



## RESEARCH PAPER

## OPEN ACCESS

## Plant protection applications in organic agriculture and farmers' approaches to organic agriculture in Kocaeli, Turkey

Mehmet Veysel Ayhan<sup>1,3</sup>, Aysun Cavusoglu<sup>\*2,3</sup>

<sup>1</sup>Ministry of Agriculture and Forestry, Kocaeli Provincial Directorate,  
Plant Protection Department, Kocaeli, Turkey

<sup>2</sup>Kocaeli University, Arslanbey Agricultural Vocational School of Higher Education, Kocaeli, Turkey

<sup>3</sup>Kocaeli University, Graduate School of Natural and Applied Sciences, Department of Horticulture,  
Kocaeli, Turkey

Article published January 26, 2019

**Key words:** Kocaeli, Organic agriculture, Plant protection applications, Questionnaire.

### Abstract

Plant production is becoming more important day by day with organic agriculture, one of the agricultural production systems. Plant protection applications with the right method are regarded as one of the most important factors to achieve sustainable organic agriculture. This study was conducted to identify the present situation in plant protection practices performed by organic agriculture enterprises on plant production and frequently faced problems such as pests, diseases, weeds and plant physiology in their fields in Kocaeli. A further purpose was to determine farmers' approaches to these problems as well as organic agriculture in plant production. In this regard, the study was carried out in the middle of 2016 by a face to face close and open ended questionnaire following a full count method in Kocaeli Province in Turkey. The data show that there are various solved and unresolved biotic and abiotic problems in organic plant farming. According to the results weeds, aphids, late blight and downy mildew are as biotic, short time period of vegetation and forest are as abiotic are mostly facing problem in the fields. "Plant Protection problems" is stated as the second most important subject by farmers. In addition farmers' awareness and expectations were revealed in the organic farming system. According to the results. Kocaeli has farmers who are aware and well educated that applies the main principles of organic agriculture, yet they remain incapable for plant protection in organic agriculture and for some other issues independent of this subject.

\*Corresponding Author: Aysun Cavusoglu ✉ [cavusoglu@kocaeli.edu.tr](mailto:cavusoglu@kocaeli.edu.tr)

## Introduction

Organic agriculture is one of the sustainable agricultural production systems that ensure the persistence of all kinds of living beings and the abiotic components in the ecosystem, and thus in nature by following methods to provide healthy and secure nutritional sources to consumers. Besides, it brings about taking care of farmers' health and profitability.

Turkey has a wide range of plant species in crop production in horticultural, ornamental, field and forage areas. Yet, it is well-known that the percentage of used agricultural lands by organic agriculture method is pretty far behind compared to the total proportion of fields used in plant production by 1.985% as of 2015.

The production was performed on an area of 23 949 000 ha countrywide in 2015. Of the lands in question, in 162 888 ha in transition period and 312 621 ha in full organic was totaly of 475 509 ha was formed by plant production lands used for organic agriculture except for fallow and natural gathering areas (Republic of Turkey, Ministry of Agriculture and Forestry, 2015; 2016).

According to Turkey Nomenclature of Territorial Units for Statistics that has been determined within European Union harmonization framework, the province of Kocaeli is at level 3 with code TR421 (Republic of Turkey, Official Gazzette, 2002). The city has an ecological advantage in that, apart from a few particular products, not only majority of the livestock sub-branches could be practiced, but also many kinds of fields and forage crops, horticultural vegetables and fruits as well as ornamental plants can be grown, representing the variety of almost all of the country. Besides its ecological advantage, it has a border gate that allows for the exportation of agricultural products, and bordered by the province of İstanbul and situated in the East Marmara Region, it is close to markets with high level of income and population, which are some of the other important characteristics of the city. Similarly Akova (2011) study on organic

agriculture in Yalova province that is neighbor province of Kocaeli and emphasized that the city has a high potential with natural resources, climate etc.

Despite these advantages, there aren't many representative organic agriculture lands of our country in Kocaeli; in contrast, they are very less in proportion and area to such an extent that it cannot even be compared with conventional farming lands. According to data from 2015, a total of 79 tons of organic plant production was realized from 21 plant products with five farmers in 31 ha. The same year, 204 tons of transition period products were obtained from 50 different plant varieties, 29 of which were firstly taking place, in 47 ha in the transition period (Republic of Turkey, Ministry of Agriculture and Forestry, 2015).

The reasons why organic agriculture is still not at an adequate level although there is rapid improvement is because it requires more human labor and there are concerns such as losing revenue because of the possible low level of productivity in the first years, the inputs in production are not enough and expensive, and there is a suspicion for the reliability of these inputs. Thus, it is obvious that there might be various factors related to "Plant Protection" applications.

"Plant Protection" is a significant and applied field in every phase of plant production and every kind of plant production system. Cultivation of plants primarily involves prevent and when required, controlling with pests, diseases and weeds by putting various methods into action. It is not possible to use all aforementioned plant protection methods and techniques in organic agriculture as it is in conventional agriculture. This situation requires more awareness, knowledge, attention and work in organic plant production.

To support plant production in organic agriculture, some researches have been carried out in economics (Merdan and Kaya, 2013; Birinci and Er, 2006), education (Başak *et al.*, 2015; Nandi *et al.*, 2015) and

plant protection subjects (Hasna *et al.*, 2009; Szymona, 2009; Madanlar *et al.*, 2005), but mostly compilation works (Bhardwaj *et al.*, 2006; Kodaş and Er, 2012; Budak, 2013; Küp *et al.*, 2013; Olle *et al.*, 2015) have been done. Unfortunately, these valuable studies are too less in number to be able to improve plant production in organic agriculture as required.

The purpose of this study is to demonstrate the plant protection problems encountered by farmers who are engaged in organic plant production in Kocaeli, and to show the solution ways preferred to overcome these problems from their viewpoints.

A further aim was to determine the degree of importance of the main topic, “Plant Protection”, compared to other factors that might be substantial in organic plant production. Besides these, the socio-economic level of farmers that are engaged in plant production by organic agriculture method, and their approach and general view for organic agriculture were identified and given in the study.

**Materials and methods**

The main material of this study were the questionnaires applied to organic agriculture farmers who have organic agriculture certificate, and actively engaged in plant production activity at least one year before the study (June, 2015-June, 2016) in Kocaeli. In identifying these farmers and all the data obtained from Republic of Turkey, Ministry of Agriculture and Forestry (MINAF) data was benefited.

The research method consists of primary data gathered by a face to face questionnaire with 5 organic plant product farmers following a “complete counting” procedure. In surveyed enterprises, 3 of the participants are business owners, while 2 of them are the most authorized ones. The questionnaire involves closed and open-ended questions.

It starts with questions for the socio-economic characteristics of farmers, goes on with plant production problems encountered in plant production, and farmers’ solution methods and ends with questions that are intended to identify farmers’ general approach to organic plant production. In the analysis and evaluation of the data gathered by the questionnaire, basic statistical calculations such as mean and percentage (%) were made due to the limited number of farmers. Besides, the responses given to open-ended questions were stated by farmers’ expressions.

**Results and discussion**

*Analysis of Farmers’ Socio-Economic Level*

According to the data collected (Table 1), in total, 5 farmers practice organic plant production actively in 4 districts among 12 in Kocaeli; 2 in Kandıra, 1 in İzmit, 1 in Gebze and 1 in Başiskele. While the research was being carried out, there were 7 certified and registered plant farmers, yet 2 of them were not included in the study as they were not actively engaged with plant production in the period in Kocaeli province.

**Table 1.** Socio-economic analysis of organic plant farm owners who carry out plant production via organic agriculture in Kocaeli.

Socio-economic parameters	Evaluation criteria	Farmers (%)	Farmers (number)
Districts	Kandıra	40%	2
	İzmit	20%	1
	Gebze	20%	1
	Başiskele	20%	1
Gender	Female	60%	3
	Male	40%	2
Age	30 years and less	0%	0
	31-40 years	20%	1

	41-50 years	0%	0
	51-60 years	60%	3
	61 years and over	20%	1
Education	Illiterate	0%	0
	Literate	0%	0
	Primary school	0%	0
	Secondary school	0%	0
	High school or equivalent school	0%	0
	Vocational high school	80%	4
	University	20%	1
	Master's	0%	0
	Doctorate		
What inspired you to become an organic farmer?	It was my own decision	100%	5
	My neighbors	0%	0
	MINAF	0%	0
	Media		
Previous farming experience	1-5 years	20%	1
	6-10 years	40%	2
	11-15 years	0%	0
	16-20 years	0%	0
	21-30 years	0%	0
	31 years and over	40%	2
Organic farm owners' organic plant production experiences	1-5 years	60%	3
	6-10 years	40%	2
	11-15 years	0%	0
	16-20 years	0%	0
	21-30 years	0%	0
	31 years and over	0%	0
Ownership status of organic agriculture land	Land owner	60%	3
	Tenant	20%	1
	Land owner + tenant	20%	1
The size of the land used for organic agriculture	0-10 da	0%	0
	11-20 da	40%	2
	21-100 da	0%	0
	101-200 da	40%	2
	More than 201 da	20%	1
Social security status of enterprise owners	Yes	100%	5
	No	0%	0
The perspective of enterprise owners' towards the income gathered by organic plant production	Profit	20%	1
	Loss	60%	3
	Profit-loss balance	20%	1

\*The information is based on farmers' statements.

\*\* The founders were taken as a basis even if the enterprises became incorporated by various kinds and names,.

\*\*\* da= decare=1000 m<sup>2</sup>

It was found out that 60% of the farm owners in the study were female (3 farmers) and 40% were male (2 farmers); with 51-60 age range predominantly, 20% (1 farmer) was 61 and over, while 20% (1 farmer) was between 31-40 age group. Besides, when considered with regards to their educational background, it can be seen that 80% (4 farmers) have bachelor's and 20% (1 farmer) has master's degree, while none of them (0%) received formal education in the field of farming such as agriculture, food, landscape etc. It was determined that 20% of the enterprises (1

farmer) had been engaged with farming 1-5 years, 40% (2 farmers) 6-10 years, and the other 40% (2 farmers) with more than 30 years. On the other hand, the length of time that was spent on organic agriculture was reported as 1-5 years by 60% (3 farmers), and 6-10 years by 40% (2 farmers). In terms of ownership status of organic farmlands, it was reported that 60% of the farmers (3 farmers) carry on their activities in their own properties, 20% (1 farmer) in a rented land, and 20% (1 farmer) both in their own properties and in rented lands.

**Table 2.** The analysis of organic plant products and production.

Organic plant products and production parameters	Evaluation criteria	Farmers (%)	Farmers (number)
What are the plant groups in organic plant production practice?	Vegetable	20%	1
	Vegetable + Fruit + Field Plants+ Medicinal and Aromatic Plants	20%	1
	Vegetable + Fruit + Field Plants+ Gathering	20%	1
	Vegetable + Fruit + Field Plants+ Medicinal and Aromatic Plants + Gathering	40%	2
Do you carry out conventional agriculture near the land?	Yes	0%	0
	No	100%	5
What kind of products do you use for soil amendment and fertilization?	Horse, donkey manure	20%	1
	Cattle manure	80%	4
	Small ruminant manure	60%	3
	Chicken etc. poultry manure	20%	1
	Ash	20%	1
Do you receive any professional counseling?	Registered commercial leaf-soil fertilizers	40%	2
	Yes	60%	3
How do you market the Organic products?	No	40%	2
	I have never made a sale.	20%	1
	I make sales directly myself.	20%	1
	I market them through intermediaries for domestic consumption.	20%	1
	I make sales directly myself + I market them through intermediaries for domestic consumption.	20%	1
Are you satisfied with the yield you get?	I make sales for consumption within the touristic facility of the enterprise + sale through mail + sale in the production place	20%	1
	Very satisfied	60%	3
	Satisfied	20%	1
	Neutral	20%	1
	Not Satisfied	0%	0
Do you recommend Organic plant production?	Not satisfied at all	0%	0
	Yes	80%	4
	No	20%	1

\* The information is based on farmers' statements.

\*\* Fee-based counseling apart from public institutions and organizations, and control and certification organization.

In addition to these, in terms of the size of enterprise lands, 40% (2 farmers) allocated 11-20 decares, 40% (2 farmers) 101-200 decares, and 20% (1 farmer) more than 201 decares to organic agriculture. All of the enterprise owners (100% - 5 farmers) have social security. When asked about their opinions in terms of

profit they made on organic agriculture, only 20% (1 farmer) found it profitable, 60% (3 farmers) reported losing, while 20% (1 farmer) said that the profit-loss balance was maintained. 100% of the farmers (5 farmers) stated that they chose organic agriculture by their own will.

**Table 3.** The proportion of key concepts used by farmers while describing organic agriculture (%).

What is organic agriculture?	Evaluation criteria	Farmers (%)	Farmers (number)
	It is important for the ecosystem (Plants, animals etc. for all micro and macro organisms).	100%	5
	It is important for human health.	80%	4
	It is a return to the old times (a return to our grandparents' and parents' times).	40%	2
	Fertilizers and pesticides used in conventional agriculture must not be used in organic agriculture.	40%	2
	It is a kind of going back to pre-green revolution.	20%	1
	It is important for the ecosystem (for components such as soil, air, water etc.).	20%	1
	It is important in order to get products that are GMO free.	20%	1
	It is important to obtain a natural taste and smell.	20%	1

\* The information is based on farmers' statements.

When the enterprises are considered in terms of organic plant production status (Table 2), it can be seen that all grow vegetables; some grow fruit, field crops and medicinal aromatic plants, while some others carry out gathering activities in addition to these. At present, one of the farmers produce processed products as well. Moreover, it was reported that a farmer who only dealt with vegetable production was preparing for field plants and fruit production and another farmer for processed products; it was also stated that one other farmer took a step for poultry breeding. Only one farmer (20%) reported that organic mushroom production, beekeeping, poultry breeding and aquaculture besides organic plant production were also cultivated.

None of the enterprises are doing conventional production near by the organic lands. During the plant production, mostly cattle and small ruminants fertilizers were used besides registered commercial

organic fertilizer.60% of the enterprises (3 farmers) are very satisfied with the yield, while 20% (1 farmer) is undecided on the ground that the results change every other year. Although 80% of the enterprise owners (4 farmers) recommend plant production by means of organic agriculture, 20% reported that they do not recommend it in terms of profitability. 80% (4 farmers) of the enterprises work with the same organization for control and certification procedures, while the rest 20% (1 farmer) receives service from another organization. Apart from these, 60% of the enterprises indicated that they receive professional information support service for a fee, while all of them expressed their appreciation for technical visits of staffs from Kocaeli Directorate of Ministry of Agriculture and Forestry.

All of the enterprises completed the transition process foreseen for the products, yet the vast majority made use of them by catering and consuming rather than marketing the products with transition period labels.

The enterprises allocate all the organic plant products for the domestic consumption, and mostly prefer marketing and exploiting of them on their own.

The farmers are fully aware of the significance of organic agriculture; they are in the knowledge that organic agriculture is practiced not only for human health and ecological sustainability, but also for the protection of all other creatures and the land. Besides, it has also been mentioned that the inputs (pesticides, fertilizers etc.) and genetically modified organisms (GMO) used in conventional agriculture cannot be used in organic agriculture as production materials or other purposes. The farmers, by varying proportions, stated that organic agriculture is some sort of returning to the old or going back to green revolution (Table 3).

*Biotic Problems in Plant Protection and Solution Methods of Farmers*

The biotic problems encountered in plant protection in the farms were specified based on farmers' statements, and these specifications were compiled with our experiences as researchers. First of all, these problems were given by their English and Latin genus name, yet giving species names in Latin was avoided since types of diseases, pests and weeds were not identified. Therefore, in order not to cause misunderstandings for future researches, this study rested on naming the kinds and the product for which they posed a problem to the farmers (Table 4).

**Table 4.** Biotic problems encountered by the farmers and host plants or fields.

In English	Pests, diseases and weeds		Host plants/fields	Facing farmers (Number)
		In Latin (Genus)		
Antracnose		<i>Colletotrichum</i> spp.	Watermelon	1
		<i>Gnomonia</i> sp.	Walnut	1
Downy mildew		<i>Pseudoperonospora</i> spp.	Cucumber	2
		<i>Pseudoperonospora</i> spp.	Pumpkin	1
Late blight		<i>Phytophthora</i> spp.	Tomato	3
		<i>Peronospora</i> spp.	Spinach	1
Early blight		<i>Alternaria</i> spp.	Tomato	1
		<i>Alternaria</i> spp.	Watermelon	1
Onion smut		<i>Urocystis</i> spp	Onion	1
Sclerotinia stem rot		<i>Sclerotinia</i> spp.	Cucumber	1
Powdery mildew		<i>Erysiphe</i> spp.	Cucumber	1
		<i>Sphaerotheca</i> spp.		
Smut		<i>Ustilago</i> spp.	Corn	1
Bacterial common blight of bean		<i>Xanthomonas</i> spp.	Bean	1
Bacterial halo blight of bean		<i>Pseudomonas</i> spp.	Bean	1
Apple scab		<i>Venturia</i> spp.	Apple	1
Peach leaf curly		<i>Taphrina</i> spp.	Peach	1
Fire blight of pome fruits		<i>Erwinia</i> spp.	Quince	1
Tomato borer		<i>Tuta</i> sp.	Tomato	2
Onion maggot		<i>Delia</i> spp.	Onion	1
Artichoke leaf beetle		<i>Sphaeroderma</i> spp.	Artichoke	1
Mites of strawberries		<i>Tetranychus</i> spp.	Strawberry	1
Aphids		<i>Aphis</i> spp., <i>Dysaphis</i> spp., <i>Myzus</i> spp.,	Summer Vegetable	3
		<i>Hyalopterus</i> spp., <i>Pterochloroides</i> spp.	Stone Fruits	1
Chestnut weevil		<i>Curculio</i> spp.	Chestnut	1
Hazelnut weevil		<i>Curculio</i> spp.	Hazelnut	1
Codling moth		<i>Cydia</i> spp.	Apple	2

Plum fruit moth	<i>Cydia spp., Laspeyresia spp.</i>	Plum	1
Peach twig borer	<i>Anarsia spp.</i>	Peach	1
White peach scale	<i>Pseudaulacaspis spp.</i>	Peach	1
Leafhoppers	<i>Empoasca spp., Asymmetrasca spp.</i>	Leafy vegetables	1
		Eggplant	1
Flea beetle	<i>Phyllotreta spp., Epithrix spp.</i>	Leafy vegetables	1
	<i>Phyllotreta spp., Epithrix spp.</i>	Eggplant	1
Mole cricket	<i>Gryllotalpa spp.</i>	Lettuce	1
	<i>Gryllotalpa spp.</i>	Tomato	1
Vegetable bollworm	<i>Helicoverpa spp.</i>	Tomato	1
Vegetable green plant bug	<i>Nezara spp.</i>	Tomato	1
Couch grass	<i>Agropyron spp.</i>	In all field	3
The other weeds	<i>Plantae</i>	In all fields	4

\*The information is based on farmers' statements.

In terms of diseases, farmers mostly encountered at problematic level with antracnose (watermelon, walnut), downy mildew (cucumber, pumpkin), late blight (tomato, spinach), early blight (tomato, watermelon), onion smut (onion), sclerotinia stem rot (cucumber), powdery mildew (cucumber), smut (corn), bacterial common blight of bean (bean), bacterial halo blight of bean (bean), apple scab (apple), peach leaf curly (peach) and fire blight of pome fruits (quince). The applied techniques of farmers are; rotation with annual plants, or applied trade and registered preparation as sulfure in powder or wettable form, bordeaux mix include copper sulphate, copper sulfate penta hydrate. Jahagirdar *et al.*(2003) and Varisco (1995) mentioned some traditional similar methods in the management of plant diseases.

In terms of pests farmers mostly faced with tomato borer (tomato), onion maggot (onion), artichoke leaf beetle (artichoke), mites of strawberries (strawberry), aphids (summer vegetable, stone fruits), chesnut weevil (chesnut), hazelnut weevil (hazelnut), codling moth (apple), plum fruit moth (plum), peach twig borer (peach), white peach scale (peach), leafhoppers (greenvegetables, eggplant), flea beetle (greenvegetables, eggplant), mole cricket (lettuce, tomato), vegetable bollworm (tomato), vegetable green plant bug (tomato) in varying level.

The methods of controlling the pests of farmers are; usage of water of garlic, onion and tobacco, usage of water added granulized or powdered red hot pepper and usage of water added soft soap (yellow soap) and thyme oil. The other used methods were planting garlic, basil or marygold around seedling, protecting ladybugs and using different kind traps. Commercial bioinsecticide containing *Bacillus thuringiensis*, commercial preparation containing Azadirachtin A or spinosad were also applied by farmers. In addition, soil chopping, horse manure with fruity soda pop or beer also used as trap for mole cricket. The application of rotation with annual plants has also become a method for harmful pests by framers.

In terms of harmful weeds; mostly couch grass is recognized clearly by farmers as harmful. They stated that the other weeds are sometimes can be dominant on the field. Farmers's methods on controlling the weeds were soil tillage before flowering the weeds manually or machinary, cutting up weeds. In fruits tree area; sowing clover around fruit tree, grazing small ruminant around tree, sowing oat in couch grass part of field, sowing garden cress weedy part of field. According to a review (Olle *et al.*, 2015) about organically grown potatoes and a study (Madanlar *et al.*, 2005) on organically grown vegetables, there were some pests, diseases and weeds control methods.



When the data was analyzed in terms of plant protection (Table 5), it was found out that none of the organic plant farmers had previously undergone integrated pest management, and all of the farmers had completed transition period. Their primary sources of information were the internet, Ministry of Agriculture and Forestry, control and certification organizations and professional advisors.

While 1 (20%) of the farmers do not use any licensed plant protection product in organic agriculture, the other 4 (80%) make use of such products. These products are often supplied directly from agricultural drug dealers or related product manufacturer/importer companies. Besides this, there are also farmers who supply it from counselors.

**Table 5.** The analysis of the questions regarding the problems encountered by Kocaeli organic farm business managers in organic plant products and production in terms of pests diseases, weeds and and the solutions offered.

Parameters regarding plant protection in organic agriculture	Evaluation criteria	Farmers (%)	Farmers (number)
Have you ever carried out an integrated pest management before organic plant production?	Yes	0%	0
	No	100%	5
Have you completed the transition periods for the products?	Yes	100%	5
	No	0%	0
Where do you apply to find solutions for plant protection problems?	The internet	80%	4
	MINAF province-district directorate	60%	3
	Control and certification organizations	60%	3
	Professional counselors	60%	3
	Other organic plant farmers	20%	1
	Neighbor farmers	20%	1
	Books	20%	1
	Plant protection product sales dealers	0%	0
	Cooperatives	0%	0
	Neighborhood representative	0%	0
Where do you get plant protection products?	Plant protection product sales dealers	60%	3
	Professional counselors	20%	1
	Directly from plant protection agricultural drug dealers/importer companies	20%	1
	I don't use any plant protection products	20%	1

\*The information is based on farmers' statements.

Furthermore, 60% of the farmers stated that diseases and pests harm their products by varying severity each year, whereas 20% emphasized that they had never encountered problems in some products (wild plum, wild cherry, cabbage). Besides, they also underlined the significance of culturing locally adapted varieties, collecting their own genetic resources and forming seed banks. According to a study (Bloch *et al.*, 2016) farm experiment are useful for identified farm-specific problems and for planning farm-specific solution.

In the light of the information gathered, farmers are aware that there might be some natural preparations and methods to use for plant protection. These methods and preparations are already being used by some farmers, whereas some others stated they don't use these at present although they are informed like as thyme oil against to diseases, garlic, *Melia azederacht*, garlic+red pepper+sunflower seed oil, planting safflower and lavender against to the pests and ash and lye, burning nettle, planting tobacco plant in the beginning and end of the rows against to both pests and diseases.

*Abiotic Problems in Plant Protection and Solution Methods of Farmers*

In terms of plant protection, biotic factors as well as abiotic ones may cause product losses to a significant degree, which can even become a threat for production in some years. Abiotic problems encountered by the farmers are given below together with their solution methods in parenthesis.

Short time period of vegetation (setting up greenhouses, growing early varieties), having all products at harvest maturity within the same time (planting in different time for extending the harvest

time for marketing), frost (building tunnel greenhouses with thermal insulation gauze), unbalanced soil ph (if it is alkaline, applying sulfur), snow (sweeping and shaking the roof of greenhouses), flood (building barriers, planting), blossom end rot (liming), scarcity of organic matter in soil (growing medicinal aromatic plants and clover), and landslides (increasing the number of benthic, water channels and terracing) were seen as problems by the farmers interviewed and stated that they had taken precautions. However, it is understood that they cannot take any precautions against hail and frost to which they are exposed in open areas.

**Table 6.** Importance of the plant protection in plant production and other subjects in organic agriculture.

Parameters for evaluation criteria	Average of significant level	Organik plant farmers's solution recommendation
Lack of integration between Organic livestock production and plant production	3,2	*Government institutions and organizations should provide support and encouragement and enable the integration of plant and animal production *Organic farmers should perform plant and livestock production more or less together by themselves. *Organic animal and plant farmers should exchange inputs and products among themselves.
Plant protection problems	3	*There should be continuous education. *Licensed pesticides should be used in Organic agriculture. *Conventional farming should not be carried out in neighboring lands. *Growth of beneficial species should be supported by increasing green areas. *Beneficial species within the scope of biological warfare should be released for plant protection. *The seeds, seedlings etc. should be suitable varieties for the region and soil.
Lack of organization	3	*MINAF Province and District Directorates as well as local authorities should be a pioneer in the organization of organic farmers. *Cooperative education should be given by bringing consumers and villagers together.
Inadequate education	2,8	*MINAF Province and District Directorates should give education on organic agriculture. *Academicians should give education on the subject in question. *Customized solutions should be provided to the enterprises on the subject in question by organizing regional teams.
Lack of knowledge in product processing techniques	2,8	*World markets and techniques for processed fruit, vegetables etc. should be researched. *Organic farmers should be given courses regarding product processing techniques. *Regulations should be clear. *Bureaucratic procedures regarding the permissions for building facilities etc. to obtain processed products should be handled quickly.
Problems regarding soil productivity and fertilization	2,6	*There should be continuous education. *Suitable and licensed fertilizers should be used.

Lack of knowledge in struggling methods other than the chemical ones such as rotation, mulching etc.	2,4	*Organic fertilizers should be used often. * There should be continuous education. *What is learnt as a result of the education should be carried into effect. *The farmer should be a good observer and should gain experience.
Marketing	2,2	*Local authorities should show a market place for organic productions. *Organic farmers should organize among themselves. *There should be key buyers-suppliers. *Consumers awareness should be raised.
Having difficulty in finding the organic production material (seed, seedling, sapling etc.)	2	*Local seed banks should be established in relevant government institutions. *The farmer should establish his/her own seed bank. *The number of seed, seedling, sapling etc. producers that meet the needs of Organic agriculture should be increased. *Research institutes should be established for the subject in question.
Having difficulty in finding pesticides and biological agents that are suitable for use in organic agriculture; being unable to carry out customized production	1,8	*Dealers which sell plant protection products should sell appropriate products that could be used in organic agriculture. * MINAF Province and District Directorates should give the necessary information about the products and provide guidance.

\*The information is based on farmers' statements.

\*\*The items were scored from 1 to 4, and their means were calculated. Here, each number represents the following: 1: unimportant, 2: slightly important, 3: fairly important, 4: strongly important"

\*\*\*The answers are ordered by frequencies.

*When organic plant farmers were asked what their "regrets" were in their plant protection and production experiences up to now, they stated that*

Being unprepared for preparing nettle etc. natural pesticides in agricultural pests, diseases and weed control, trying to obtain these pesticides, yet being caught unprepared when diseases, pests and weeds come out every season; being unable to systematize these works.

Being late for applying organic pesticides for diseases and pests.

Growing the same vegetable and field plants in the same place, one on the top of another; being unable to do rotation.

Leaving couch grass in the same place instead of removing it and causing it to proliferate more.

Being late for weed fight and being defeated by it.

Trying to grow summer vegetables in an open field and exposure to hail; being unable to build an greenhouse system.

Being unable to harvest earlier, being late for harvesting.

Planting seedlings in fruit garden without clearing the stones.

Being unable to taking care of walnut gardens in the first years, failing to spare time.

Plowing the fruit garden and causing erosion instead of mowing grass without plowing.

Obtaining more expensive and less healthy seedlings with more loss while trying to obtain ready seedlings, Planting hazelnut seedlings in rows rather than in beds and thus, experiencing difficulties in cultivation, Planting annual plants very deeply on a slope and losing plants as a result of landslide after the rain.

Growing cv.Sakız artichoke on advice, yet failing to sell since it is not favored and growing cv. Bayrampaşa artichoke instead.

Buying sloping land, and thus suffering extreme hardships in farming in the long run; start the work with a level ground instead.

Spreading corn seed instead of planting it in rows.

*When organic plant farmers were asked what their final remarks were on “plant protection”, they stated that*

There must be a good book that offers solutions based on organic agriculture principles and addresses Plant Protection problems thoroughly.

It is essential that there be preparations which are simple to use and cheap to prepare, and whose safety tests are done by trying them out.

More information should be given on preventive plant protection practices and protective natural pesticides should be accessible.

University education should be given in organic agriculture at the level of bachelor degree.

Scientific studies shouldn't be theoretical, and farmers should be informed about the findings of such studies.

Szymona (2009) after a detailed study on plant protection in organic farms in Poland, emphasized that new and more efficient registered plant protection and biological products are necessary. In our study this idea is also high lightened by farmers.

*General problems and relatively importance level of plant protection in organic plant production within the eye of farmers*

The farmers were asked some questions regarding some potential problems that might be encountered during plant protection in organic plant production

and in other independent issues. What they were expected to do was to state how serious these problems were. In order to evaluate their views, the attitude sentences were scored as “1: unimportant, 2: slightly important, 3: fairly important, 4: strongly important” and their weighted mean was calculated. In addition, they were also asked of their opinions about solution recommendations which were written in order of importance (Table 6).

In terms of the weighted mean, the point that “Organic livestock and plant production is not integrated” was regarded as the most important issue by 3.2 points.

The farmers underlined that relevant institutions and organizations of the government should support doing organic plant production and livestock production together.

On the other hand, farmers also suggested that those who carry out organic plant production practices should also practice livestock production in their own conditions.

They also recommended exchanging the inputs or products between organic livestock farmers and organic plant farmers.

“Plant Protection problems” is stated as the second most important subject by a mean of 3 points. In order to overcome these problems, farmers indicated that the ministry should provide continuous trainings, safe pesticides should be applied, conventional agriculture should not be done in neighboring areas, the growth of beneficial species should be supported by increasing green areas, releasing beneficial species should be aided, and locally suitable varieties should be produced.

Lack of knowledge in fighting methods other than chemical ones such as “rotation and mulching” has a score of 2.4. As a solution, farmers suggested that there should be continuous education, and they

emphasized the importance of putting into practice what was learned during the education as well as the significance of being equipped with knowledge to be able to do observations in farming.

*When farmers were asked what their final remarks were on “organic agriculture”, they stated that Organic agriculture farmers must have a strong will and firmly believe in what s/he does.*

Consumers and farmer candidates should be set an example by designing pilot farm projects that involves all phases of agriculture starting from cultivation, unprocessed and processed product gain and all the marketing chains. Besides, they should be helped to grasp the importance of the subject in question and farmer-consumer meetings should be enabled.

Entrepreneur villagers should be brought in organic agricultural production.

Entrepreneurship training should be given about the subject in question.

Harvesting time for most of the products is in the summer and the wealthy class who can consume these relatively expensive organic plant products go on vacation which creates a marketing problem during this season. Therefore, this problem needs to be overcome.

All problems regarding organic agriculture should have one-stop solutions and/or have other guidance resources.

Being engaged in organic agriculture around fresh water basins should be promoted.

The number slow-city like residential areas should be increased and example towns and cities should be built in which only the practice of organic agriculture is encouraged.

Organic agriculture should be practiced in areas where no problem in planting, maintenance work, harvesting, and finding part-time workers is likely.

Plant products should be processed and presented in domestic and foreign markets in order to get high yield products.

It is essential to establish organic drug-pesticide industry by increasing medicinal aromatic plant production in organic agriculture.

Realistic projects should be put forward by farmer-academician collaboration.

Niggli *et al.*(2017), Arbenz *et al.* (2017), Marsh *et al.*, (2017) also mentioned in their studies that they are limited knowledge, practices, scientific support and technology transfer in organic farming and it is emphasized that the factors needs to be building and improving through new scientific studies and collaborations. The highlights are supported our findings.

### **Conclusion**

To conclude, Kocaeli has farmers who are aware and well educated that applies the main principles of organic agriculture, yet they remain incapable for plant protection in organic agriculture and for some other issues independent of this subject. Organic agriculture in our city is not actually carried out by people who practiced farming from past to present continuously, but with the efforts entrepreneurs who got involved in it later, by those who have not received any formal education, but sticks to the primary aims and purposes of organic agriculture by being self-aware and environmentally conscious.

This situation brings along the problem awaiting for solutions in plant production and marketing. The problems in plant protection could be surmounted by setting forth all kinds of reliable and scientifically tested protection and struggling methods that can be suggested for possible difficulties, and by passing this

information to the organic plant farmer via written, visual, audial etc. means without delay.

### Acknowledgements

This article was presented at Turkey 6<sup>th</sup> National Plant Protection Congress in Konya/Turkey in 5-8 September 2016. Abstract Book, p 769.

### References

- Akova SB.** 2011. Yalova: potential organic agricultural land of Turkey. *EchoGeo* **16**, 1-18.
- Arbenz M, Gould D, Stopes C.** 2017. Organic 3.0- the vision of the global organic movement and the need for scientific support. *Organic Agriculture* **7**, 199-207.
- Başak H, Özcan S, Yılmaz V.** 2015. Organic Agriculture Knowledge and Expectations of Farmers Attended About Organic Agriculture in Demirci District of Manisa Province. *Turkish Journal of Agricultural and Natural Sciences* **2(4)**, 324-331.
- Bhardwaj A, Kiradoo BD, Saini N, Sahani MS.** 2006. Fate of organic farming in contrast to conventional farming systems- A thrust to organic food. *Emirates Journal of Agricultural Science* **18(2)**, 47-51.
- Birinci A, Er K.** 2006. The comparison of the costs of organic and conventional peach production in Karacabey District, Bursa Province. *Atatürk Üniv. Ziraat Fak. Derg.* **37(2)**, 207-216.
- Bloch R, Knierim A, Haring AM.** 2016. Increasing the adaptive capacity of organic farming systems in the face of climate change using action research methods. *Organic Agriculture* **6**, 139-151.
- Budak F.** 2013. Biyolojik çeşitlilik ve organik tarım. *Biyoloji Bilimleri Araştırma Dergisi* **6(2)**, 45-50.
- Hasna, MK, Ögren E, Persson P, Mårtensson A, Rämert B.** 2009. Management of corky root disease of tomato in participation with organic tomato growers. *Crop Protection* **28**, 155-161.
- Jahagirdar S, Ravikumar MR, Siddaramaiah AL.** 2003. Traditional methods in the management of plant diseases- A review. *Agricultural Reviews* **24(2)**, 142-146.
- Kodaş R, Er C.** 2012. Organic Farming in Cereals. *Journal of Agricultural Faculty of Uludag University* **26(1)**, 103-116.
- Küp F, Sağlam R, Yetkin C, Tobi İ, Uludağ A.** 2013. Organik tarım uygulamalarının aşamaları ve pratikte karşılaşılan sorunlar. 28. Ulusal Tarımsal Mekanizasyon Kongresi-Konya 103-110.
- Madanlar N, Yoldaş Z, Durmuşoğlu E, Gümüş M, Örümlü E, Onoğur E, Tüzel Y.** 2005. Plant protection practices in organic vegetable growing in greenhouse in the preservation zone of Tahtalı (Menderes, İzmir, Turkey) Dam. *Ege Üniv. Ziraat Fak. Derg.* **42(1)**, 75-83.
- Marsh L, Zoumenou V, Cotton C, Hashem F.** 2017. Organic farming: knowledge, practices, and views of limited resource farmers and non-farmers on the Delmarva Peninsula. *Organic Agriculture* **7**, 125-132.
- Merdan K, Kaya V.** 2013. The economic analysis of organic agriculture in Turkey. *Atatürk Üniv. Sosyal Bilimler Enstitüsü Dergisi* **17(3)**, 239-252.
- Nandi R, Bokelmann W, Nithya VG, Dias G.** 2015. Smallholder organic farmer's attitudes, objectives and barriers towards production of organic fruits and vegetables in India: A multivariate analysis. *Emirates Journal of Food and Agriculture* **27(5)**, 396-406.
- Niggli U, Andres C, Willer H.** 2017. Building a global platform for organic farming research, innovation and technology transfer. *Organic Agriculture* **7**, 209-224.
- Olle M, Tsahkna A, Tähtjärvi T, Williams IH.** 2015. Plant protection for organically grown potatoes- a review. *Biological Agriculture & Horticulture*, **31(3)**, 147-157.

**Republic of Turkey, Official Gazette,** Date: September, 22, 2002, Number: 24884.

**Republic of Turkey, Ministry of Agriculture and Forestry.** 2015. (date of access: August,4, 2016) [www.tarim.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler](http://www.tarim.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler)

**Republic of Turkey, Ministry of Agriculture and Forestry.** 2016. (date of access: August, 4, 2016). [www.tarim.gov.tr/sgb/Belgeler/SagMenuVerileri/BUGEM.pdf](http://www.tarim.gov.tr/sgb/Belgeler/SagMenuVerileri/BUGEM.pdf)

**Szymona J.** 2009. Plant protection means applied in Polish organic farms. *Phytopathologia* **52**, 13-19.

**Varisco DM.** 1995. Indigenous plant protection methods in Yemen. *Geo Journal* **37(1)**, 27-38.