neither to the questions regarding the size of the enterprise which received the loan or the practices and techniques of beekeeping which would incur costs (Fıratlı, 2003). The evaluation study conducted by ORKÖY staff found that there were some shortcomings in the national level findings, and it was stated that "…**however, in some of the questionnaires, many of the questions on the 37 item questionnaire were left unanswered or had extreme or unrealistic responses or did not provide information and thus were not included in the evaluation.**" (Fıratlı, 2003). A review of the rural development studies conducted regarding rural development activities shows that valuable and exemplary studies were also carried out. The yield and socio-economic problems of villager families (enterprises) carry out beekeeping in the rural areas were investigated at the regional and provincial level (Bölüktepe & Yılmaz, 2008; Çakmak et al., 2003; Erkan & Akşin 2001, Doğaroğlu, 2009; Kutlu & Sezen, 1999). These studies provide important information for the further development of ORKÖY beekeeping loan practices. It is possible to provide guidance for the future of ORKÖY beekeeping loans which can be provided in the

future. There are also international studies which reflect the situation of beekeeping (Sillani, 1988; Hoopingarner & Sanford, 1991; Singh, 1996; Dedej et al, 2000; Ram & Singh, 2005). These studies are valuable, in that they allow a comparison of beekeeping in Turkey and other countries. New approaches to beekeeping loan practices can be developed by taking these into consideration.

This study shows the current situation of the enterprises which have taken advantage of the beekeeping loans as support provided by ORKÖY.

The study aims to make a comparison of levels of sustainability and profitability, of beekeeping enterprises which benefitted from ORKÖY's beekeeping loans, in the two different regions. The scope of the study includes two regions: the forest villagers who have taken beekeeping loans in the forest villages of Antalya, Burdur and Isparta in the Western Mediterranean Region and the second group are those who have taken loans in the forest villages of Elazığ province in the South Eastern Anatolia Region.

2. MATERIALS AND METHOD

The material of the study comprises of data obtained from: i) studies conducted in this field, ii) institutional data from practices in the Western Mediterranean Region (provinces of Antalya, Burdur and Isparta) and the province of Elazığ in the South Eastern Anatolian Region, iii) results of the semi-structured face to face interviews and questionnaires conducted with muhktars in villages where the ORKÖY beekeeping loans were used. The data from organisations and institutions were obtained by reviewing the resources.

The original field data was collected from the two regions in two stages. The first stage was to obtain the "sustainability" data and the second stage was to obtain the "economic and profitability" data. The **sustainability data** was evaluated by taking into account the following: a) for the Western Mediterranean Region, ORKÖY practices in Antalya before and after 1995 and ORKÖY practices in Burdur and Isparta before and after 1990. The sustainability of the ORKÖY practices was evaluated for the last 20-25 years in this period. The data from the Western Mediterranean Region was obtained by means of semi-structured interviews with a complete sample of 373 forest villagers who have taken loans from ORKÖY. Sustainability was evaluated for grant and economic support practices in Elazığ between 1990-2000.

Economic and profitability data was obtained by a) face to face questionnaires with 128 enterprises who have benefitted from ORKÖY beekeeping support for forest villages in Antalya, Burdur and Isparta in the Western Mediterranean Region to obtain "gross profit margin" for

economic and profitability values. In the scope of the Elazığ province of the South Eastern Anatolian Region, **economic and profitability data,** b) there was two types of beekeeping loan activities by ORKÖY between 1990-2000. The first of these was a grant loan. In this practice, beekeeping grant support was provided to those enterprises who were interested. The second was the provision of economic support. The enterprises who took advantage of the loans paid the loan back with a low interest rate in the time identified. The forest villagers of this region were taken as a complete sample. The sample consisted of 361 villagers benefiting from ORKÖY grant loan support and 59 enterprises (forest villagers) who have taken out a beekeepers loan.

An economic analysis was carried out to identify the profit of beekeeping enterprises who used the ORKÖY beekeeping loans in the forest villages in the two regions. The ***gross profit analysis*** method was used to conduct the economic analysis for the enterprises. The gross profit analysis is based on dividing the group into two as fixed and variable costs according to the production items. The gross profit is calculated by subtracting the changing costs from the gross output value. The gross profit includes the profit which is remaining once the changing costs are subtracted. The gross profit is an important success measure in determining the competitive strength of the production activities in regards to the current scarce means of the enterprise (Aras, 1988; Erkuş et al., 1995; Rehber & Tipi, 2005; Çetin & Tipi, 2011). To put it another way, the gross profit is a significant criteria which shows the success of the enterprise. Gross profit is an important measure of success in determining the competition strength of the production type in terms of evaluating the optimal of production factors of the enterprise (Çetin, 1988).

3. RESULTS and DISCUSSION

3.1. Sustainability in Forest Village Beekeeping Enterprises

According to the ORKÖY District Development Plans prepared for the provinces of Antalya, Burdur and Isparta, which make up the Western Mediterranean Region, the percentage realisation of the beekeeping support investment plans were 11.46% (Coşgun et al., 2015). Between the years 1974-1999, in the Blacksea Region, the percentage of realisation of the ORKÖY beekeeping support investment plans were 11.2%. The national level percentage realisation of the ORKÖY beekeeping support investment plans were 11.0% (Coşgun, 2005). From the time of the establishment of ORKÖY in the Western Mediterranean Region until today, the percentage of those taking advantage of the ORKÖY beekeeping loan support before the year 1990 was 68.68%.

Table 6: Sustainability of ORKÖY Beekeeping Investments in the Western Mediterranean Region

Provinces	Number of Families Using Loans									
	Before 1990	Percentage of the General Total (1191) (%)	After 1990	Percentage of the General Total (1191) (%)	Total	Continuing		Not Continuing		TOTAL
						No. of Families	Percentage after 1990 (%)	No. of Families	Percentage after 1990 (%)	
Antalya *	632	53.06	198	16.62	830	70	18.77	128	34.32	198
Burdur	94	7.89	54	4.53	148	13	3.49	41	10.99	54
Isparta	92	7.72	121	10.16	213	38	10.19	80	21.45	121
TOTAL	818	68.68	373	31.32	1191	121	32.44	249	66.76	373

*(Before and after 1995)

It can be seen that 32.44% of the enterprises that have taken advantage of the ORKÖY beekeeping support in the provinces of the Western Mediterranean Region (Table 6). It can be said that only one out of three enterprises using the ORKÖY beekeeping support investments.

Of the total 361 persons who received the ORKÖY beekeeping grant support in the forest villages of Elazığ in the South Eastern Anatolian Region, only 7.20% are continuing their beekeeping activities and 92.80% are not continuing. On the other hand, out of the 59 persons who took the economic support ORKÖY beekeeping loan, 17% continue beekeeping, while 83% do not continue (Çok et al., 2016). Of the 420 forest villager enterprises who took advantage of the ORKÖY beekeeping loan support in the period between 1990-2000 in Elazığ, 9.38% continue their beekeeping activities. The sustainability ratio of enterprises was higher in those who took advantage of the economic support loans. The fact that the enterprise must make repayments for the loan in a certain period is an important factor which has an impact on the sustainability of the enterprise. As the grant is not repayable, it was easier to stop beekeeping activities in the face of the challenges faced. However, as the beekeeper knew that there was repayments to be made for the loan in a certain period, it meant that they continued to combat against the problems they had and to continued. The level of sustainability of the enterprises which took advantage of the economic support beekeeping loans was higher due to the higher awareness of the enterprises. So, as it is known that they would have to make repayments for the economic support loan, it was ensured that the more conscious enterprises took advantage of this support loan.

The level of sustainability of beekeeping enterprises in forest villages which benefitted from the ORKÖY beekeeping support was different in both of the regions. The sustainability rate of beekeeping enterprises for Elazığ of the South Eastern Anatolia Region was 3 times lower than that of the sustainability rate in the Western Mediterranean Region. The factors

which had an impact on the sustainability rate was that there are more forest village beekeeping enterprises in the Western Mediterranean Region, the beekeeping season is longer and migratory beekeeping practices are more widespread in this region.

3.2. Income of Forest Village Beekeeping Enterprises

The Average Gross Output Value of the beekeeping enterprises in the Western Mediterranean Region which benefitted from the ORKÖY beekeeping loans and which continue their beekeeping activities was found to be 11,189TRY, while their Average Net Profit was 1,284.05TRY, their Average Relative Profit was 1.24TRY and their Agricultural Profit was 2,229.54TRY.

The assessment of the income of Elazığ forest villages in the South Eastern Anatolian Region which are continuing their beekeeping enterprises showed that, the average gross output value of 26 beekeeping enterprises who benefitted from the grant support was 13,823.45TRY, while their average net profit was 10,640.65TRY and their average relative profit was 4.34TRY. The average gross output of beekeeping enterprises which took the economic support loan was calculated to be 18,192.50TRY, while their average net profit was 14,813TRY and average relative profit was 5.67TRY. The average gross production value of the total of 36 beekeeping enterprises which continue their production and which have taken the grant and economic support loan was 16,007.97TRY, and their average net profit was 12,726.82TRY and average relative profit was 4.73TRY.

It can be seen that the gross output value for the forest village beekeeping enterprises in South Eastern Anatolian Region province of Elazığ and the beekeeping enterprises in the forest villages of Western Mediterranean Region is similar. However, the net profit and relative profit values are higher. The most important reason for this is the differences in the costs of production. The beekeeping enterprisers in the forest villages of Western Mediterranean Region are locating the hives in different areas during summer and winter months and in the periods where bees produce honey. The cost of transportation is significant. The highest cost of transportation is accessing the hives for period checks in the wintering period and transportation is the highest cost within production costs. This being the case, the net profit and also the relative profit values decrease. According to the information received from the interviews conducted in forest villages in Westen Mediterranean Region, the beekeepers of Isparta and Burdur carry out the wintering in Antalya and in their own regions in the summer months. The forest village beekeepers of Antalya take their colonies as far as Muğla in certain periods. This scale of migratory beekeeping is not the case for the forest village beekeepers of Elazığ. This situation means that the beekeeping costs for the Elazığ region is reduced.

Another important factor which impacts on the lower production costs is the shortened period of honey production due to the climate characteristics.

The gross output value and the relative profit value of beekeeping enterprises which are not in forest areas was found to be lower than the Western Mediterranean Region in terms of the gross output value, but has a similar relative profit value. For example; the study by Ören (et al., 2010) divides the enterprises as small, medium and large. The average economic analysis values for the enterprises as follows: gross output value, 23,050.80TRY, net profit 4,553.90TRY, relative profit 1.20TRY and agricultural income 13,506.40TRY. According to Saner (et al., 2005), the size of enterprises as small, medium or large is differentiated according to the size of the colony. In this case, the relative profit was found to be 1.05 for small enterprises, 1.09 for medium enterprises and 1.28 for large enterprises and the average was found to be 1.12. According to Ören (et al, 2010), the gross output value was 13,815.90TRY, the net profit was -4,054.4oTRY and the relative profit was 0.8 for small enterprises. There is significant relationship between the profitability and the size of the colony. As the number of colonies increase, the expenses per colony are reduced and this creates a significant impact on the net profit and relative profit. Therefore, the colony size should be determined in terms of optimal enterprise size. The forest village beekeeping enterprises have stated that 50-60 colonies would be more effective as a colony size for the ORKÖY support. There is currently no economic analysis to support this. As income and costs/expenses show significant differences according to regions, it is recommended that any analysis in this scope should be conducted by region.

Another important economic analysis for beekeeping enterprises is the level of yield of the production. The yield of honey per hive of households which have benefitted from the ORKÖY loan support in forest villages of Antalya is 11.15kg.; this figure is 14.17kg for forest villages of Burdur and 10.44kg for Isparta. The average yield of honey per hive of the forest village households benefitting from the ORKÖY beekeeping support in the Western Mediterranean Region is 11.37kg. Saner (et al., 2011) states that, the average honey yield per hive of enterprises producing organic honey is 11.38kg and the average honey yield per hive for conventional production is 11.70kg. The study of Saner (et al., 2005) showed that the honey production was 22.36kg for the group I enterprises, 24.34kg for the group II enterprises and 22.99kg for the group II enterprises. According to Ören (et al., 2010), the yield for hive is 19.76kg. The Turkish general average yield of honey per hive is 14.63kg (DİE, 2003). According to a study conducted in the Aegean Region, the yield in the provinces of Aydın, Denizli, İzmir, Manisa and Muğla is 13.44kg (Özbilgin et al., 1999). In light of this information, it can be said that the honey yield per colony in forest villages is close to that of the Turkish average.

4- CONCLUSION

It was found that the level of sustainability of forest village enterprises which had benefitted from the ORKÖY beekeeping loans is below the expectation. The socio-economic conditional of the region have an impact on the sustainability of the enterprises. This leads to regional differences. In the Western Mediterranean Region, 1/3 of beekeeping enterprises which have benefitted from the supports continue, while only 10% continue in the South Eastern Anatolian Region province of Elazığ; this is below the expectation. The main reason for this is that the enterprises do not see beekeeping as a main source of livelihood. For 68.8% of the enterprises which have benefitted from the ORKÖY beekeeping support in forest villages of Western Mediterranean Region, beekeeping is not the main source of income (Coşgun et al., 2015). In the province of İzmir, only 25% of enterprises have their main source of livelihood as beekeeping, while 75% are also conducting other agricultural activities; this situation can be accepted as a reason for the low level of sustainable beekeeping enterprises (Saner et al., 2011).

Considering that the Annual Average Gross Output Value of beekeeping enterprises in forest villages in the Western Mediterranean and South Eastern Anatolian Region is between 11-16,000TRY, this is a significant source of income for these village enterprises. A level of annual income between $3,600-5,300USD is very significant, **especially considering that the level of average income of forest village enterprises are generally between $400-600USD** (Sakman, 1974).

The average yield of honey per hive for the forest village families in the Western Mediterranean Region who have benefitted from ORKÖY beekeeping loan practices and who continue their beekeeping activities is 11.37kg. Several studies have found that this yield is accurate and some beekeepers can obtain almost double this yield (Seven & Akkılıç, 2005; Soysal & Gürcan, 2005; Kekeçoğlu et al., 2007; Fıratlı et al., 2000). The national average of honey yield per hive is 14.63kg. To see that the yields are close to the national average is a positive finding (Saner et al., 2005; Solmaz, 2007; Gençdal, 2010; Parlakay & Esengün, 2005; Ören et al., 2010). The reasons for lower yields per colony of forest village enterprises can be stated as a lack of knowledge about better beekeeping and the problems regarding the queen bees (Coşgun et al., 2015).

The main reasons why forest villagers do not sufficiently benefit from beekeeping supports can be stated as: i) forest villagers do not know enough about beekeeping, ii) loss of product or colonies due to mistakes in the application of support, iii) production management, style and product diversity and iv) not having adequate knowledge about marketing (Kaftanoğlu et al., 1995; Coşgun et al., 2015).

Suggestions for improving the sustainability of beekeeping enterprises and to increase the evolution are as follows: i) selecting young entrepreneurs, ii) providing applied training, iii) increasing the number of hives for the loan support and iv) provision of hives (which receive loan support) to be coordinated with the local beekeepers union/association (Çok et al., 2016; Coşgun et al., 2015).

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Chapter 10

BLACK CUMIN *(NIGELLA SATIVA L.)* SEED AND OIL: COMPOSITION, USES AND HEALTH EFFECTS

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Introduction

The goal of the United Nations Sustainable Development Goals (UNSDG), which is also called "Good Health and Welfare," is to promote human well-being and healthy living related to environmentally friendly techniques in food well as health-promoting medicinal plants and herbs. Scientists are looking for new foodstuffs with new properties that could be designed to improve their health. Current research shall have a major impact on the way we eat in the near future (McClements 2019). Medicinal plants and interest in the same are increasing as sources rich in phytochemicals for functional nutrients, nutraceuticals, and medicines with developments in the field of nutrition. The demand for plants to extract their phytochemicals, oils, and bio-active compounds has increased recently due to the beneficial roles of different bio-active phytochemicals. Several researches examine bio-active compounds and therapeutic properties and focus on investigating the toxicological effects and way of effects of plant extracts, oils, and bio-active phytochemicals (Sultan et al., 2009; Ramadan and Moersel, 2002; Batiha et al., 2020; Ramadan and Wahdan 2012; Kiralan et al., 2014; Hassanien et al., 2015).

The World Health Organization emphasizes the research of medicinal plants due to its positive effects on human health. Scientific studies on aromatic plants emphasize quality assurance, quality control, safety, activity, species toxicity, dosage, clinical trials, therapeutic applications, and drug interactions. Medicinal plants are of great interest, especially those with multiple biological effects. Black cumin (Nigella sativa, Ranunculaceae family) is important because of its common food and medicinal applications (Hassanien et al., 2014; Öz et al., 2018; Kiralan et al., 2016).

Black cumin is a cultivated plant known for a long time, and it is widely used in bread, muffin, and some cheese varieties, especially in the Middle East countries. Black cumin was also used by ancient Egyptians for therapeutic purposes. It was reported that the private doctors of the Pharaohs always kept a bowl of black cumin ready, and they used it both to facilitate digestion after excessive food feasts and as a medicine for colds, headaches, toothaches, and inflammations. Hippokrates and Dioscorides mentioned the black cumin as "Melanthion" in their works (Altınterim, 2010).

Black cumin, which has been one of the frequently used medicinal plants, is a dicotyledonous plant from the Ranunculaceae family. It attracts attention with its rich historical and traditional past. Nigella seeds and oils obtained from the seed are the sources of the plant's active ingredients (Goreja, 2003). The homeland of black cumin is Eastern Mediterranean countries and Eastern and Southern Europe. Black cumin spread to other

countries from there. It has also spread in North Africa, India, and Turkey (Fong, 2002).

N. Sativa is widely used in traditional medicine to cure various respiratory and stomach-intestinal diseases in all Islamic countries from Morocco to Pakistan, and locally but commonly in Southern Europe (Riaz et al., 1996). After Avicenna, the great Turkish medical scholar and philosopher, explained its therapeutic effects in his works, black cumin was discovered as an important medicinal plant. Until the 18th century, black cumin has been used for many purposes, including anti-inflammatory and milk enhancer and in the treatment of rabies, snake bites, and tumors (Altınterim, 2010).

The black seed's nutritional content is 20.8% crude protein, 3.7% crude ash, 7.0% moisture, 34.8% lipid, and 33.7% carbohydrate (Atta, 2003).

The essential oil composition of *N. Sativa* L. was determined in a study conducted in 2002. It was determined in the study that the compounds seen most in *N. Sative* seeds are Thujene (3.27%), *o*-Cymene (3.26%), *p*-Cymene (33.75%), Thymoquinone (3.80%), Thymol (26.78%), β-β-Elemene (5.47%), Longifolene (3.11%) (D'Antuono et al., 2002).

Nigella sativa seed oil (stable or essential) is widely used in many foodstuffs, cosmetics, and pharmaceuticals (Kiralan et al., 2017). Black cumin oil is a popular natural pain-reliever and is used as an antiseptic and analgesic medicine and also to treat joint pain and stiffness. The mixture of nigella sativa seed oil and sesame oil is used to treat abdominal ailments, jaundice, dermatosis, cough, fever, liver ailments, headache, eye pain, and hemorrhoids. Thymoquinone (TQ) is the main active ingredient in N. sativa essential oil, and most of the Nigella sativa properties are attributed to it (Kiralan et al., 2018).

It is known that the essential oil of black cumin is involved in various reactions. It was determined that it has antihistamine, anti-inflammatory, anti-infective, and bronchodilation (vasodilation) properties, inhibits protein kinase C, known as the histamine release trigger of crystalline nigellon, its essential oils balance the immune system, regulates allergic reactions, supports metabolism, lowers cholesterol and sugar, increases interferon production by stimulating bone marrow, and contains essential cofactors for enzyme reactions of trace elements (Ali and Blunden, 2003).

Nutritional content and oil acids of black seed

The high nutritional and therapeutic value of Nigella sativa seeds may be attributed to their significant amount of content of protein, fiber, minerals, and vitamins. The nutritional content of black cumin seed consists of Protein (26.7%), Lipids (28.5%), Carbohydrates (24.9%), Crude fiber

(8.4%), and Ash (4.8%) (Rashid et al., 2020).

It was reported in another study that the nutritional content of black cumin is 20.8% protein, 31.9% carbohydrate, and 38.2% lipid. Besides, the moisture content of black cumin seeds was reported as 4.64% and ash 4.37%, and crude fiber 7.94%. As secondary metabolites, it contains some functional molecules in the amount of mg/100 g as 10.1 alkaloids, 3.7 flavonoids, 7.6 saponins, and 2.2 tannins, respectively (Mamun and Absar 2018; Kazmi et al., 2019). The most important active compounds of Nigella sativa are thymoquinone, dithymoquinone (nigellone), thymohydroquinone, and carvacrol p-cymene, t-anethole, 4-terpineol, sesquiterpene longifolene a-pinene, and thymol. The therapeutic properties of N. Sativa are mainly due to the quinine compound, where thymoquinone (TQ) is the most bioactive compound, and it is the main component of the essential oil with various pharmacological benefits (Boskabady and Shirmohammadi, 2002; Ali and Blunden, 2003).

The mineral and vitamin content of black cumin is also very rich. Some minerals (mg per 100 g) of black cumin are Calcium 188 ± 1.5, Iron 57.5 ± 0.5, Sodium 85.3 ± 16.07 and Potassium 1180 + 10.0. Some vitamins contained in black seed are B 1 (thiamin) 831 ± 11.36, B 2 (riboflavin) 63 ± 3.32, B 6 (pyridoxine) 789 ± 8.89, PP (niacin) 6 311 ± 16.52 and Folic acid 42 ± 4.58 (µg per 100 g) (Nergiz and Ötleş, 1993).

Muffin oil contains a high percentage of polyunsaturated (PUFA), followed by monounsaturated (MUFA) and a low percentage of saturated (SFA) oily acids. The characteristic oily acid for Nigella sativa oil is linoleic acid. This oily acid level is variable and ranges from 49.1% to 68.0%. Major MUFA is oleic acid ranging from 16.2% to 25.0% in oils from different countries.

Considering the amount of saturated fatty acids, the most abundant acid is palmitic acid with 3.35-5.93% (Kiralan et al., 2020).

When the amount of saturated fatty acids are examined, the most abundant fatty acid is palmitic acid with 3.35-5.93% (Kiralan et al., 2020).

Table 1. The fatty acid content of Nigella oil (Öz et al., 2018).

Fatty acids (%) of black cumin oil		
C14:0	Myristic acid	0.46±0,02
C14:1	Myristoleic acid	0.72±0,27
C16:0	Palmitic acid	12.47±0,08
C16:1	Palmitoleic acid	1.10±0,22
C18:0	Stearic acid	3.45±0,11
C18:1 n9	Oleic acid	27.37±0,82
C18:2 n6	Linoleic acid	49.72±1,44
C18:3 n3	Linolenic acid	0.355±0,03
C20:1	Ecosenoic acid	2.295±0,02

n=5

Pharmacological effects of Nigell sativa

Black used in the food and therapeutic fields is used to treat many diseases in Southeast Asia, North AfricA, and the Middle East (Bakathir and Abbas, 2011).

Studies have reported that black seed has positive effects on lipid profile and significantly reduces serum triglyceride and LDL cholesterol (AlNaqeep et al., 2011). In their studies, Nader et al. (2010) investigated the effect of thymoquinone on serum lipid profile in rabbits fed with a cholesterol-rich diet, reported that black cumin increased HDL-cholesterol concentration and significantly reduced total cholesterol, LDL, and triglyceride levels.

It is known that black cumin has antimicrobial properties effective against many bacteria, fungi, and viruses, and is a relatively safe drug with a long remarkable history in traditional medicine, while also being more effective than many standard anti-microbial drugs (Abdallah, 2017).

Antibacterial effects

In an article published in 1999, it was reported that *N sativa* essential oil inhibits the growth of both Gram (+) and Gram (-) microorganisms, excluding some strains of Pseudomonas aeruginosa. Again in the same study, it was reported that aqueous methanol extract of *N sativa* showed antibacterial activity against *Streptococcus mutans*, and the plant extract was thus effective in preventing tooth decay and plaques (Khan, 1999).

In the study conducted by El-Kamali et al., Researchers found that *N. sativa* essential oil was effective against Gram (+) (*S. aureus, Bacillus subtilis*) and Gram (-) (*E. coli and P. aeruginosa*) bacteria using the disk diffusion method. The antibacterial effect was maximal when using *Bacillus subtilis*. Besides, its essential oil has been found to have antibacterial effects against *Shigella dysenteriae, Shigella sonnei*, *Shigella boydii, Vibrio cholerae* and *E. coli* (El-Kamali et al., 1998).

Extracts of this plant in different concentrations (100, 200, 400 ug / disk) in studies aimed at investigating the effect of black cumin seed against disease-causing microorganisms The disease has been tested on microorganisms with amoeba, such as *Klebsiella pneumoniae, Salmonella typhim*urium, *Staphylococcus aureus,* B*acillus cereus,* E coli, and Candida albicans, and it was found that black seed stopped the development of Staphylococcus aureus (Morikawa et al., 2004).

The effects of Nigella sativa's pathogenic bacteria such as Yersinia enterocolitica, Listeria monocytogenes, Corynebacterium pseudotuberculosis, Corynebacterium renale, Brucella abortus, Pasteurella multocida, Mannheimia haemolytica, E. coli, Trueperella

(Arcanobacterium) pyogenes, and S. aureus have been reported. et al., 2013). In experimental studies, it has been reported that black cumin oil and extracts show antimicrobial activity on bacteria resistant to multiple antibiotics, and this activity is due to thymohydroquinone and active compounds such as melanin and timohidroquinone (Kamil, 2013).

Antifungal effects

As a result of a study investigating the potential antifungal effects of different black seed oils on twenty fungal species, it was reported that the black seed oil used in the study showed significant antifungal activity depending on the amount used. It was also reported in the same study that essential oils had the most effective antifungal effect (Islam et al., 1989).

A moderate inhibitory effect was reported in a study examining the effects of black seed, black seed oil, and extracts against Candida albicans, dermatophytes, and some aflatoxin-producing fungi and some pathogenic yeasts in vivo and in vitro (Shokri, 2016).

Besides the antibacterial activities of black cumin oil, it has also been reported by some researchers to exhibit antifungal activities. It has been reported that black seed essential oil creates inhibition zones for Aspergillus flavus, Fusarium graminearum, Fusarium monolyformme, and Penicillium viridicatum (Ramadan, 2015).

Antioxidant Effect

Free radicals, which are compounds with high activity as a result of oxidation, can occur during vital activities or with the effect of endogenous sources such as respiration, enzyme reactions, and various environmental sources such as cigarette smoke, air pollution, UV rays, ionizing radiation and xenobiotics (Young & Woodsite, 2001). Oxidation products must be inactivated for the protection of both human health and food. In other words, antioxidants can be defined as substances that prevent their negative effects on foods by reacting with oxygen (Bulca, 2014).

Lipid and protein oxidation plays an important role in the quality of meat products and because it leads to changes in taste and color, loss of essential fatty acids, changes in organoleptic properties, shortening shelf life, and reducing the nutritional value of muscular foods (Pranav 2018). Also, synthetic antioxidants in both food and pharmaceutical industries have various toxicities and side effects (Mukhtar et al., 2019).

In recent years, an effort has been made to use medicinal herbs as natural antioxidant sources. Amplification of free radicals is accompanied by major indicators and a number of progressive pathological conditions such as aging, cancer, endocrine disease, and neurological disorders (Lupoli et al., 2018). It has been reported that black seed is a high cumin

plant and is one of the naturally occurring medicinal plants that act as an equally important antioxidant in vivo and in vitro (Özdemir et al. 2018).

The pharmacological and toxicological properties of black seed weeds were investigated by Ali and Blunden (2003). The pharmacological and toxicological properties of black seed seeds were investigated by Ali and Blunden (2003). This fraction of essential oil has analgesic, antipyretic, antimicrobial, and antineoplastic activity. This lowers fat blood pressure and speeds up breathing. Studies on mice showed a decrease in cholesterol, glucose, and triglyceride ratios in plasma concentrations. It has also been found that black cumins' toxicity is at a low level (Ali and Blunden, 2003).

In another study, thymoquinone protects human cells from oxidation and provides cell healing by inhibiting harmful effects. Thymoquinone has a high potential for carcinogenesis, eicosanoid production, and membrane lipid oxidation. Additionally, TQ works as an effective chemoprotective agent with a hyperproliferative effect in experimental animals. Thymoquinone exerts anti-proliferative effects on cancer cell lines of the colon, ovary, larynx, breast, lung, myeloblastic leukemia, and osteosarcoma. In addition, TQ protects from various diseases and has been reported to prevent the immune system's weakening (Ramadan 2016).

The thymoquinone (essential oil's main component) in black seed oil prevents non-enzymatic oil peroxidation in liposomes (Houghton et al., 1995). The free radical reduction properties of compounds such as thymoquinone, carvachol, t-anethole, and 4-terpineol obtained from Nigella sativa were determined using fine surface chromatography (TLC) (Burits and Bucar, 2000).

The use of black cumin in other diseases

It has been reported that *Nigella sativa* extract kills cancer cells, and after treatment of bone marrow with *Nigella sativa* extract, an increase in the number of cells related to the immune system is observed. It has also been shown to induce myelopoiesis (blood and marrow formation). When the blood of patients with cancer is left to this plant, there is an increase in the production of tumor-specific antibodies (gained immune elements) as well as an increase in the number and activation of macrophage (giant lymphocyte cells that have settled in the tissue and fights infections in the tissues) (Goreja, 2003).

Black cumin seed has been created so that it can be instrumental in multiple effects such as a diuretic, blood pressure reducer, milk enhancer, appetizer, and menstrual dilator. Its oil is used against dandruff and hair loss (Junemann, 1998; Fong, 2002).

Dithymoquinone compound isolated from the essential oil of Nigella sativa seed has been shown to suppress symptoms in most of these patients when administered orally to some patients with bronchial asthma (Salem, 2005). It has been reported that thymoquinone has a relaxing effect, so it can be used successfully in the treatment of bronchial asthma when eaten alone or mixed with honey (Al-Majed et al., 2001).

Çakmakçı and Çakır retarded in their compilation that black cumin and its components have antibacterial, antiviral, anthelmintic, antifungal, antiparasitic, analgesic, anti-inflammatory, antitumor, immunomodulator, antidiabetic, hepatoprotective, antihistamine, antihypertensive, antihyperlipidemic effects and most importantly, antioxidant activity as well as many other pharmacological activities. Besides, black cumin is effective against various cancers (breast, colon, stomach, lung, and skin cancers), various immune diseases, cardiovascular diseases, hypertension, epileptic seizures, diabetes, various allergic diseases, colds, headaches, toothache, asthma, bronchitis, degassing, diuretic, menstrual, jaundice, various rheumatism and inflammatory diseases, prostate, ulcer, leukemia, dysentery, infections, obesity, back pain, hypertension and gastrointestinal problems, nasal congestion, hemorrhoid treatment reported that it is effective against diseases/problems such as hair breakage, preventing hair loss and dandruff, eczema and skin diseases, parasite infections, treatment of intestinal worms, scorpion and spider bites, lowering the level of cholesterol in the blood (Çakmakçı & Çakır, 2011).

The use of black seed in animal nutrition

Nigella sativa, which has an important place in human nutrition and health, is also very important for animal nutrition and health. In animal nutrition, the use of N. Sativa pulp, seeds, or fat in the diet of ruminants as a dietary supplement can provide production, environmental and economic benefits. N.Sativa has been reported to have positive effects on growth performance and food digestibility in ruminant animals (Yasmina et al., 2020).

As a result of a study investigating the effects of black seed added to lamb feeds, it was reported that 0.2% of black seed oil added to feeds increased the growth performance of lambs (El-Naggar et al., 2019). In another study, it was reported that 12 grams of black seed added to lamb feeds per day significantly increased growth (Cherif et al., 2018). Black seed contains many bioactive components with various pharmacological activities that may be beneficial for the health of livestock. Black cumin seed meal contains thymoquinone, which has antibacterial, diuretic, hypotensive and immuno-enhancing activities by increasing the percentage of neutrophils and thus increasing the body's defense mechanism against infection (Kanter et al.2005).

The role of N. sativa in strengthening the immune system is due to the Zn, Cu, Mn, Mg, Se, vitamin C, vitamin A, vitamin E and folic acid (Toma et al.2010). The folic acid, Fe and vitamin C content of black seed play a role in red blood cell formation, maturation and heme biosynthesis (Mariod et al.2017).

The inclusion of black cumin oil or extract in poultry diets as alternative growth promoters can bring many advantages due to its antioxidant, antimicrobial, and pharmacological properties. Growth performance, laying performance, reproductive performance, nutrient utilization, and egg quality can be improved by the dose-dependent application of black seed products in poultry. Also, the pathogenic bacteria count in chickens' gut can be reduced with Nigella sativa seeds (Mohamed et al., 2020).

In a study in which the additions of black cumin seed (10 g / kg) and black cumin seed extract (1g / kg) were used in broilers, the feed consumption increased in the other two groups compared to the control group, and the group in which black cumin seed was added compared to the control group and the group in which the black cumin seed extract was used. It has been stated that it has a positive effect on the feed conversion rate and also the use of black cumin seeds has a higher carcass weight than the control group (Erener et al., 2010).

In a study, where 1, 2 and 3% of black seed was added to the rations of laying hens, it was found that in the group with 3% added black seed, larger eggs were obtained in the groups with 2 and 3% added egg size, weight, shell thickness and egg yolk. Cholesterol ratio has been reported to decrease significantly (Aydın et al., 2008).

A lot of research has been done on fish using Nigella black seed oil. Doğu (2011) added different amounts of black seed extract to the broodstock feed of trout, and its effects on some spermatological parameters, seminal plasma composition, and DNA damage in spermatozoa were examined during the breeding season in rainbow trout. As a result of this research, he reported that black seed has a positive effect on some of the organic and inorganic parameters of seminal plasma by lowering the cholesterol values of trout semen and increasing the sodium (Na +) values. In studies on rainbow trout, it has been reported that black seed oil added to fish feed increases the growth performance of trout, changes their nutritional content and fatty acid profile, and increases shelf life (Öz, 2018; Öz et al., 2018; Öz et al., 2017; Öz , 2017; Öz et al., 2016).

Abdelwahab et al. (2012), black cumin and turmeric in their study investigated the effect of the mixture on blood parameters and growth performance of Asian sea bass (Lates calcarifer). As a result of the research, it was reported that the mixture of turmeric-black cumin improves the

growth performance of Asian sea bass and does not affect blood parameters.

Altınterim (2010) investigated the effects of black seed (Nigella sativa, L) oil on non-specific immune system parameters of rainbow trout (Oncorhynchus mykiss, Walbaum, 1792). According to the results of the study, significant changes were detected in the immune system and erythrocyte count, leukocyte count, hematocrit level, NBT level, total protein and total Ig parameters of fish treated with black seed oil. However, despite these changes, at the end of the 21st day, although the effects of this accumulation diminish, it has been determined that the fish's immune system strengthens and the black cumin oil to be used regularly and in certain proportions will keep the immune systems of the fish at a very high level.

Conclusion

Nigella seeds and essential oils are the sources of the plant's active ingredients. These components are antibacterial, antiviral, anthelmintic, antifungal, antiparasitic, analgesic, anti-inflammatory, antitumor, immunomodulatory, antidiabetic, hepatoprotective, antihistaminic, antihypertensive, antihypertensive, antihyperlipidemic, and most importantly because of their many other beneficial pharmacological effects in terms of antioxidant activity. It is also a plant with a high potential for use in terms of both health and aquaculture in ruminant and fish nutrition.

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Chapter 11

RETRIEVING ACTUAL EVAPOTRANSPIRATION FROM LANDSAT 8 IMAGERY: A CASE STUDY OF ADANA, TURKEY

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1. INTRODUCTION

Evapotranspiration (ET) is best described as the water loss from soil to the atmosphere due to evaporation and transpiration from vegetation. ET is a good indicator of irrigation effectiveness and total water consumption from vegetation and it is also difficult to measure and monitor.

The remote sensing has become one of the valuable data sources and accurate estimation of evapotranspiration is considered as the key factor in water management (Beg, et al. 2016). Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI), surface albedo, surface emissivity, and land surface temperature (LST) can be retrieved by remote sensing technology to be used in ET calculation. LST is one of the most critical factors affecting the accuracy of the ET estimates. It directly indicates how much energy and water may be available over the land surface. LST and other surface variables like surface albedo, soil moisture, emissivity, fractional vegetation cover, NDVI, and LAI affect the accuracy of the retrieved ET (Liou & Kar, 2014).

In this study, SEBAL model was employed in order to calculate actual ET using Landsat 8 for Adana. There are several models for ET calculation using remote sensing techniques and SEBI, SEBS, S-SEBI, SEBAL, METRIC, and TSM are some of them. Widely used and popular model, SEBAL, was employed in this particular study.

2. MATERIALS AND METHODS

2.1. Input Data

In order to carry out this study, the Landsat 8 scene acquired on August 31, 2020 (with path/row: 175/34) was downloaded from USGS website. Landsat 8 captures images of the earth every 16 day and can be downloaded free of change from USGS webpage (USGS, 2020). Landsat 8 has two sensors on board: the operational land imager sensor (OLI) and thermal infrared sensor (TIRS). OLI has 9 bands with 30m spatial resolution (except for panchromatic band) while the TIRS has two thermal bands with 100m spatial resolution as illustrated in Table 1 below (USGS, 2020).

Table 1. Landsat 8 band descriptions

Band Number	Band Width	Description	Resolution (m)
Band 1	0.435 - 0.451	Coastal/Aerosol	30
Band 2	0.452 - 0.512	Blue	30
Band 3	0.533 - 0.590	Green	30
Band 4	0.636 - 0.673	Red	30

Band 5	0.851 - 0.879	NIR	30
Band 6	1.566 - 1.651	SWIR-1	30
Band 7	2.107 - 2.294	SWIR-2	30
Band 8	0.503 - 0.676	Pan	15
Band 9	1.363 - 1.384	Cirrus	30
Band 10	10.60 - 11.19	TIR-1	100
Band 11	11.50 - 12.51	TIR-2	100

Among the popular methods, the radiative transfer equation method has been employed for this particular study. The detailed information regarding the RTE methodology can be obtained from the papers published by Oguz (2016a, 2016b).

2.2. Study Area

Adana is selected as the study area in this study because it is the sixth most populated city of Turkey and has large fertile soils. Adana is located in southern part of Turkey. The city is situated on the Seyhan River, 35 km inland from the north-eastern coast of the Mediterranean Sea. The southern and central portion of the province mostly falls within the Cukurova Plain, to the north, the plains give way to the Taurus Mountains. The neighbor provinces are Mersin to the west, Hatay to the southeast, Osmaniye to the east, Kahramanmaras to the northeast, Kayseri to the north, and Nigde to the northwest. The province is divided into 15 districts but only major districts, Ceyhan, Yuregir and Seyhan were selected as the study area since they are among the most populated districts of Adana as illustrated in Figure 1. Adana is home to 2.2. million people and one of the largest province in Turkey, as well an agriculturally productive area, owing to its large fertile plain of Çukurova. The north of the city is surrounded by the Seyhan reservoir. The Seyhan Dam, completed in 1956, was constructed for hydroelectric power and to irrigate the lower Çukurova plain. Two irrigation channels in the city flow to the plain, passing through the city center from east to west. There is another canal for irrigating the Yuregir plain to the southeast of the city. Adana has a hot-summer Mediterranean climate (Csa) under both the Koppen classification, and a dry-hot summer subtropical climate (Csa) under the Trewartha classification. Winters are mild and wet. Frost does occasionally occur at night almost every winter, but snow is a very rare phenomenon. Summers are long, hot, humid and dry. During heatwaves, the temperature often reaches or exceeds 40 °C (Wikipedia, 2020).

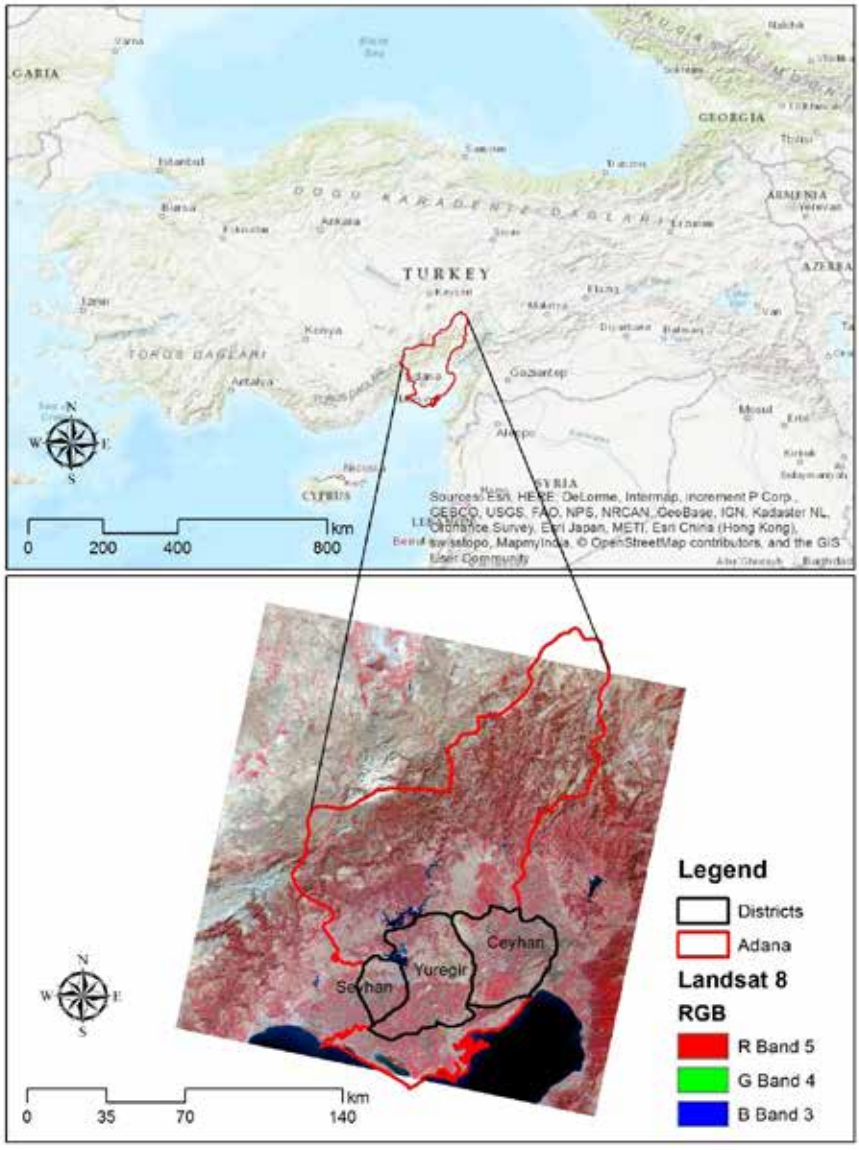

Figure 1. Location map of Adana and the districts of Seyhan, Yuregir, and Ceyhan.

SEBAL model was employed in this study. SEBAL can be calculated using the following equation:

$$ET = Rn - G - H \quad (1)$$

where

ET: Actual evapotranspiration rate (mm/hr)

Rn: Net radiation flux (W/m2)

G: Soil heat flux (W/m2)

H: Sensible heat flux (W/m2)

More detailed information regarding SEBAL model can be obtained from Waters et al (2002). Model Builder in ArcGIS has been used to calculate actual ET from Landsat 8 satellite imagery.

3. RESULTS

Using Model Builder in ArcGIS, ndvi, lai, surface albedo, emissivity, LST, net radiation, soil heat flux, sensible heat flux, and latent heat flux were calculated and their spatial distribution maps were created as illustrated in Figures 2-10 below.

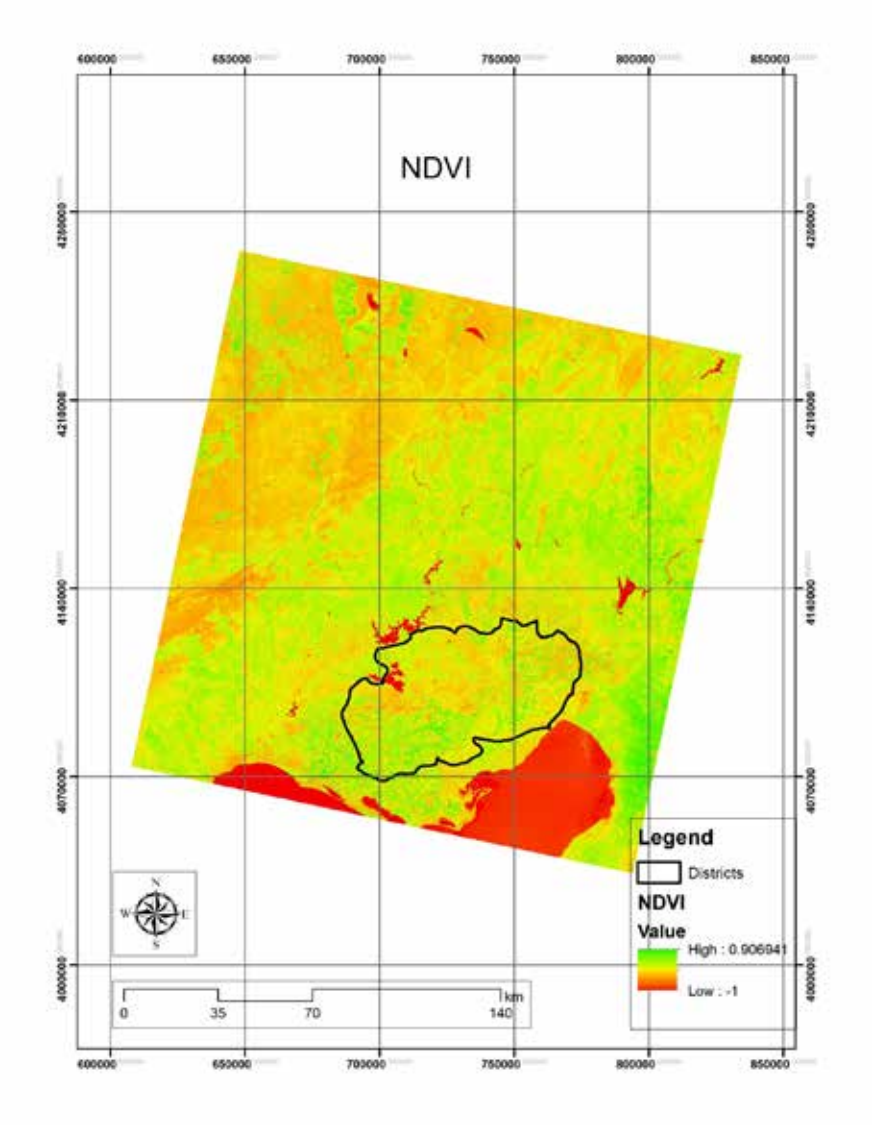

Figure 2. Spatial distribution of NDVI

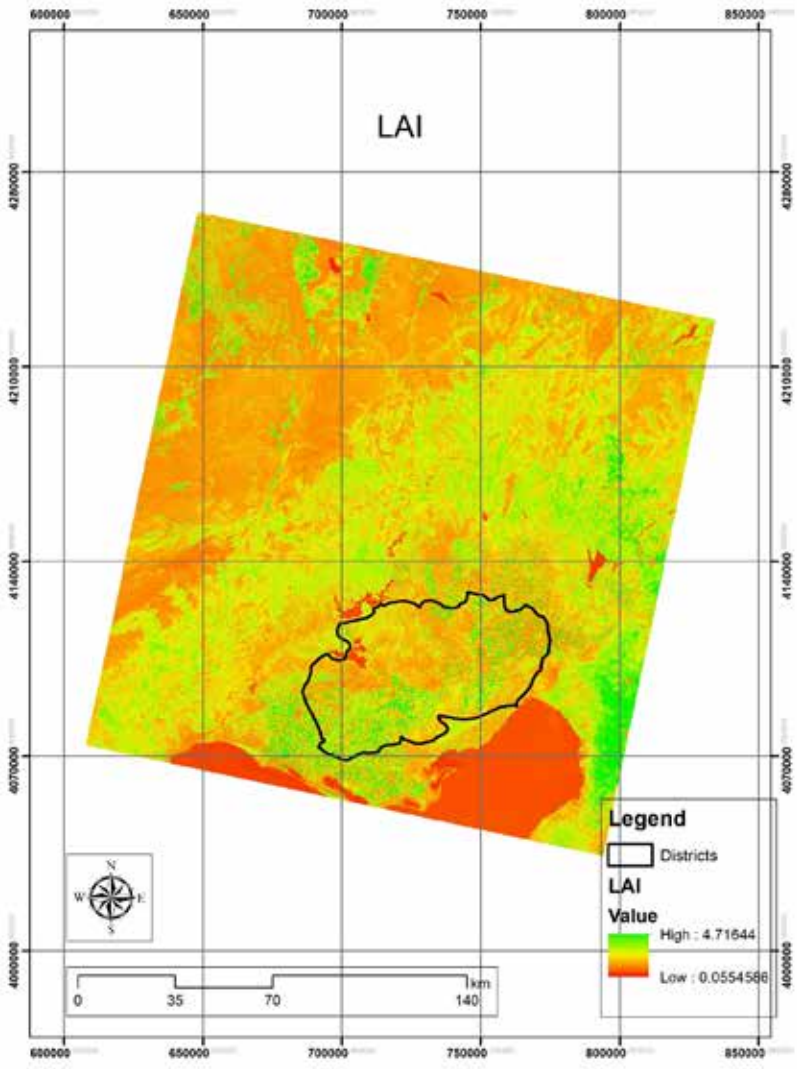

Figure 3. Spatial distribution of LAI

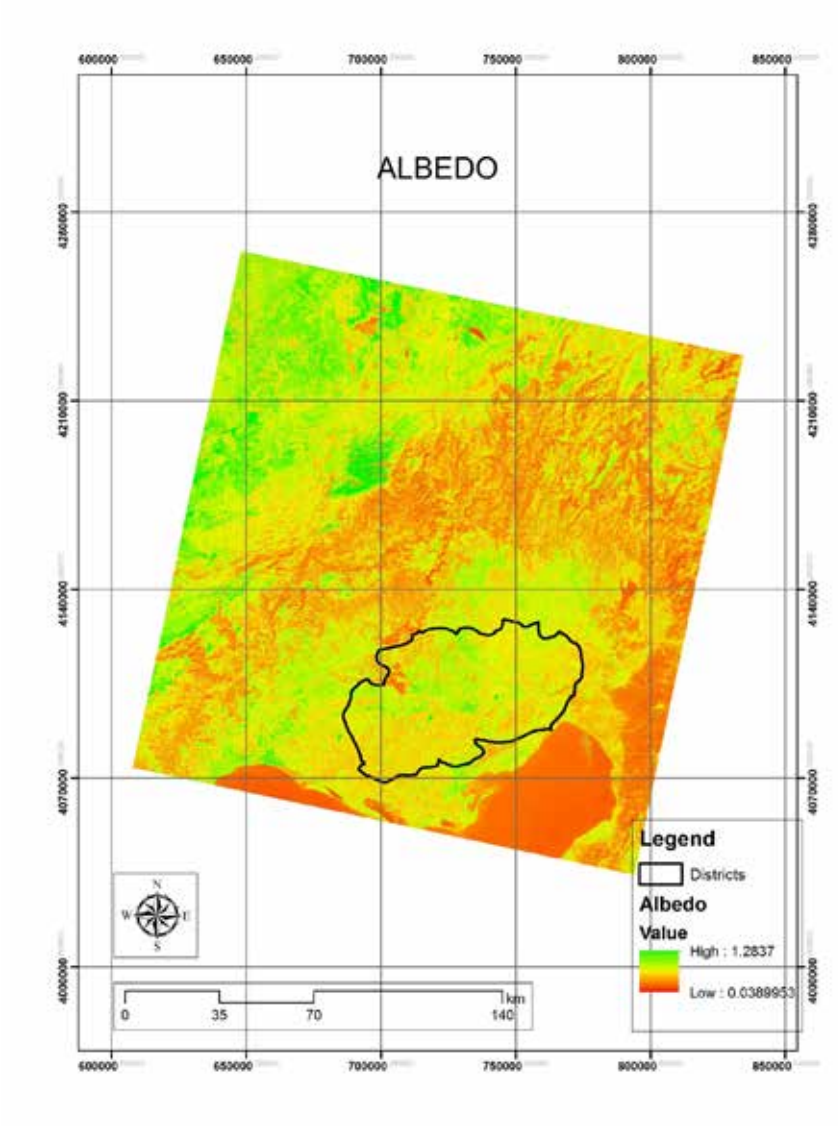

Figure 4. Spatial distribution of albedo

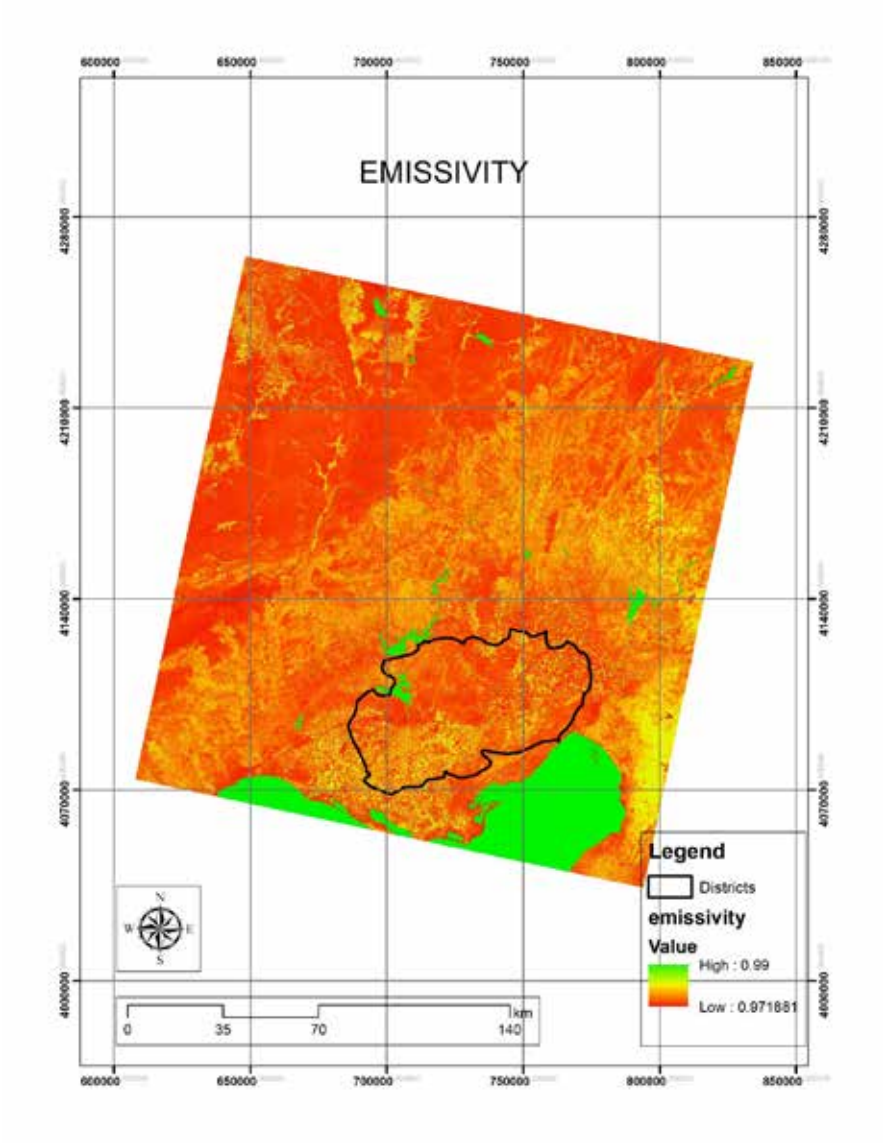

Figure 5. Spatial distribution of emissivity

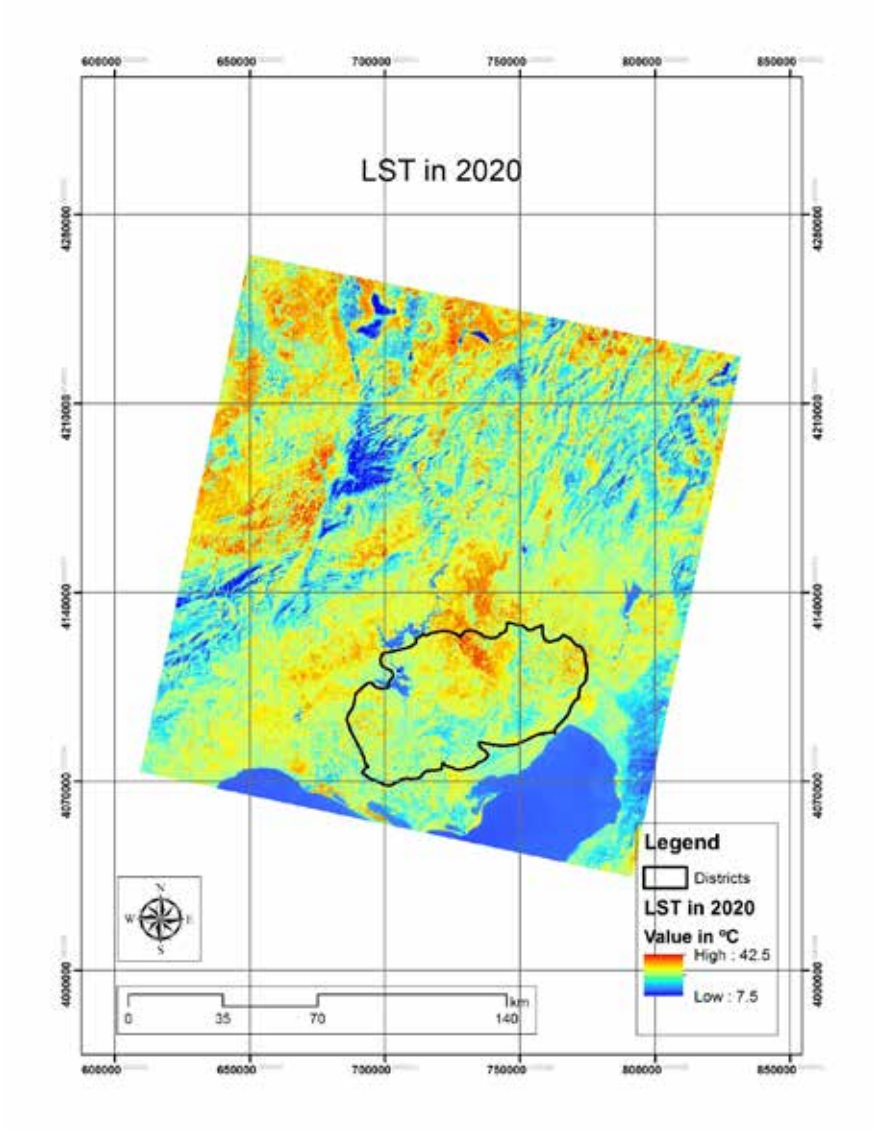

Figure 6. Spatial distribution map of LST.

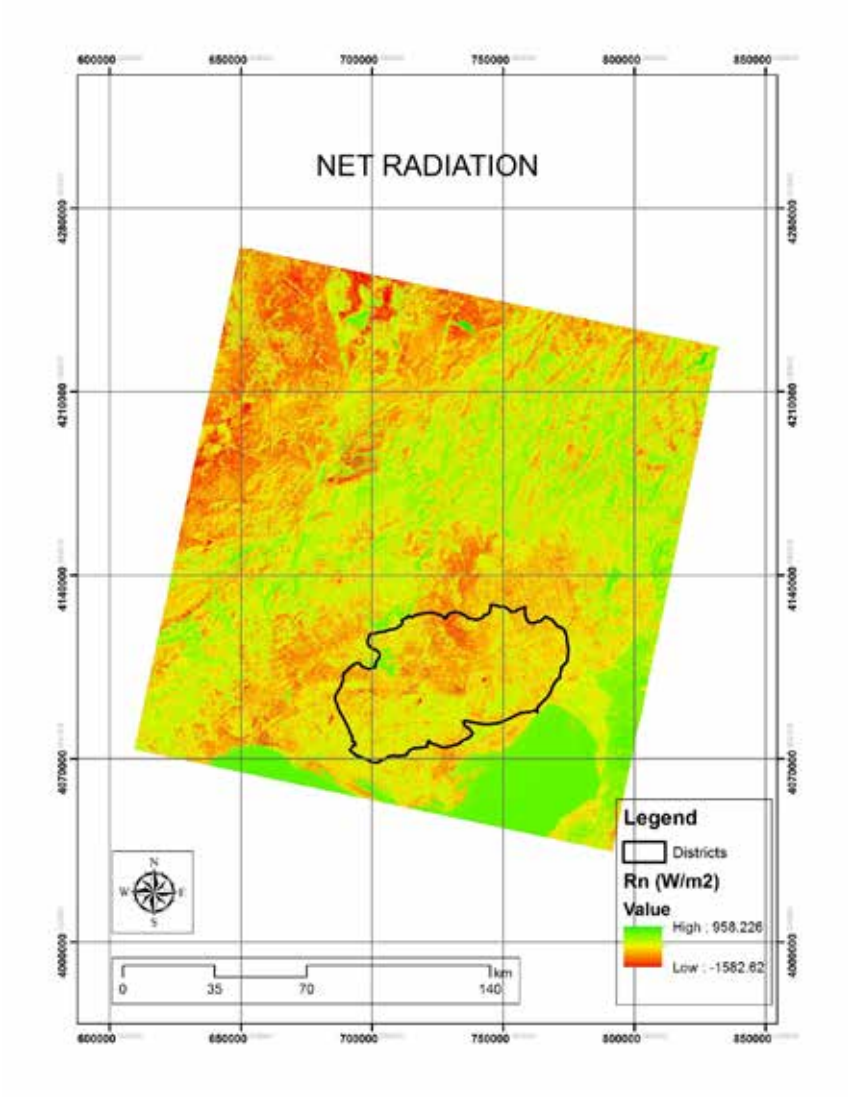

Figure 7. Spatial distribution map of net radiation.

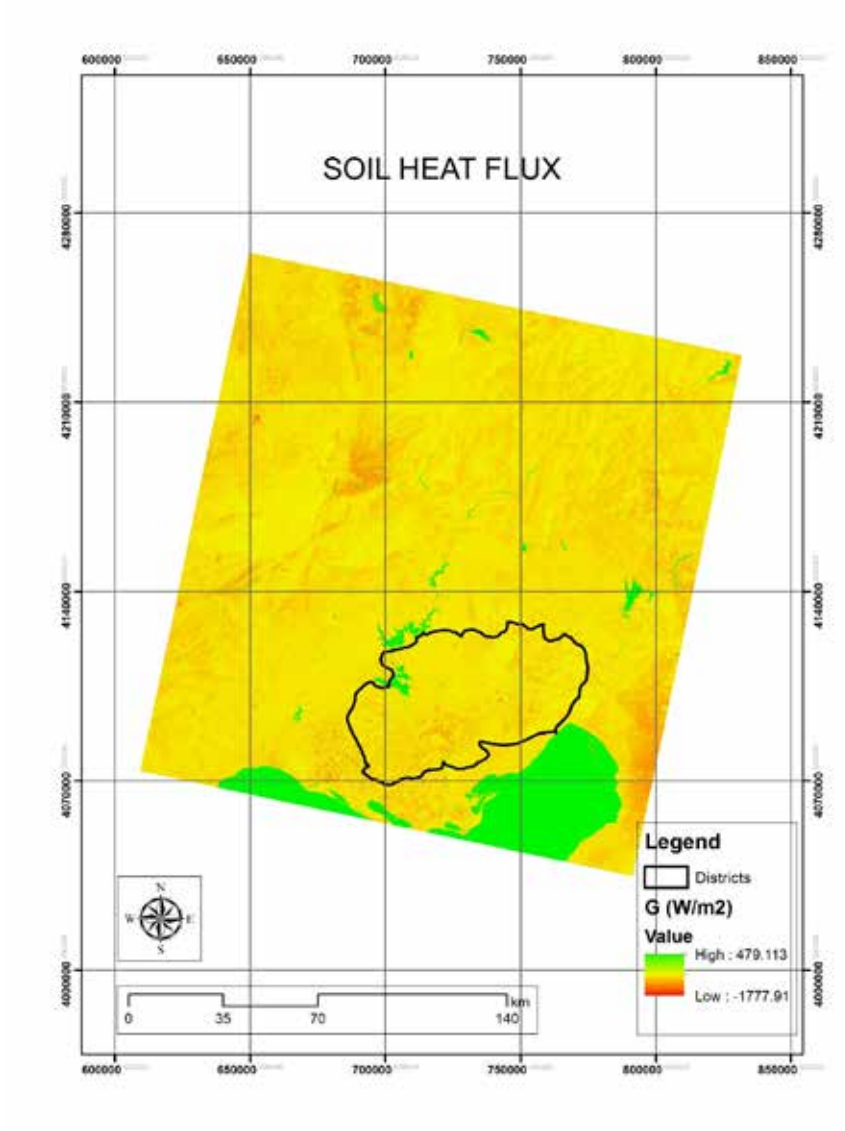

Figure 8. Spatial distribution map of soil heat flux

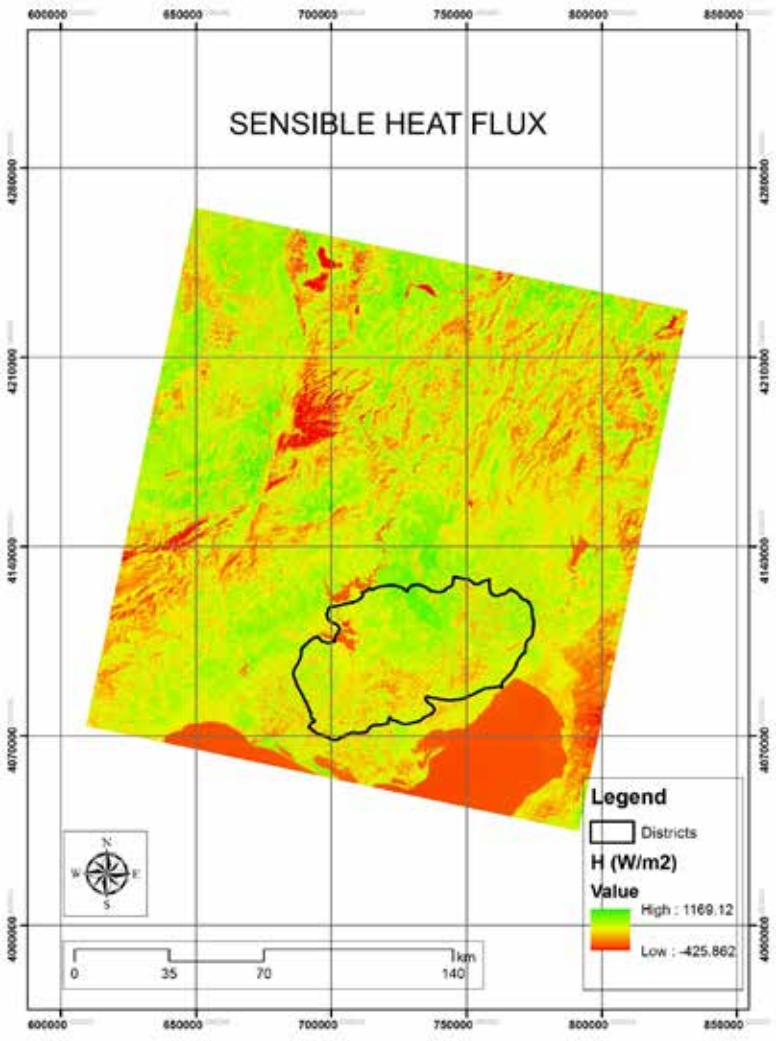

Figure 9. Spatial distribution map of sensible heat flux

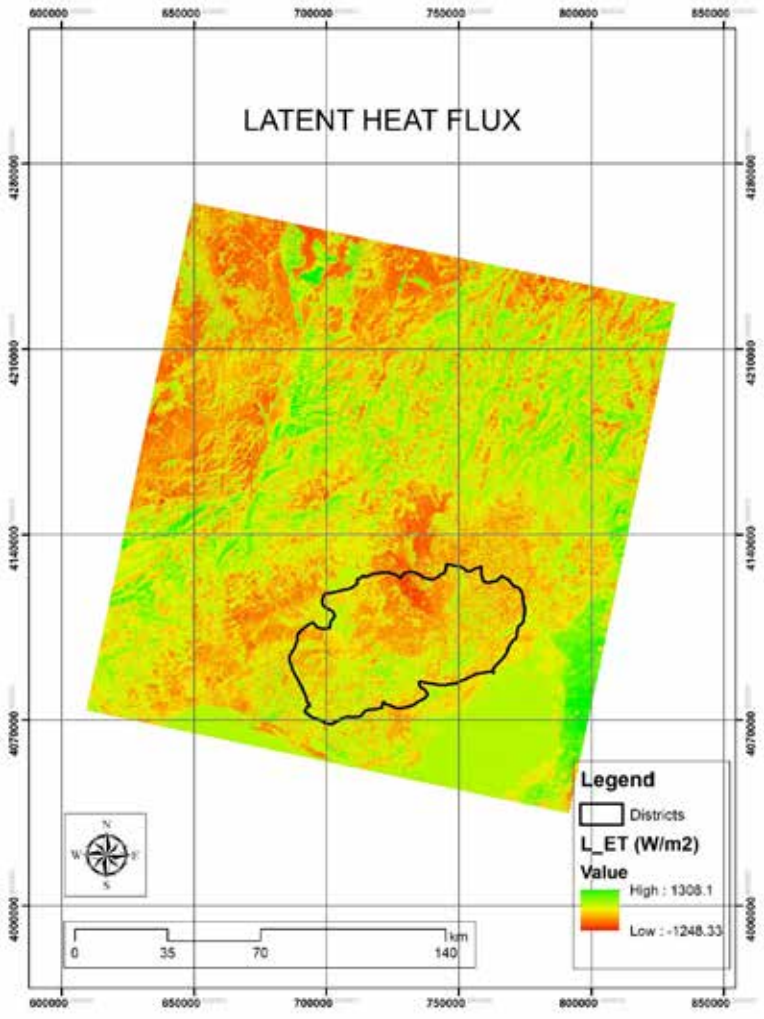

Figure 10. Spatial distribution map of latent heat flux

Finally, spatial distribution map of ET is illustrated in Figure 11 below.

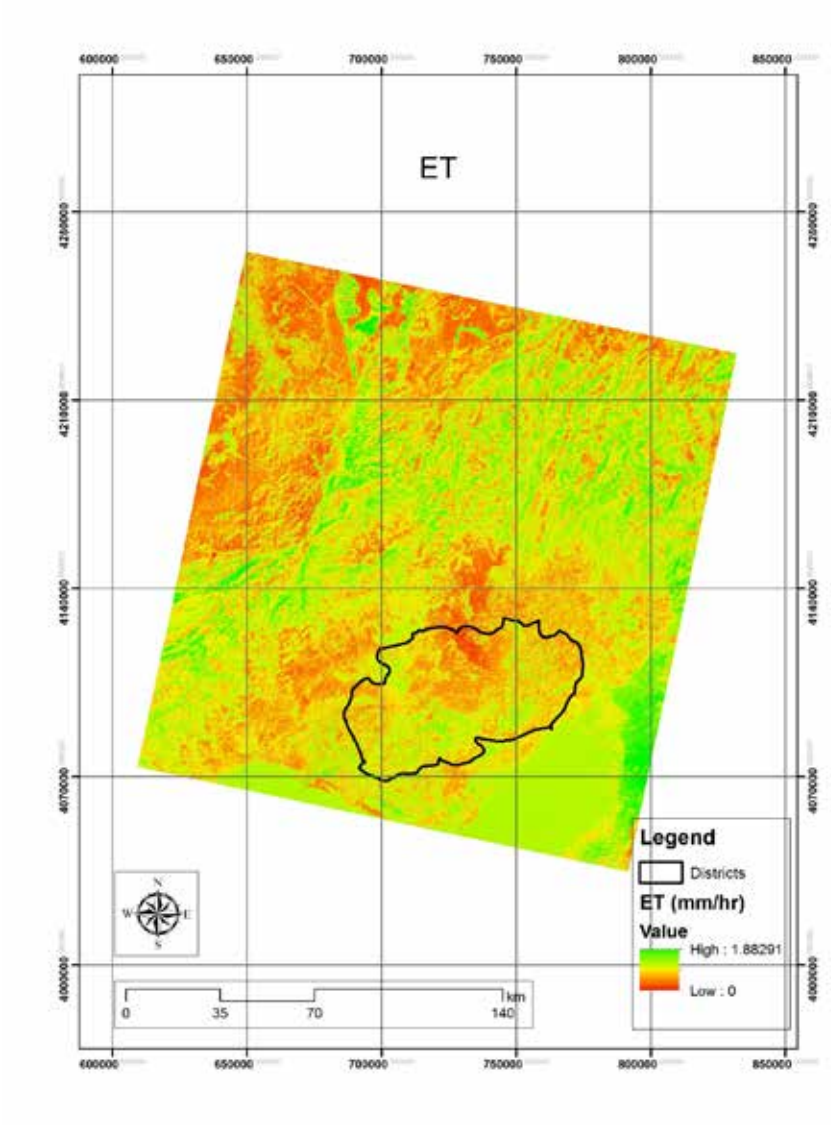

Figure 11. Spatial distribution map of ET

To better see the variation in ET over the study area, districts of Seyhan, Yuregir and Ceyhan were merged using dissolve tool in ArcGIS and then spatial distribution maps for the three districts were clipped out using the extract by mask tool in ArcGIS. Figure 12 illustrates spatial distribution map of ET in district level.

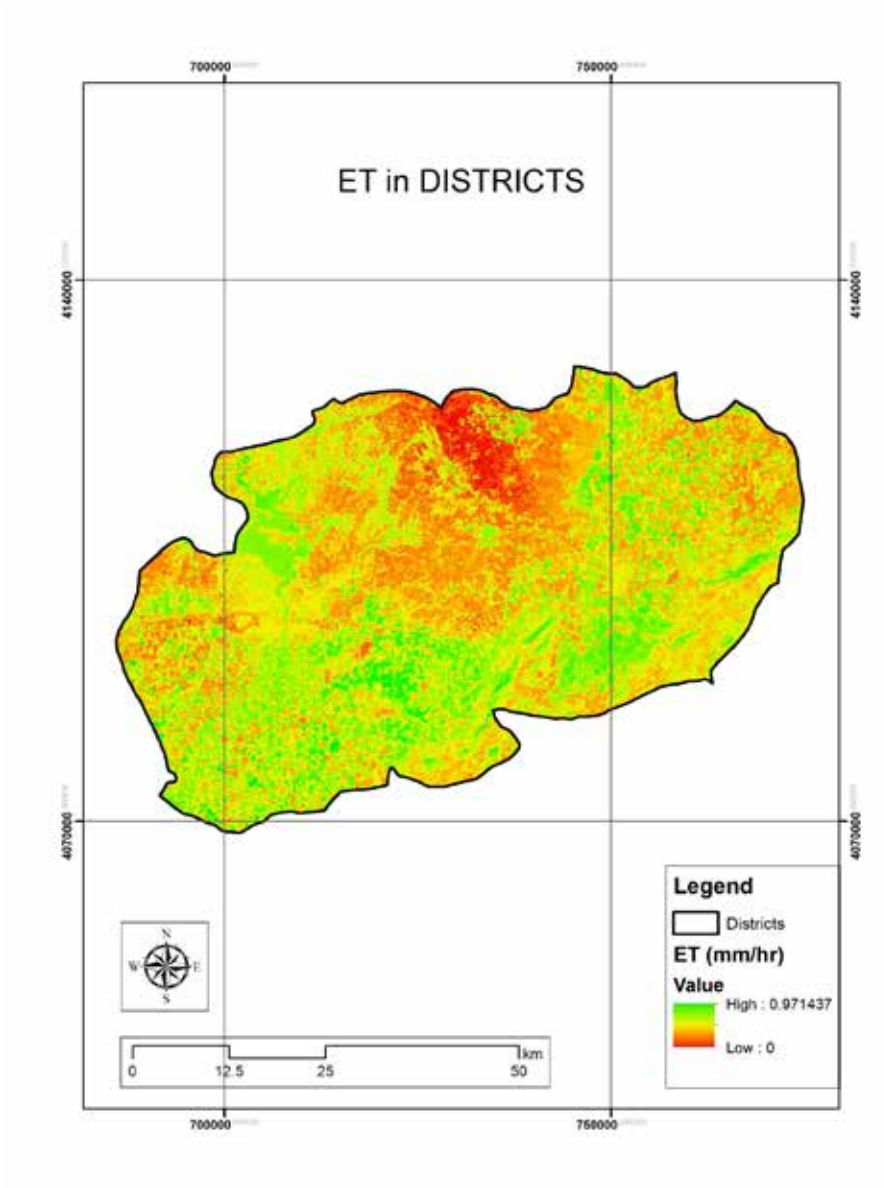

Figure 12. Spatial distribution map of ET in the districts of Seyhan-Yuregir-Ceyhan

4. CONCLUSION

For better water management, correct estimation of evapotranspiration is quite important. The use of remote sensing brings an important contribution for the assessment of crop water status. However, the use of

remote sensing for operational applications presents still several problems. For example, crop monitoring requires the routine processing of images on a near real time basis. Thus, relatively long temporal resolution and the cost of images make their use often unattractive. Users may save time and effort during evapotranspiration estimation from Landsat 8 imagery.

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