

ORGANO-MINERAL FERTILIZER APPLICATIONS FOR SUSTAINABLE AGRICULTURE

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Abstract

Intensive farm applications which were the major solution were proposed to nutrient to growing human population, damage to soil fertility, ecosystem elements and human healthy seriously. This damages come up long terms. Intensive farm applications cause to decrement of soil fertility and yield quality. While the soil reduces because of intensive farm applications human population increases every year. So intensive farm applications is not a good solution and idea for nutrient to increasing human populations.

This study aimed to present solutions alternative of intensive farm applications. We propose to alternative farm applications against to intensive farm applications are organic farm (OF), organo-mineral farm (OMF). In this paper it was given some organic and chemical farm applications results to compare. Some of the results of organic and mineral applications given in this paper were studied by our research group. Some of results of this paper showed that, some of organic farm applications were increased to yield more than chemical applications. However organic applications cost is higher than other chemical or intensive farm applications. Because of the high cost and low yield of organic farming it is not prefer commonly. So that we suggested that organic and mineral (organo-mineral) applications together with suitable rate for sustainable agriculture and soil quality.

Key words: organic farm, soil ecology, intensive agriculture, organo-mineral farm.

INTRODUCTION

Organic agriculture; including preparation of soil before planting in agriculture, in agricultural production from planting to harvest, chemical fertilizer, drug, etc. can be named as the form of agricultural production in which inputs are not present and each stage is controlled in a certificated manner. Organic agriculture has also become popular in developing countries other than developed countries. The organic agriculture in Turkey, which is among the developing countries, started production in the middle of the 1980s with the aim of meeting the demands of the developed countries first. Production started with contracted production with a few kinds of products such as raisins, dried figs, dried apricots and hazelnuts and the production quantity and fields continued to increase with the increasing demand in years. While the area of organic production in Turkey was 89,827 hectares in 2002, it increased by 5.7 times in 2015 with 515,268 hectares. The organic production area in Turkey was seen in Eastern

Anatolia with a share of about 30% and at least about 0.7% in Marmara. In the same year, the amount of organic production in Turkey was 310,125 tons in 2002 while it increased by 3.75 times in 2015 to 1,164,202 tons (Kızıltuğ and Fidan, 2016).

The lack of chemical fertilizers in organic agriculture contributes to the reduction of input cost in production and contributes to soil fertility and sustainability and it may be considered that our current fertile soil will be transferred to future generations and directly affect the future nutritional problem. Otherwise, the increase in the use of chemical fertilizers and medicines is not difficult to predict, firstly, that our existing agricultural land will become inefficient in time and deteriorate the quality of the products. Excessive chemical use destroys the viability of the soil and can cause poisoning after a certain place. Turkey has increased its use of chemical fertilizers by 4.8% in the last 6-7 years. But our arable land has decreased by about 1.5% in the same years (TUIK, 2015). As understood from this, the use of chemical fertilizers has reduced

our existing arable land. In this research, the effects of organic, intensive and conventional agriculture on the land of the country will be examined, the differences between the productivity and the economy in the products produced.

MATERIALS AND METHODS

Many researches and reports on the current status of organic agriculture, development over years, foreign trade and marketing have been made with the beginning of organic agriculture in Turkey. In this study, the reports of the thesis, articles and institutions used from the existing data were utilized. The production amount, production area, number of farmers, changes in the diversity of crops, fertilizer and drug use data, and the statistical data of TÜİK and the Ministry of Agriculture and Livestock. The obtained data were interpreted by calculating the percentages by using the appropriate program and the changes according to the years.

RESULTS AND DISCUSSIONS

1. Advantages and disadvantages of organic, intensive and conventional agriculture in Turkey and World

Soils, one of the indispensable elements of production, are decreasing and exploited every year. In the same time human population is growing rapidly. Because of this case people have to do intensive agriculture. However, this is a paradox for sustainable agriculture. Because, intensive tillage applications damage to soil productivity and quality. While people population is increasing rapidly on the other hand soils are decreasing because of intensive tillage applications. The most important cause of intensive farming is human population growth. So firstly we have to keep the human population under control and save to fertile soil.

Organic agriculture is done to get better and healthier products and to protect soil health and productivity. Organic materials have regulatory effect for soil. Soil organic matter is an important source of nutrients for plant growth that needs to be maintained for agricultural sustainability. Conventional and intensive farming involves repeated heavy tillage and large use of fertilizers and pesticides and can

result in organic matter losses and yield degradation in cultivated soils (Lampkin, 1998; Herencia et al., 2006).

Lots of studies have shown good and beneficial effects of organic material application for crop production. In this regard, Aggelides and Londra (2000) assessed the effects of compost produced from municipal solid waste (MSW) and sewage sludge on soil physical properties. According to several research results, addition of organic matter improved soil properties such as aggregation, water-holding capacity, hydraulic conductivity, bulk density, the degree of compaction, fertility and resistance to water and wind erosion (Franzluebbers, 2002; Çelik et al., 2004). Not only organic materials but also some microorganisms as mycorrhiza effect soil physical properties. Addition of organic materials of various origins to soil has been one of the most common rehabilitation practices to improve soil physical properties. Mycorrhiza has been known to play a significant role in forming stable soil aggregates (Çelik et al., 2004). According to Ortas (2002) plant roots, root hair, mycorrhizae and fungal hyphae play a significant role by binding agents within and between aggregates. Since soil management systems influence soil physical fertility, it is important to determine the effect of long-term organic and inorganic fertilizer amendments on soil physical properties such as aggregation, porosity and water-holding capacity (Çelik et al., 2004).

Conventional horticultural cropping, due to continuous soil removal and intensive use of pesticides and fertilizers, is a main activity leading to deterioration of soil physical, chemical and biological properties (Albiach et al., 2000; Ferreras et al., 2006). Mineral fertilization provides readily available nutrients for plant growth; however, it does not contribute to improve soil physical condition on the other hand mineral applications damage to soil nutrient balance. Organic matter inputs through organic amendment, in addition to supply in nutrients, improve soil aggregation, and stimulate microbial diversity and activity (Shiralipour et al., 1992). Improvement of soil aggregation through its effects on soil water content, temperature, aeration and mechanical impedance influences root development and seedling emergence (Ferreras et al., 2006).

Organic and conventional agriculture can be incalculated in many areas. It is necessary to answer the questions such as the positive and negative effects of organic and conventional agriculture. Organic farming is including ecological agriculture tillage systems and stimulate to soil productivity. There isn't any chemical material in organic agriculture. According to a study by Merdan (2014) organic agriculture is regarded not only as an agricultural technique but also as a health and life prescription. Depending on societies' level of consciousness related to environment and health, the interest in organic agriculture is rising and organic agriculture market in the world is increasingly expanding. Since the developed countries can't cover the home demand in organic agriculture they consume the products exported by the developing countries. Since developed and wealthy countries are exploitation to organic products more than developing countries, it is not advantage. If all people could use organic products it was a advantage. But unfortunately most of people think about this that a utopia. Some of researchers like us think that if organic farm's products use just for vital need as food, clothes and drugs can be enough for healthy life and agricultural sustainable. But like this life style isn't acceptable for most of people. However, a lot of people in the world have to live like this condition because of most of countries which never accept like this life style and live in wealthy. So cost of organic farm inputs is decreased by government and organic farm's incentives by government are increased. Organic agriculture is a production system in which animal and herbal production is considered as a whole, land productivity and animal welfare are based on, the use of inputs acquired in the business firm is aimed, the latest information and technology are used, the supervision and certification based on certain rules from seed to soil are required (Merdan, 2014).

The pricing of organic products in the outer and inner market is higher than in conventional agriculture. A new employment field has been created for many people in our country with the presence of the new international market. No chemical substance (nitrate, nitrite etc.) accumulates in the products since no chemical

application is made in organic products (Anonymous, 2017). Major disadvantages of organic farming are increasing population, demand of outside market and inadequate organic farm's product, small ecological farming areas, and antagonistic effect of neighbour conventional and intensive farm areas and applications.

Conventional agriculture. Agricultural technique which is widely used today. The use of plant and animal breeds as a single species, in general modified by genetics or exposed to excessive chemistry. It is an agricultural technique which has the destruction of the soil by frequent and dense soil treatment and the damages which can lead to irregular and excessive irrigation, salinization and even sodification which is a later stage.

It can be said that the advantage of conventional agriculture is that the products come to the early harvest with the applied chemicals. Disadvantages are the disruption of the aggregate structure of the soil with irregular and heavy tillage machines, the loss of the living areas of the living organisms living in the soil, the increase in cost due to the use of too many chemical substances, the lack of application of cropping seasons, the rapid loss of organic matter from the soil, Nitrate accumulation, and many other disadvantages.

2. Changes in organic agriculture in Turkey over the years

The development of organic production in our country by organic production and foreign trade and the support of many state institutions (universities, research institutes etc.) have accelerated the development of organic production by farmers (Demiryürek, 2011).

These developments led to an increase in the number of producers, the amount of production and the variety of products.

Table 1 shows the number of farmers, their production, their area, and the variation in product variety between 2002 and 2015 for organic production. While the number of products was 150 in 2002, an increase of 31.33% in 2015. The number of products has been increasing and decreasing over the course of 14 years and the year with the highest product variety is 2008. The number of farmers increased by about 5.6 times from 2002 to

2015. Compared to the previous year, there was an increase of 138.3% in farmers, 200% in product area and 85% in product quantity in 2009. The reason for this was implemented between 2000-2008 years of Direct Income Support. This support has been made more comprehensive by changing the way of ending with organic farming, good farming practices and supporting many crops (Tan et al., 2014). It is thought that organic products in 2009 were

caused by the change in the supporting policy due to the increase in the area, quantity and number of producers. Despite a 5.7-fold increase in organic production by the end of 2002, there was a 38.8% decrease in 2015 compared to the previous year. The amount of organic production was 310,125 tons in 2002 and increased about 6 times in 2015 to 1,829 million tons.

Table 1. Organic production area, production, number of farmers and number of crops (2002-2015)

Years	Number of crops	Number of holdings		Area		Production	
	(Number)	(Number)	(%)	(Hectares)	(%)	(Tonnes)	(%)
2002	150	12 428	-	89 827	-	310 125	-
2003	179	14 798	19.1	113 621	26.5	323 981	4.5
2004	174	12 751	-13.8	209 573	84.4	377 616	16.6
2005	205	14 401	12.9	203 811	-2.7	421 934	11.7
2006	203	14 256	-1.0	192 789	-5.4	458 095	8.6
2007	201	16 276	14.2	174 283	-9.6	568 128	24.0
2008	247	14 926	-8.3	166 883	-4.2	530 224	-6.7
2009	212	35 565	138.3	501 641	200.6	983 715	85.5
2010	216	42 097	18.4	510 033	1.7	1 343 737	36.6
2011	225	42 460	0.9	614 618	20.5	1 659 543	23.5
2012	204	54 635	28.7	702 909	14.4	1 750 127	5.5
2013	213	60 797	11.3	769 014	9.4	1 620 466	-7.4
2014	208	71 472	17.6	842 216	9.5	1 642 235	1.3
2015	197	69 967	-2.1	515 268	-38.8	1 829 291	11.4

Source: www.tarim.gov.tr , 2017

Table 2: Organic Products in Conventional Products in Turkey (2014)

Products	Organic Products	Conventional Products	Total	Range (%)
	Amount of Production (Ton)	Amount of Production (Ton)		
Wheat	217,843.08	15,482,156.92	15,700,000	1.41
Olive	62,664.25	1,705,335.75	1,768,000	3.67
Fig	52,130.35	248,151.65	300,282	21.01
Apple	48,449.45	2,431,994.55	2,480,444	1.99
Grape	27,319.09	4,148,036.91	4,175,356	0.66
Cotton	27,058.22	2,322,941.78	2,350,000	1.16
Nut	10,192.75	439,807.25	450,000	2.32
Lentil	9,314.48	335,685.52	345,000	2.77
Apricot	4,102.34	265,897.66	270,000	1.54

Source: GTHB and TÜİK (Kızıltuğ and Fidan, 2016)

Table 3: Chemical fertilizer use, 2009-2015 (tons)

	2009	2010	2011	2012	2013	2014	2015
Fertilizerused	10 278 731	9 592 752	9 074 308	10 148 982	11 415 756	10 694 543	10 777 779
Nitrogen (21% N)	6 730 852	6 397 089	5 995 500	6 817 217	7 542 247	7 107 106	7 077 214
Phosphorous (17% P ₂ O ₅)	3 416 978	3 028 666	2 882 296	3 129 299	3 662 099	3 353 104	3 437 368
Potash (50% K ₂ O)	130 901	166 997	196 512	202 466	211 410	234 333	263 197

Source: GTHB, 2017

Table 2 shows organic production and conventional production quantities of some products in 2014. According to the chart, it is observed that organic production quantities are produced in 1-4% of total production quantities except vetch (Karaman et al., 2013). In his study, 449.29 kg of product was purchased from conventional cherry production whereas 351.43 kg of organic cherry production was received. In this case it is observed that there is a loss of approximately 22% with a loss of 97.86 kg. Despite the product losses on the obtained yield basis, as well as higher yields in conventional agriculture, soil, environmental and economical losses are experienced. The amounts of chemical fertilizers used in this direction between 2009 and 2015 are presented in Table 3. No significant change has been observed in the amount of fertilizer used during the current years. However, the differences between organic and chemical fertilizer applications have been investigated (Demir et al., 2003). As a result of different organic fertilizer applications in tomato plant ecological production, it has been argued that the mineral content of tomatoes is not much different from traditional agriculture. However, in terms of nutrients it is said that it is the same as the traditional method, even richer. In a similar study, the results of the application of chemical and organic fertilizers on yield and quality of tomato plant were investigated. In the results obtained, only the chemical fertilizer application was found to be better than the organic fertilizer application in terms of efficiency. However, it has been observed that the best yield is obtained from chemical + organic fertilizer application (Demirtas et al., 2012). As can be understood from both studies, the use of chemical fertilizers alone with the use of organic fertilizer tillage is both effective in quality and yield, and also minimizes the damage to soil and environment. Consideration should be given to environmental and soil damage as well as loss of quality and efficiency in the use of chemical fertilizers alone. The fertilizers used have direct and indirect damages. Excessive fertilizer use is harmful to the environment as a result of soil salinization, heavy metal accumulation, nutrient element imbalance, degradation of soil vitalities, nitrate and nitrite accumulation in groundwater,

atmospheric spreading of gases and ozone layer effect, and greenhouse effect. To overcome these problems, serious economic investments and long-term implementations are required (Sönmez et al., 2008).

CONCLUSIONS

Organic or ecological agriculture is useful for soil fertility and healthy. However it is not enough to nutrition for increasing human population. Nowadays it is proposed as a major solution against to nutrition of growing human population is conventional and intensive farm. This farm applications and their products damage to soil quality and human healthy. In addition as a result of this applications fertility soils are decreased seriously. İntensive and conventional tillage agriculture to nourish growing people population, caused a new soil and human health problems. So we proposed to organic and mineral (organo-mineral) applications with suitable rate.

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