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Research Article/Araştırma Makalesi

A Study on the Relationship between Fertilizers, the Environment and Fertilizer Use: An Example of Alasehir and Sarıgol in Manisa Province, Turkey

Ayşe Nuray CEBECİ[1]

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Fertilizer-environment, Turkey, Alasehir, Sarigol, fertilizer, soil, consciousness, agricultural pollution.

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Abstract
Today, environmental, human and public health awareness are at varying levels in different countries, however on the whole, great progress has been made. The problems caused by the use of inputs in agriculture are experienced in different dimensions in developed and developing countries, as well as in Turkey. Merely having laws is not sufficient for the use of the appropriate fertilizer. As such, the situation in Turkey and in the world during the 2007-2017 period has been primarily studied employing the deductive method. In addition, the study attempts to determine the use of chemical fertilizers, and the factors affecting it, of producers who depend on agricultural activities and make a living mainly from viticulture in the Alasehir and Sarigol districts of Manisa province, which is one of the most important production and export centers of Turkey and has an important place in agricultural inputs. It is aimed to reveal the effects fertilizer use has on flora and fauna in the local ecosystem as well as the preferences and behaviors of the producers in fertilizer usage, and to determine whether the producer is conscious in the use of its product as an input. This research is of great importance in terms of being able to shed light on other studies and researchers, as it one of the few academic studies conducted in the region.

1. Introduction

The ever-increasing global food demand, the decrease in agricultural land and the declining quality of agricultural land are rapidly endangering food security, at the same time while the negative effects of agriculture on the environment are reaching serious proportions.

Soil is the main habitat of all species of living organisms in the terrestrial structure, which makes up 30% of the earth. Soil, air, water and fire (heat, light, and energy) are absolutely necessary for life functions and form the basic structure of life on Earth. This basic structure is built on an absolute natural balance. A negative factor that may occur in any way on one of these basic structures can lead to the deterioration of the natural balance and cause the loss of living things. Just as there

[1] Corresponding Author. ORCID: 0000-0001-9875-6698. Ph.D, Manisa Celal Bayar University, nuray.cebeci@cbu.edu.tr

are paramount life functions within a living plant, human or animal structure, there are similarly very large life functions, changes and transformations within the soil structure. In short, the earth is alive. In terms of its basic function on living organisms, it is literally the mother of earth, the basis of life.

The land presence of agricultural enterprises in Turkey has gradually decreased and the number of land plots have increased. Land aggregation and agricultural reform practices have not achieved the desired results. The vast majority of agricultural enterprises are not of an economic and rational scale and structure. (Kük, 2008: 27). However, the environmental performance of agriculture can be improved in our country by adopting and implementing environmentally conscious agricultural policies (product and input policies), and with the use of environmentally conscious technologies.

The yield of agricultural products in Turkey has not yet been increased to the desired level. Approximately 82% of the total cultivated and sown area in Turkey is fertilized with chemical fertilizers each year. Thus, in connection with water and the atmosphere, millions of tons of chemicals are given every year to the soil (Bayrakli and Balkaya, 2001: 20).

When chemical fertilizers are used in large quantities, they have a devastating and lethal effect from microorganisms, to worms and various soil maggots. Fertilizer powders that come into direct contact with these organisms have a lethal effect. The provision of excess nitrogen fertilizers to the soil adversely affects the activity of microorganisms such as Rhizobium sp. In this case, the way to utilize the free nitrogen of the air is blocked. In addition, it is also the case that the fertilizers with an excess of nitrogen limit the activity of nitrification bacteria. Thus, the second source of nitrogen, which is cost-effective, is also damaged (Topbas and Brohi, 1998: 31).

Discussed below are a number of important research papers on the subject:

The most important work done in the region in 1983 on the subject of research is an associate professorship thesis carried out in the central districts and villages of Manisa. According to research conducted on the use of chemical fertilizers in the central districts and villages of Manisa (Caglayan,1983: 104**)**; 96% of the enterprises examined use chemical fertilizer and believe in the benefit of the fertilizer in increasing production. According to data from 1981, a total of 187.7 kg/ha of fertilizer was used in pure nutrients in each hectare of cultivated agricultural land in the region. This value is well above the Turkish average (1979-52.6 kg/ha). In the same study, the importance of soil analysis in the use of fertilizer is also mentioned and unfortunately, this issue is not taken into consideration in the region. It is understood that, only about 2.1% of the enterprises using fertilizer do so by analyzing the soil.

The most important research papers and studies on the subject are summarized below.

Eraktan stated in his 1994 declaration that interventions were made in the EU on the use of fertilizer in agriculture within the framework of a common agricultural policy and environmental policy. It is emphasized that, in the use of a proper

fertilizer, merely a law will not be sufficient, but the importance of raising the awareness of producers is needed together with a law.

In his research thesis dated 1997 Olhan, E. focused on the environmental problems created by the use of inputs in herbal production, while focusing on the example of Manisa, and specifically examined the concept of environmental pollution. Turkey's importance in terms of ensuring balanced input use, the protection of natural resources and public health, as well as the necessity of integrating environmental policies while creating agricultural policies were also highlighted (Olhan, 1997: 158).

In a study conducted in Manisa in 2004-2005, the attitudes and behaviors of the vineyards on the use of agricultural fertilizer sought to be demonstrated. According to survey data from 117 producers operating in Manisa province, it was found that producers sourced fertilizer from the organizations where they used credits, 40.5% had soil analysis done, 39.7% did not, and 19.8% sometimes had soil analysis. In the same study, it is also emphasized that the habit of composting based on soil analysis has not developed sufficiently in many parts of Turkey, within the production branch as well as in the vineyards of Manisa province (Karabat, 2005: 166)

2. Materıals and Method

2.1. Materials

In the research, the main material in order to take an approach to attitudes and behaviors in fertilizer-environmental relations and fertilizer use was; survey data obtained from agricultural enterprises, as well as data from official institutions, such as agricultural forest district directorates, agricultural chambers, the Alasehir Commodity Exchange and TARIS-AR-GE (TARIS-R&D) in the region.

The data was obtained by the survey method from 16 settlements and 100 vineyard enterprises selected from Alasehir and Sarigol district centers and villages selected as research regions are in first place. Surveys cover the 2017-2018 production period. In the study, statistical data obtained from the Manisa provincial and Alasehir-Sarigol Agriculture and Forest district directorates were used to determine the settlements to be surveyed. Sixteen villages were chosen for the purpose which where villages that had the highest concentration of viticulture under the current restricted working conditions. Within the framework of existing limited personal working opportunities, 100 producer surveys were conducted in 16 villages, with equal proportions. The producers, who were selected objectively, were interviewed face-to-face and the previously prepared manufacturer questionnaire forms were filled out.

Some of the surveys are in the Region of Alasehir; Implemented in the Centre, Ornekkoy, Gobekli, Caberfakıllı, Subasi, Cakırcaali, Delemenler and Gobekli. The other part of the study was carried out in Sarigol, Center, Kizilcukur, Karacaali, Dadagli, Tirazlar, Kavakkiri, Uluderbent and Kocaklar. Survey data were obtained with technical support from vineyard business owners, Manisa provincial and Alasehir district Agriculture and Forestry Directorates, Sarigol Agricultural Chamber, and the Alasehir-Sarigol Forestry Management Departments. In the

provision of other materials, national and international statistical organization reports, congress and information papers, theses, articles and reports were used: FAOSTAT INDIVIDUAL REPORT-FAO-World fertilizer trends and Outlook to 2018-TUIK-2018, other important data sources.

2.2. Method of Collecting Data

The settlements that are connected to the two districts mentioned for the surveys are located in the field of vineyard production and are thought to represent the region best. Afterwards, the surveys were carried out through face-to-face interviews with farmer randomly selected out of farmers from a list formed with the help of a computer using data from Manisa Provincial Agriculture and Forestry Directorate, Alasehir District Agriculture and Forestry Directorate, and farmer registration system data.

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

$\sigma_{p_x}^2 = Oranın\ Varyansı$

$n = Örnek\ Hacmi$

$N = Anakütle$

$p = Oran\ (maksimum\ örnek\ hacmine\ ulaşmak\ amacıyla\ p = 0.5\ alınmıştır.)$

The proportional sample volume formula was used to determine which viticulture producers to enter data for. (Gunes and Arikan, 1988:145; Newbold, 1995: 867; Miran, 2002: 28).

Equation:

n= Sample Volume,

N= Total number of producers in selected villages

P= Proportion of viticulture farmers

(1-P)= Proportion of non-viticulture farmers

X^2= Variance

95% confidence interval and 5% margin of error were accepted and calculations were made taking into account p=0.50, (1-p)=0.50.

The data obtained from the survey study were first evaluated using average and percentage calculations.

3. Findings and Discussion

It is very important that human beings learn the correct behaviors about the environment and are educated accordingly. The root of many problems is lack of education and insensitivity. The destruction of the environment is not limited to one sector. Our world is facing environmental and soil pollution from intensively used agricultural fertilizers. Fertilizer is one of the most important inputs in agricultural production. When not implemented adequately, it causes significant losses in efficiency and quality. Otherwise, especially by washing through with

nitrogen and phosphorus fertilizer, it causes pollution of base and surface waters. In addition, if nitrogenous fertilizers are overused, the amount of nitrate in the leaf reaches a level that threatens human health (Atılgan, A., 2007: 47).

Agricultural activities producing greenhouse gases in Turkey consist of livestock, the use of nitrogen fertilizer, burning of straws and the production of unshelled rice. Diazomonoxide (N2O) emissions are as a result of agricultural sources, nitrogen delivery to the soil and overgrazing. Artificial or animal fertilizers applied to soil or water are reduced to ammonia and nitrogen oxides and then converted into N2O. To eliminate or reduce the negative environmental impacts of chemical fertilizers, fertilization should be primary based on soil analysis.

Fertilizer, whose raw material is largely dependent on overseas sources and whose prices are directly affected by oil prices, is one of the indispensable inputs of production. Chemical fertilizers in Turkey have been continuously supported as an input on the grounds that their use has not reached the desired level. However, the level of a farmer's awareness of fertilizer use and environmental impacts in Turkey is still not sufficient. Excessive and unconscious use of chemical fertilizers leads to environmental problems. New regulations and serious applications are needed to reduce or prevent damage to the environment (soil, water, atmosphere, plants, animals, people and ecology).

According to a 2018 projection by the FAO, it is expected that total fertilizer consumption worldwide will reach 226,150,381 million tons by 2030 with an increase of 32.1%, and this will increase by 52.8% to 156,727,886 million tons in developing countries. In developed countries, fertilizer consumption is projected to increase by 1.8% by 2030, while in European Union countries it is estimated to decrease by 2.4% (Zhang and Zhang, 2007: 427).

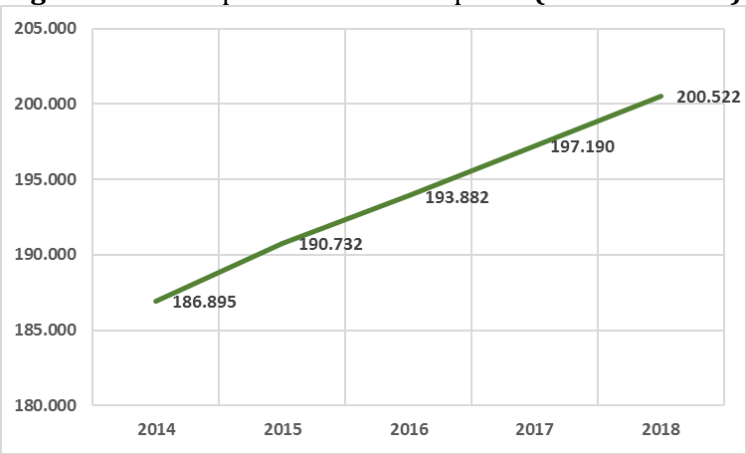
Globally, plant food demand ranks N first with a share of 59.5% in 2018, while Phosphorus (P2O5) ranks second with a share of 23.2% (Table 1)

Table 1. World Demand for Plant Nutrients, 2014-2018 (thousand tons).

Fertilizer Type / Year	2014	2015	2016	2017	2018
Nitrogen (N)	113.147	115.100	116.514	117.953	119.418
Phosphor (P_20_5)	42.706	43.803	44.740	45.718	46.648
Potassium(K_20)	31.042	31.829	32.628	33.519	34.456
Total	186.895	190.732	193.882	197.190	200.522

Source: FAO, 2018

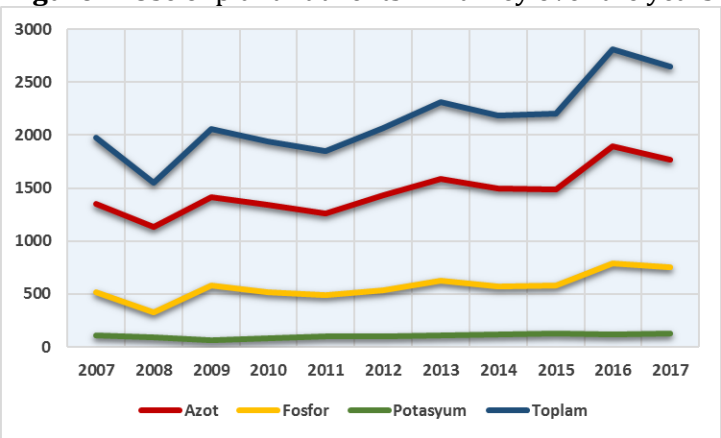
Figure 1. World plant food consumption **(N+P2O5+K2O)**



World plant food consumption has generally followed an increasing trend (Figure 1)

The use of chemical fertilizer in our country has followed a fluctuating and increasing course in total in the last ten years (**Table 2 and Figure 2**). In this way, global nitrogen use and total fertilizer use are on an upward trend as compared to years, i.e. from 2007 to 2016, while turkey has declined with the economic crisis in 2016-2017 (Figure 2)

Figure 2. Use of plant nutrients in Turkey over the years



In general, the territory of Turkey is poor in plant nutrients such as nitrogen and phosphorus, and potassium, calcium and magnesium are not a problem, thus the demand for nitrogenous and phosphorus fertilizers of agricultural land is (Aydeniz.1991: 613, Olhan.1997: 20).

Although not at the same speed in Turkey, the use of chemical fertilizers in the world tends to increase year-on-year. The most widely used commercial fertilizers in agriculture are nitrogenous and phosphorus fertilizers (**Table 3**). Nutrients such as phosphorus and potassium, and especially nitrogen, are indispensable elements in plant production. However, excessive and improper application of commercial fertilizers containing these elements brings many harms as well as benefit. In one study, it is reported that 50% of commercial fertilizers used in agriculture can be useful, and the rest is removed from the environment by seeping through the soil, surface flow and evaporation (Ciftci et al. 1996: 34).

Table 2. Use of Chemical Fertilizers in Turkey for Years (Plant Nutrient-BBM)
(thousand tons)

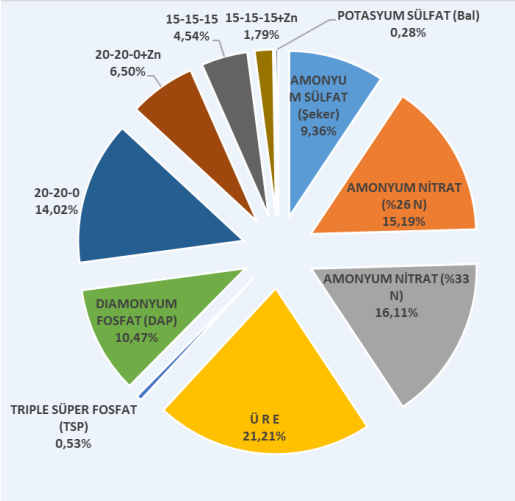
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nitrogen	1355	1133	1413	1343	1259	1432	1584	1493	1486	1896	1764
Phosphor	516	328	581	515	490	532	622	570	584	792	754
Potassium	109	89	65	83	98	101	105	117	131	118	125
Total	1980	1550	2059	1941	1847	2065	2311	2180	2201	2806	2643

Source: TURKSTAT, 2018

Table 3: Chemical Fertilizer Consumption Situation in Turkey (2007-2017 / Ton)

Fertilizer Type / Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Ammonium Sulfate (Sugar)	359.927	292.460	460.787	456.613	413.110	467.729	499.101	431.857	483.283	652.589	727.056	5.244.512
Ammonium Nitrate (26% N)	1.005.838	809.726	953.613	736.375	733.193	883.212	798.593	736.495	607.558	624.205	625.090	8.513.898
Ammonium Nitrate (33% N)	889.969	744.245	1.014.338	872.652	842.090	995.848	1.040.160	945.454	875.913	803.716	4.024	9.028.409
URE	772.232	770.231	808.253	879.523	760.295	872.413	1.100.865	1.074.122	1.105.355	1.766.383	1.976.770	11.886.442
Triple Super Phosphate (Tsp)	40.401	19.434	23.292	20.109	29.198	24.222	26.166	25.457	38.066	32.783	18.821	297.949
Diammonium Phosphate (Dap)	428.012	149.098	665.435	495.465	386.467	460.497	615.745	505.565	449.783	887.871	820.242	5.864.180
20-20-0	718.200	542.192	703.818	701.586	679.739	672.532	732.723	702.651	755.008	819.753	825.441	7.853.643
20-20-0+Zn	296.758	247.399	241.076	322.864	347.383	347.294	331.718	352.066	403.249	381.861	371.967	3.643.635
15-15-15	260.201	226.981	168.841	189.646	205.891	202.751	215.146	215.012	256.166	301.621	301.453	2.543.709
15-15-15+Zn	102.344	66.322	43.754	71.385	85.389	83.703	80.457	96.095	110.760	129.504	134.789	1.004.502
Potassium Sulfate (Honey)	28.058	15.484	10.396	19.798	19.688	15.719	13.707	8.731	6.004	8.968	7.689	154.242

Figure 3: Chemical Fertilizer Consumption in Turkey (%) (2007-2017)



Looking at the use of chemical fertilizers in our country over the years, foreign markets, oil prices, depending on an input, therefore instability and instability in the domestic market and economy is considered an indispensable input it also directly affects fertilizer consumption. In addition, the producer is trying to choose the cheapest fertilizer by considering the prices of chemical fertilizers that are in line with the overall inflation rates of the country, not according to the needs of the soil and product (see Table 5 and Figure 4).

When the consumption of chemical fertilizers in Turkey is calculated as BBM (2007-2017) it can be said that fertilizer use in the unit area is 103,063 kg/ha on average, varying from 72 kg/ha to 137.7 kg/ha. However, when the situation is examined throughout the province of Manisa, where the research area is located, in line with the data and calculations, chemical fertilizer consumption was encountered in the unit area ranging from 319 kg/ha to 530.6 kg/ha, and the average fertilizer consumption in the unit area in Manisa province was determined as 418 kg/ha. When the same calculations were made for the Alasehir district in accordance with the data obtained, the chemical fertilizer consumption value in the unit area between 2007 and 2017 was found to be 260.4 kg/ha on average (Alasehir-Table 4).

Table 4. Chemical fertilizer consumption (use) status by unit area in Turkey, Manisa and Alasehir* (as BBM) kg/ha

Years	Chemical Fertilizer Consumption in Turkey (BBM) Kg/Ha	Chemical Fertilizer Consumption in Manisa Province (BBM) Kg/Ha	Alasehir County Chemical Fertilizer Consumption Kg/Ha
2007	90,1	-	275,6
2008	72	-	279,4
2009	96,5	-	242,7
2010	90,8	-	251
2011	90	-	268
2012	100,3	319,06	242,7
2013	112,4	319	193
2014	105,3	331	194,4
2015	106,6	522,3	225,5
2016	137,7	530,6	230,4
2017	132	486,1	201,3
Average 2007-2017	103,063	418	260,4

According to the results of the analysis conducted by the Soil-Water organization, on average 70% of the country's land is poor or very poor in both nitrogen and phosphorus. This causes nitrogenous and phosphorus fertilizers to be predominant in fertilizer consumption.

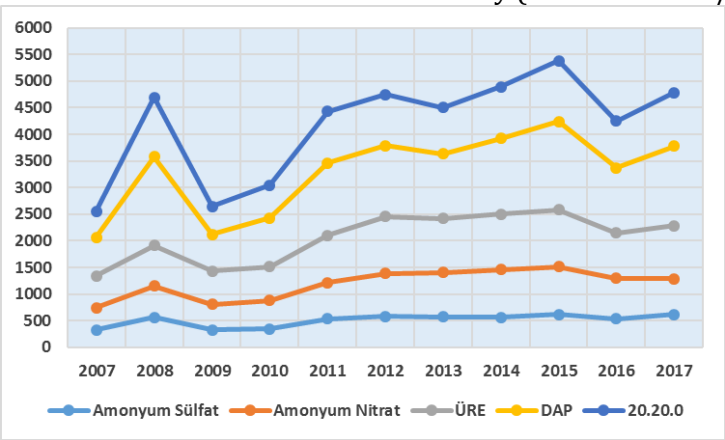
On the one hand, while developed countries continue to use dense fertilizer, on the other hand, in developing countries, the state is trying to eliminate inadequate use, while at the same time the consumption of fertilizer is fluctuating according to fertilizer prices and the purchasing power of the producer. The unconscious use of fertilizer makes the increase in agricultural environmental problems inevitable.

Table 5: Chemical Fertilizer Prices in Turkey (2007-2017- TL/Ton)

YEARS (Prices TL/Ton)	Ammonium Sulfate	Ammonium Nitrate	ÜRE	DAP	20.20.0
2007	329	410	602	725	493
2008	564	585,5	760	1672	1110
2009	325	479	630	689	520
2010	347	531	631	919	617
2011	532	678	893	1362	964
2012	583	800	1071	1332	958
2013	566	836	1018	1209	873
2014	564	891	1045	1425	965
2015	619	893	1069	1659	1145
2016	532,3	766,7	852,4	1215,4	878,3
2017	617,3	666,1	1000	1494	1010

Source: TURKSTAT, 2018.

Figure 4: Chemical Fertilizer Prices in Turkey (2007-2017- TL/Ton)



Factors such as agricultural problems, problems in the institutional structure, lack of planning, lack of proper guidance, inability to develop the farmer's knowledge and skills, etc. directly affect the use of fertilizers. Along with these factors, the purchasing power of the farmer also impacts the use of chemical fertilizers. According to a study on this subject, chemical fertilizer consumption decreases in years when the price of chemical fertilizer increases, where there is no or low government support, and when the product price is low (Eraslan et al. 2010: 21).

Most importantly, the majority of farmers still fertilize traditionally and buy the fertilizer based on its color (Yilmaz et al. 2009: 31). In the study, 34% of farmers decided on their own knowledge and experience when determining the amount of fertilizer, 38% of them were composted and 37% said they did not participate.

Education and publishing services in the agricultural sector are not adequate. Agricultural organizations and professional organizations should strive to address this deficiency with theoretical and applied farmer training programs. The use of the right type and quantity of fertilizer is critical to prevent environmental damage from fertilization by adhering to sustainable farming principles.

Until the 2000s in Turkey, the production and fertilizer policy can be summarized as "*produce as much as you can, as much as you can consume*". Continuous encouragement of fertilizer use has increased consumption. There is no control over fertilizer consumption (use) and farmers are not conscious about the use of fertilizers. For this reason, soil analysis laboratories operate at low capacity (Olhan, 1997: 41).

Wrong fertilizer applications cause the occurrence of problems in soils including salting, heavy metal accumulation, nutrient imbalance, deterioration of microorganism activities, eutrophication and nitrate accumulation in waters, issuance of nitrogen and sulfur-containing gases in the air, the greenhouse effect etc. (Sonmez et al., 2008: 24).

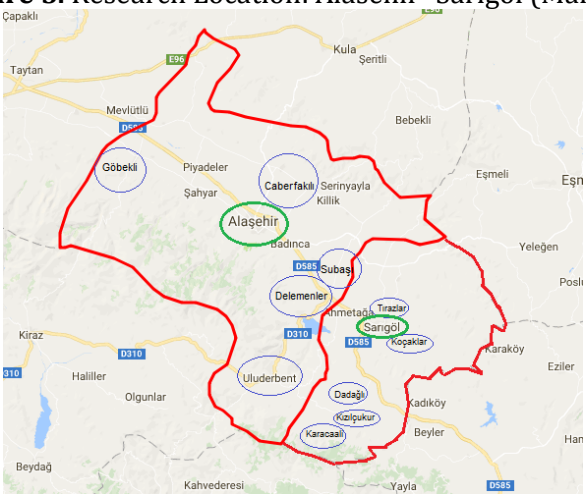
3.1. General Information about the Research Location

Manisa is a province of Turkey with a wide range of herbal and animal products. Chemical fertilizers are one of the important inputs that are effective in increasing agricultural production and supplying quality products. In this section, general information about the geographical location, climate data, socio-economic

characteristics and agricultural structure of the Alasehir and Sarigol districts of Manisa province, which are selected as research areas, are given.

Alasehir is a district in the inner Aegean region, located in the eastern part of the Gediz plain, which is one of the east-west-facing plains in Western Anatolia, 118 km away from Manisa province and has an area of 977 km2. The district is a graben through which the Alasehir River flows and consists of very high plateaus and mountains that limit it from the south and north. It is located in the transition from a Mediterranean climate to a terrestrial climate. The average annual rainfall of the district is 500 mm (Karakuyu and Ozcaglar, 2001-17.).

Figure 5. Research Location: Alasehir -Sarigol (Manisa)



The Sarigol district is located 131 km away from Manisa province, with an area of 423 km2, and a height of 320 m from the sea, located at the starting point of the Gediz plain at $38^0\ 52^1\ 09^{11}$- $38^0\ 19^1\ 54^{11}$ north latitudes and in the south east of Gediz graben extending towards NW-SE $28^0\ 25^1\ 52^{11}$- $28^0\ 52^1\ 04^{11}$ east longitudes. A Mediterranean climate prevails. According to the 1975-2008 annual climate data, the average temperature in the region (^{0}C):16.6, maximum temperature (^{0}C): 41.2, rainfall average (mm):29.1 (Bucak, 2011: 245). Sarigol's economy is based entirely on agriculture and almost all of the plains are vineyard areas. There is 19,210 ha of agricultural area, 18,071 ha of forest area and the district area measures 42,300 km^2, registered farmers number 5637 and vineyards (8100 ha), as well as cereals, tobacco, fruit growing (chestnuts, walnuts, cherries, pomegranates, apples) and a small number of livestock and beekeeping play active roles in the county economy.

The majority of enterprises in the Alasehir region of the research area conduct viticulture as monocultures. While the proportion of enterprises engaged in viticulture only in Manisa is 66.67%. Besides viticulture, a production pattern model is formed in the form of corn, cotton, wheat and different combinations of these products. In the Sarigol region, viticulture is again the first, while wheat, barley, tobacco, chestnuts, olives and ovine livestock activities are also observed.

Fertilization has a distinct importance in cultural practices aimed at increasing productivity and quality in viticulture. An effective and balanced fertilization with other cultural processes, both improves the physical, chemical and biological structure of the soil, and restores the plant nutrients that vines remove from the

soil every year, that is required for development and product use (Celik et al., 1998: 253).

According to the findings, 95% of vineyard enterprises use chemical fertilizer every year. In a study conducted in the Kavaklıdere vineyard areas, nitrogen deficiency was found in 48% of the vineyard areas in the region, a lack of phosphorus in 24% and potassium deficiency in 52% (Okur et al., 2002: 15). It was stated that 24% of Alasehir vineyard areas had mild nitrogen and phosphorus deficiency, and 71% had potassium deficiency (Kovanci and Atalay, 1977: 119). The nutritional status of the Aegean region's vineyards was examined by soil and plant analyses and it was determined that 57% of the vineyards required nitrogen, 73% needed phosphorus and 55% required potassium .As seen in studies conducted in the vineyard areas in the Aegean region, deficiencies in nitrogen, phosphorus and potassium nutrients have been identified. Chemical fertilizers should be used to meet these deficiencies. For these reasons, the use of chemical fertilizer sourcing was found to be high in the region, which is the research location.

3.2. The Most Widely Used Chemical Fertilizers In Region Of Research

Although chemical fertilizers are divided into 5 main groups according to the type of nutrients in their composition (Uzbek, 1975: 91), the most widely used fertilizers in the field of research are nitrogenous fertilizers, potassium fertilizers and composite fertilizers (mixed) are at the forefront.

From nitrogenous fertilizers containing only nitrogen from plant nutrients in their compositions, ammonium nitrate from the subgroup of nitrate-ammonium fertilizers, urea from the subgroup of amide fertilizers and ammonium sulfate from the subgroup of ammonium sulphate are the most widely used fertilizers.

Composite fertilizers containing more than one plant nutrient in their composition have become fertilizers that are preferably used in the world and in Turkey, especially in practice, because they save time (Caglayan, 1983: 45).

The most widely used forms in the field of research are: 20-20-0, 18-46-0 (DAP), 15-15-15 Zn (**Tables 6 and 7**).

Figure 6: Amount of chemical fertilizer used in agricultural fields in Manisa (total for the last decade) (tons) 2007-2017

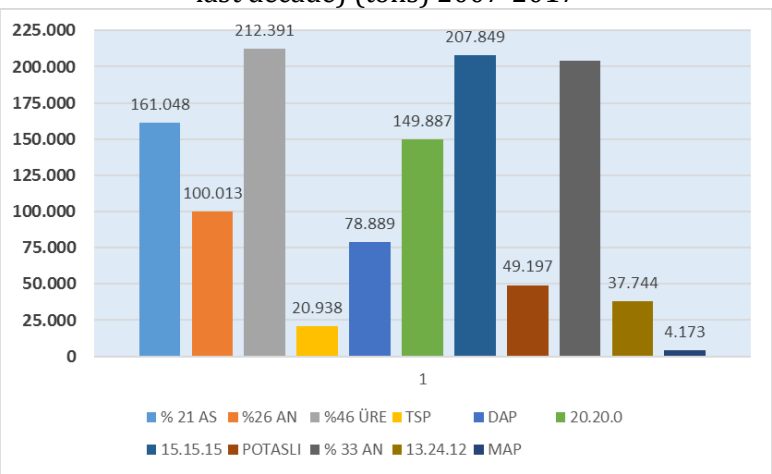


Table 6. Total amount of chemical fertilizer used in agricultural fields in the Manisa Province (tons) 2007-2017

Fertilizers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
21% AS	12.753	11.785	15.077	15.491	13.240	14.195	11.017	12.577	15.916	17.614	21.383
26% AN	18.403	9.717	9.477	8.830	7.960	9.044	7.868	7.415	8.065	8.351	4.883
46% ÜRE	17.431	19.780	18.628	18.960	14.248	14.765	14.335	15.350	20.350	27.630	30.914
TSP	3.358	1.998	1.286	1.967	1.543	2.777	2.180	1.595	1.726	1.361	1.147
DAP	8.160	2.514	7.341	8.061	7.553	5.827	6.927	6.000	6.756	9.626	10.124
20.20.0	17.674	12.636	15.590	12.638	10.426	14.176	11.204	10.760	12.757	14.400	17.626
15.15.15	22.163	20.772	14.034	16.850	13.085	16.348	15.439	16.200	22.763	24.604	25.591
POTASSIC	5.571	5.658	2.342	4.431	6.165	4.697	4.483	3.351	4.788	3.975	3.736
33 %AN	20.343	21.066	20.781	17.584	16.875	19.746	13.530	16.100	38.585	18.607	1.006
13.24.12	1456	2143	840	1181	1.609	3.646	3010	2500	8.141	8453	4765
MAP	55	222	71	104	228	335	230	315	762	1294	557
TOTAL	127.367	108.291	105.467	106.097	92.932	105.556	86.983	92.163	139.847	135.915	116.410

Source: Manisa Agriculture and Forestry Provincial Directorate Records, 2018

Table 7. The amount of chemical fertilizers used in the agricultural fields of Alasehir district of Manisa province (tons) 2007-2017

YEARS	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A.Sulphate 21%	1586,8	1944,1	2232	2070,8	2140,5	1.863,45	440,55	1486,8	2061	1658,6	1454,7
A. Nitrate 26%	573,35	598,7	550,7	461,4	310,75	401,6	378,5	311,2	243,1	256,35	38,35
A. Nitrate 33%	1095,7	1464	834,45	794,6	959,4	987,3	764	1181,2	1047,5	1012,9	0,25
ÜRE 46%	1006,6	1125	1075	1005,6	911	731,85	682,75	696,85	805,8	834,29	1134,4
T.S.P	846,9	705,5	216,75	366,7	484,86	538,95	535,1	405,75	417,1	358,2	298,6
20.20.0 Kom	944,8	828,84	1232,4	1270,9	924	871,15	837,6	719,4	585,9	530	731,2
15.15.15	937,85	1435,4	968,75	1167,1	878,65	521,45	552,45	496,85	560,3	240,65	373,85
Dap(18.46.0)	853,4	174,45	302,05	456,1	921,85	759,3	680,45	397,1	479,6	720,8	743,7
15.15.15 + Zn	532	212,95	126,2	492,2	661,55	984,85	1.091,05	1072,8	1370,3	1653,7	1519,5
P. Sulfate	1440,8	1229,4	460,08	879,85	1255	983,42	1.059,65	139,05	325,43	814,88	753,9
P. Nitrate	80,9	108,83	45,475	117,93	94,425	73,87	45,02	63,99	57,33	48,5	56,05
Total	9899	9827,1	8043,8	9083	9541,9	8717,19	7067,12	6971	7953,2	8128,8	7104,4

Source: Alasehir Agriculture and Forestry District Directorate Records, 2018

Figure 7: Amount of chemical fertilizers used in agricultural fields in the Alasehir district of Manisa province (total of last 10 years) (tons) 2007-2017

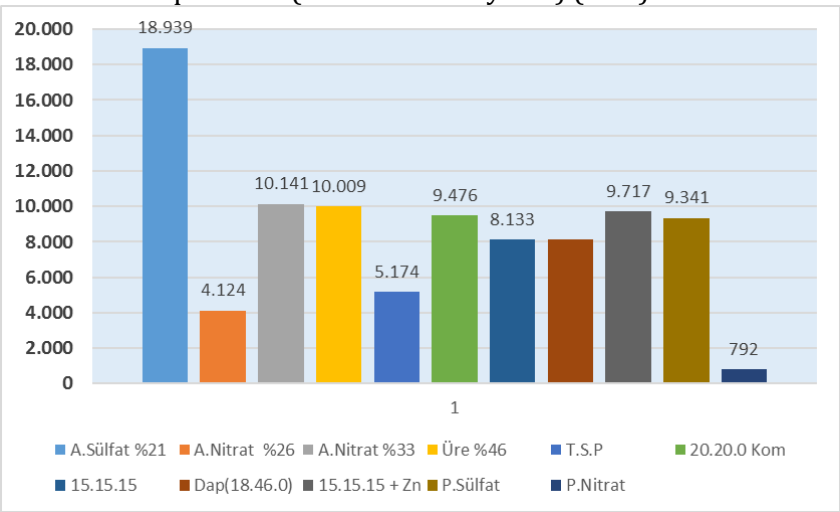


Table 8: The amount of chemical fertilizers used in the agricultural areas of Sarigol district, Manisa Province (tons)

YEARS	2015	2016	2017
A. Sulfate 21%	792,5	607,35	563,4
A. Nitrate 26%	447,68	445,75	112,5
A. Nitrate 33%	957,25	550,4	0
URE 46%	691,2	354,55	582,6
T.S.P	142,4	102,1	0
20.20.0 Kom	887,85	55,1	0
15.15.15	446,9	650,7	155,3
Dap(18.46.0)	583,05	735,35	624,95
15.15.15 + Zn	547,8	422,75	624,75
P. Sulfate	279,45	569,55	478,85
P. Nitrate	86,4	3,6	0
Total	5862,48	4497,2	3142,35

Source: Sarigol Agriculture and Forestry District Directorate Records, 2018

Figure 8 : Total amount of chemical fertilizers used in agricultural fields in the Sarigol district of Manisa province (last 3 years) (tons) 2015-2017

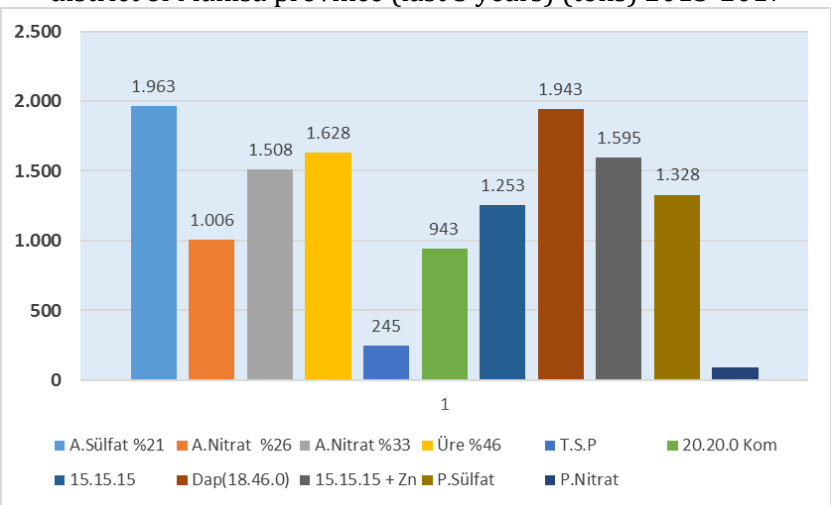


Table 9. The number of producers registered to the Farmer Registration System (CSR), the number of producers who had soil analysis according to official data, and the % rate (2013-2018) In the Research Location (Alasehir-Sarigol)

Years	Total Number of Registered Producers (Herbal)	Number of Producers Who Conduct Soil Analysis	%
2013	13698	1045	7.63
2014	14377	1650	11.47
2015	15078	1375	9.12
2016	15545	2255	14.5
2017	15600	2319	14.8
2018	16061	1833	11.4
Average			11.50%

Source: Alasehir Commodity Exchange and Taris Ar-Ge (Taris R&D) records were used.

Table 10. The main settlement and number of manufacturers in the survey study

District Field Group	Settlement Area in the Group	No. of Producer Interviews
Alasehir		
A1	Caberfakili+Çakırcaali+Ornekkoy+Delemenler+Gobeklikoyu	25
A2	Center+Subasi+Baklaci	25
Sarigol		
S1	Kizilcukur+Karacaali+Kavakkiri+Center	25
S2	Dadagli+Kocaklar+Tirazlar+Uluderbent	25
Total		100

A total of 100 producers selected from 16 villages were interviewed from the Alasehir and Sarigol districts selected as research areas. 88% of the producers interviewed in the research stated that they use chemical fertilizers, and that they have been doing this for 20 years, which is roughly the state of the region in terms of fertilization. Even though this is a rough estimate, it is still important in terms of being revealed (table 10). Looking at the educational status of producers according to age groups, it is observed that 60% of producers are aged 30 and younger, and 43.3% of those between the ages of 31 and 40 are high school graduates. In general, it is understood that around 44% of high school graduates,

25% of primary school graduates and 47.8% of the farmers who graduated from primary school are clustered between the ages of 51 and 60 (table 11).

Table 11. Education status by age group of producers

Age group Education level	30 and under	Between 31 and 40	Between 41 and 50	Between 51 and 60	61 and older	Total
Primary School	0 %0,0	5 %16,6	6 %17,6	11 %47,8	3 100,0	25 %25
Middle School	3 %30	6 %20,0	6 %17,6	2 %8,7	0 %0,0	17 %17
High School	6 %60,0	13 %43,3	16 47,0	9 %39,1	0 %0,0	44 %44
University	1 %10,0	6 %20,0	6 %17,6	1 %4,3	0 %0,0	14 %14
Total	10	30	34	23	3	100

Table 12. Land size and % distribution of enterprises in the research area

Research Area	The size and distribution of the land *(da, %)				
	I	II	III	IV	Total
A1	12 %19,6	6 24,0	6 66,6	1 20,0	25 25,0
A2	13 %21,3	7 28,0	2 22,2	3 60,0	25 25,0
S1	20 %32,7	5 20,0	0 0,0	0 0,0	25 25,0
S2	16 %26,2	7 28,0	1 11,1	1 11,1	25 25,0
Total	61 %100	25 100	9 100	5 100	100 100

*I : 0-20 da, II:21-40da, III: 41-60, IV: 61 and above

61% of producers have land assets ranging from 0-20, where approximately 41% of these are owned by businesses in the Alasehir region, and 59.1% are in Sarigol region. The second group in terms of land size and distribution indicates land presence ranging from 21-40. In this group, which receives a 25% share in total, both regions exhibit a similar situation. 86% of the 100 manufacturers interviewed have 40 acres and less land assets. (table12)

88% of 100 agricultural enterprises use chemical fertilizer. The remaining 12% use farm fertilizer and organic fertilizers (green fertilizer, pigeon manure, sheep manure, etc.) (table 13).

Table 13. Where producers in the field of research source fertilizer

Research Area	Source of fertilizer*				
	1	2	3	4	5
A1	0	17	5	0	3
A2	2	15	4	1	0
S1	0	21	3	0	1
S2	3	12	4	0	6
Total	5	65	16	1	10

Footnote* 1. chemical fertilizer not used 2. Bought from fertilizer/pharmaceutical dealer 3. TARIS/Tkk-cooperative 4. Agricultural Chamber 5. Other (2 and 3 together)

When the sources where the producers in the field of research obtain fertilizer is examined; 65% is from the private sector- fertilizer /pharmaceutical dealers (table 13).

In another study conducted in the region, very close rates were found (Cebeci and Yener, 2013: 211).

Table 14. The place consulted to determine the amount and type of fertilizer.

Research region	1	2	3	4	5	Total
Alasehir						50
A1	5	11	2	5	2	
A2	9	6	4	2	4	
Sarigol						50
S1	11	10	2	1	1	
S2	7	10	1	2	5	
Toplam	32	37	9	10	12	100

1. Own knowledge and experience, neighbor-friend-environment
2. Pharmaceutical-fertilizer dealer-agricultural engineer-private sector
3. Technical staff of the directorate of agriculture and forestry district
4. Cooperative (TARIS-Agricultural credit cooperatives)
5. Other (2+3+4... or all)

When the place consulted to determine the amount and type of fertilizer is examined, producers in the research region prefer to consult agricultural engineers in the private sector, pharmaceutical and fertilizer dealers and also keep their own experiences in the foreground. In addition to these preferences, the manufacturer responded negatively to questions about soil analysis by 58%. Another study conducted in the Aegean region determined that the rate of soil analysis was 25% (Isin and Ozerin, 1997: 10).

Table 15. Status of whether soil analysis is conducted

Settlement	No	Yes	Once every how many years analysis is done.
Alasehir	28	22	2-3
Sarıgol	30	20	2-3
Toplam	58	42	2-3

According to the findings, 58% of the vineyard business owners in the region did not perform soil analysis, whereas 42% had soil analysis however, it was determined that the analyzers preferred soil analysis mostly every 2-3 years, not every year.

In another study conducted in the research region, it was found that 31.04% of producers who declared soil analysis did not comply with the results of the analysis (Yener and Cebeci, 2013: 227).

Table 16. Whether producers use organic / farm fertilizer

Settlement	Yes	No	Total
Alasehir	26	24	50
Sarigol	25	25	50
Total	51	49	100

According to other studies on fertilizer use in the research area, all of the producers use chemical fertilizers. About 50% of them also use farm fertilizer (organic fertilizer).

The reasons for using fertilizer from producers using chemical fertilizer in the field of research have been determined as follows:

I. Fertilizer increases yield, there is a sense that a satisfactory production cannot be achieved without the use of more fertilizer (58% of producers).

II. The idea that soil and plant mainly need it to meet the nutritional needs of the vineyards (20% of the producers).

III. Due to the smallness of the land has created the idea that using fertilizer is both a necessity and a tradition (22%).

4. Results

Although the use of chemical fertilizers, which constitute agricultural environmental problems and are an important input both in the world and in Turkey, is increasing in general. The most widely used commercial fertilizers in agriculture in the country and research region are nitrogenous and phosphorus fertilizers. Nutrients such as phosphorus and potassium, especially nitrogen, are indispensable in herbal production. However, excessive or improper application of commercial fertilizers containing these elements cause many kinds of harm as well as benefits. While intensive fertilizer use occurs in developed countries, in developing countries ("Turkey") fertilizers use is supported by the state on the grounds of inadequate use, often varies according to fertilizer prices and producer income, and as a result, with the unconscious use of fertilizers, agricultural environmental problems are increasing. Fertilization affects the environment, soil, water, air and plant quality indexes. In order to prevent environmental pollution caused by fertilizers, in European Union countries, the use of fertilizer is enforced by law and taxes are imposed on fertilizer consumption.

In Turkey, it is accepted that fertilizer use is not at the level that can cause environmental pollution (103 kg/ha) and the consumption of fertilizer, which is a BBM exceeding 400 kg/ha in some provinces, is ignored: For example, fertilizer consumption in Manisa was 418 kg/ha according to the average of the last 6 years. This value corresponds to approximately 4 times the country as a whole. The use of chemical fertilizers in Alasehir was determined as 260.4kg / ha. The average use of chemical fertilizers in both Manisa province and Alaşehir region is above the country average.

In fact, the Sarigol and Alasehir districts, which are the selected research regions, are located in the Gediz River Basin in the Manisa province. According to general findings, both in the country and in the general field of research, environmentally conscious agriculture should definitely be developed. For this reason, the rights and responsibilities of landowners and farmers regarding agricultural practices must be clearly determined.

The implementation of environmentally conscious agricultural production methods and techniques in Turkey has not developed sufficiently.

Fertilizer and other agricultural inputs, where mostly uncontrolled, cause contamination of drinking water resources, soil and grain products, and the atmosphere by metal and organic micro pollutants. For the future, it is of great importance to develop agricultural policies to consider sustainable agricultural production and to adequately inform and direct farmers about current and new practices. By informing farmers of the important and critical points of agricultural practices, the effects of pollutants can be prevented or reduced.

In agriculture and the environment, it is seen as a necessity to educate all segments of society throughout the country first, and then to bring environmental awareness to all our people. While serious awareness practices are carried out in our country, it is possible to discover what is occurring in our country.

- In order to develop environmentally sensitive agriculture; It is important that agricultural enterprises have an optimum (appropriate value) size, rational structure, sufficient technical equipment, qualified labor force and strong financial structure. Organizing producers is also important in terms of solving environmental problems together. In order to mitigate the negative impacts of agriculture on the environment, especially the use of fertilizers, it is necessary to establish and update the agri-environmental indicators that firstly demonstrate these effects and measure the environmental performance of agriculture.
- The agricultural bureaucracy should be withdrawn from the field and the audit mechanism should be seriously activated.
- Agricultural consultants should be taken urgently into a training process. In the field of agricultural activity, farmers must be obliged to work with a consultant. All legal responsibilities arising from agricultural activities should be provided to the advisors and at this point the professional representatives of the producers should be assigned as the Chambers of Agriculture and the economic representatives as cooperatives. Urgently all agricultural activities in our country and in our region should be recorded. Agricultural input usage figures and all other activities on the basis of all fertilizer and pharmaceutical dealers and cooperatives should be recorded by the chambers of Agriculture, which is the professional organization of farming, and cooperatives on the basis of farms.
- The Chambers of Agriculture, non-governmental organizations and related universities that have been in the agricultural sector for years, such as cooperatives, agriculture and environmental policies and the working systems of these institutions in the current form in our country should be reviewed. Urgent arrangements should be made to bring in professional executives who are politically free, impartial, knowledgeable and experienced and experienced CEOs to the management of such institutions.
- Residual products should be banned immediately within the country. Products that threaten life and environmental health should be taken for periodic analysis, and public health and environmental health should be ensured with coordinated and serious studies.

In this context, environmental provincial directorates and agricultural provincial directorates should coordinate their work in the fields of environment and fauna health, circulation and use of unhealthy products, polluting of streams, unsuccessful activities that cannot take any measures against industrial waste and all misconduct of duty should be prevented by clarifying the competencies and duties of all institutions that have jurisdiction in this regard by being audited with independent inspections.

Consequently, in our country and in the study region, agricultural organizations and all relevant institutions, working in parallel with the realities of the world and the country, should remove the image of managing the situation and saving the day. They should be ensured to take their place under a modern, organized and competitive Turkish Agricultural Order that can perform against all countries of the world.

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