DETERMINATION OF CURRENT STATUS IN THE RESULTING OF WASTE MATERIALS FROM PRODUCTION OF GREENHOUSE AND ITS ENVIRONMENTAL INTERACTION

Atilgan Atilgan, Hasan Oz, H. Ibrahim Yilmaz, Hale Uzer
Suleyman Demirel University
atilganatilgan@sdu.edu.tr

Abstract. In greenhouses, several waste materials that may occur from production and waste materials may lead to environmental pollution. Agricultural production wastes, in greenhouses, plastic cover material released in the post-production, pesticide and fertilizer applications together with waste materials and plant wastes in a way disposed of that is left to environment. In this research; agricultural enterprises are chosen on purpose in Antalya Centrum, and Alanya, Aksu, Serik, Kumluca, Manavgat districts. The selection of surveyed enterprises to be using simple random sampling method was determined as the enterprises number 150. As a result of study, the current status of waste materials occurring in plastic greenhouses and attempted to determine the possible impact to the environment. In this study, waste materials was determined randomly drop from enterprises in to the environment enterprises of plastic sheeting material 28.6 %, from the plant waste 91.3 %, in the fertilizer material 24 %, from the agricultural chemicals 26.7 % and using of resulting from the fuel 100 %. The elimination of these negativity, manufacturers raising their awareness for waste management and clean for future generations to leave the field of agriculture and the environment. These applications are discussed for the realization of about the necessary precautions.

Keywords: greenhouse, waste, plastic material, fertilizer material.

Introduction

Greenhouse cultivation is a high system cultivation under a protective cover, which is built in different shapes by covering with materials that can transmit light such as glass, plastic, etc.; without being dependent on environmental conditions, where factors such as heat, light, humidity and air can be kept under control and cultivated plants and their seeds, seedlings and saplings can be produced, plants can be protected and displayed [1]. In terms of cover material greenhouses are classified as glass, plastic, artificial fiber and Plexiglas. Plastic covered greenhouses are getting more popular. The widely used plastics are PE (polyethylene) and PVC (polyvinyl chloride). Plastics corrode because of external factors and tear off. Their life time changes between 6 months and 1-4 years [2]. Plastic cover materials need to be renewed because of their short life time. Disposing the waste plastic product in greenhouses turns out to be an important problem. Although the agricultural activity performed using modern methods is very productive, the adverse effects on the environment increases gradually. Most of these effects can be seen as unfavorable results on the environment related to more intensive agricultural activity, more heavy production and increasing emissions [3].

While agricultural production is affected by the environmental problems to a great extent, the agricultural production itself has gained a feature creating environmental problems. The uses of chemical fertilizers and pesticides, high efficiency products, high level water usage and mechanization have deteriorated agriculture's traditional nature [4]. Also, during the use of these products, leaving the plastic packages and plastic containers on agricultural lands turns out to be another potential pollution source. Besides polluting the environment while being processed, plastics also pollute the environment to a great extend as a result of littering after the usage [5]. The very widely used plastic packaging materials decomposes in a long time on the environment, which causes the environmental pollution to increase day by day. Within the solid wastes; the decomposition time for plastic bottles is 1000 years, aluminum cans 10-100 years, plastic covered milk bottles 5 years, orange peel 6 months, chewing gum 5 years, battery 100 years, plastic bag 10-20 years, paper 2-5 months and glass bottle 4000 years [6].

The amount and specifications of the waste products resulting from agricultural activities changes, dependent on factors such as the socioeconomic level of the area and the dietary habits. Nowadays; gathering, transporting, storing and neutralizing the solid wastes has gained a big importance. The waste products which are not stored in an appropriate way result in pollution of underground and above ground water; breeding of pests; spread of bad smells; visual pollution and spread of microbes.

Also, since the decomposition of glass and plastic within the waste products takes a long time; it results with the permanent pollution of land [6].

Pesticides can also pollute the environment through air. The pesticides, which can evaporate, constitute dangers for human and environmental health through air pollution. The evaporability of the active ingredients causes detrimental effects on all living creatures around areas where intense pesticides are used. This subject carries a bigger importance especially for human beings living in areas where intensive agriculture is made [7]. The pesticides can contaminate water ecosystem in various ways. Water is contaminated with pesticides through the direct contact of insects and plants within or beside water, washing of the contaminated plants and soil with rain water; discharge of pesticide industry wastes to streams and still water, and washing the empty packages with water resources. Pesticides within the water ecosystem can affect the water flora and fauna in a negative way [8].

The goal of this study is to determine the recycling of plastic cover materials used in greenhouse buildings, the waste products of production practices and their environmental interactions; within plastic greenhouse enterprises in Antalya region, where greenhouse cultivation is intensely made.

Materials and method

The research material is made of primary data gathered through surveys from the plastic greenhouse enterprises and agricultural enterprises operating under plastic cover material within Antalya region. In addition, the statistical information and results of various researches about the subject in our country and other countries have been used. Through the information derived from the technical personnel of Provincial Directorate of Agriculture and the registers about the greenhouse cultivation activities; agricultural enterprises from center of Antalya, Alanya, Aksu, Serik, Kumluca, and Manavgat regions are chosen on purpose, where commercial production is carried out. Also, by choosing the enterprises for the surveys, the formula below is used for Simple Random Sampling [9].

$$n = \frac{N \cdot Z^2_{\frac{\alpha}{2}} \cdot P(1-P)}{d^2 \cdot (N-1) + Z^2_{\frac{\alpha}{2}} \cdot P(1-P)}, \quad (1)$$

where n – the sample size;
N – the number of samples in the population;
P – observed at a rate of x in the population;
$Z^2_{\frac{\alpha}{2}}$ – α = 0.10 table value;
d – deviation from the average in a certain percentage.

For determining the sample size we have worked with 10 % margin of error and 90 % confidence limit and the number of participating enterprises have been set to 150 by using the above formula (equation 1). The enterprises surveyed have been chosen randomly. For evaluating the results of the surveys made, Microsoft Office 2007 based Excel program is used. From the data derived by survey results, descriptive statistics (number and percentile) have been calculated and turned into tables. In the study two-way tables are formed for education levels and answers given for; recycling methods of cover materials, production wastes, fertilizer wastes and wastes of heating material. To analyze the independence of two qualitative variables with two or more categories, chi-square independence test is used [10].

Results and discussion

Within the 150 greenhouses used in the study, 65 % have received elementary education. It has been determined that, in the greenhouses where education level is low and traditional production methods are used instead of modern production, environmental awareness and consciousness is lower. In the traditional enterprises, greenhouses have smaller production areas and are usually scattered. This characteristic increases operation costs and decreases the possibility of implementing new technologies to greenhouses. Enterprises with small and scattered agricultural lands are one of the

main problems of our country. It is believed that a legal regulation on this subject would make a great contribution to greenhouse cultivation [1]. When the land distribution of surveyed enterprises is examined, 75 % has 0,5 ha or less greenhouse cultivation size. Only 4.7 % have a greenhouse cultivation size bigger than 1ha (Fig. 1).

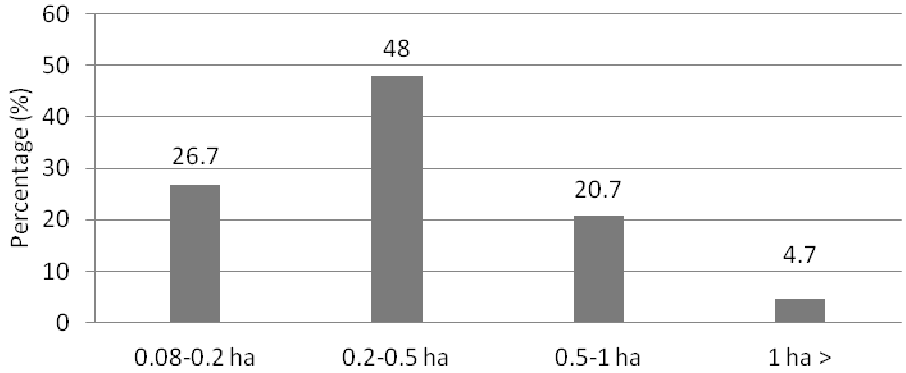

Fig. 1.**Greenhouse cultivation size within the surveyed enterprises**

Single cropping and double cropping is widely used in Antalya region. Tomato plant is the mostly produced vegetable in the production line, where vegetable production takes the first place [11]. In greenhouses with traditional production methods rather than modern production methods, tomato is the most produced plant [1]. Within the participants of the survey the higher production is tomato plant with 58 % followed by pepper (16 %), cucumber (15.3 %), eggplant (8 %) and others.

With the development of plastic technology, using plastic as a cover material increased instead of glass material; due to cheapness and ease of use. The plastic cover materials used are manufactured according to one year of economic life or several years of economic life. The replaced plastic materials become the source of pollution both for the enterprise itself and the environment. Plastic is a source of pollution not only due to production process, but also due to being left on the environment after usage. One of the most common examples is; the plastic cover materials, used plastic pesticide containers and the nylon bags they are stored in. Hence, plastic can exist in nature for 500 years without deterioration. Plastic material amount coming out of one hectare of greenhouse land is around 5 tons [12]. It is a truth that, deterioration of 5 tons of plastic material in nature will negatively affect both the surrounding area and the organisms.

It has been determined that within the surveyed enterprises, 61 % have discarded the changed cover materials in an appropriate way. The rest on the other hand (39 %) have tried to discard them in a way that will conclude with danger to both environmental and human health (Fig. 2).

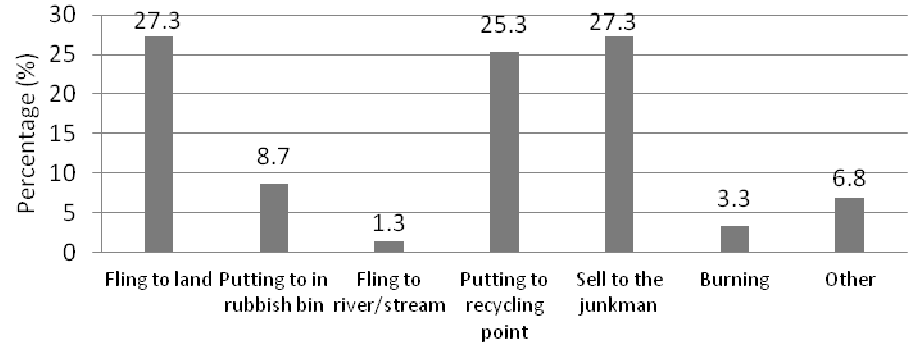

Fig. 2.**Evaluation of plastic cover materials within surveyed enterprises**

In all of the agricultural practices in our country including greenhouse cultivation enterprises; plant waste evaluation after production has either been done insensibly or has been ignored totally. These wastes are either gathered in big areas and burned, or are left on land or rivers. While the plant waste products are gathered together and burned, all of the living organisms within the vicinity are damaged. This results in both deterioration of the ecosystem and decreasing productivity of land. As for the plant waste products left on land or river, they cause pollution. Whereas, when the plant waste products are used as compost, they will not be waste any more and will become organic material with

a healing feature for the land. The compost that comes out is an organic fertilizer close to farm manure, which is very important in terms of land productivity [13].

Within the participating enterprises, it is determined that only 8.7 % are using the plant waste for compost and the remaining 91.3 % are leaving them on nature for decomposition (Fig. 3).

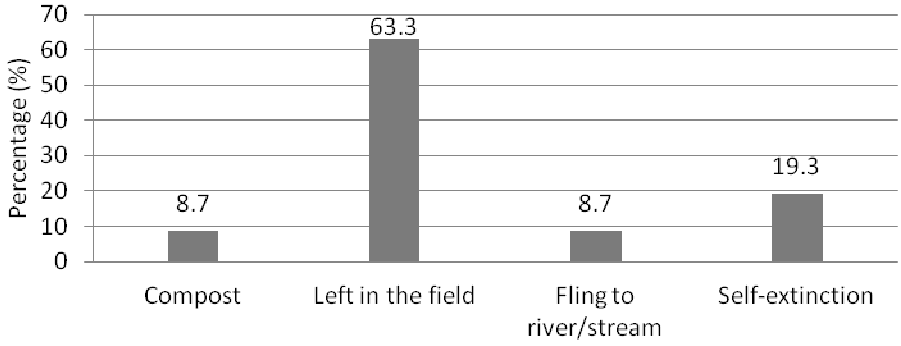

Fig. 3.**Treatment of plant waste within the surveyed enterprises**

Some of the chemical fertilizers and pesticides used for agricultural purposes, result with the pollution of land. Having these substances on land, may cause the rain water and surface currents to carry them to other sources [14]. Production may benefit from applications such as fertilization to a great extent, but also cause big damages to all of other sources if not used properly. It has been determined that enterprises are not careful enough in terms of discarding fertilizer waste material used for agricultural production. 50 % of the participants are leaving them uncontrolled in surroundings interacting with the nature (Fig.4).

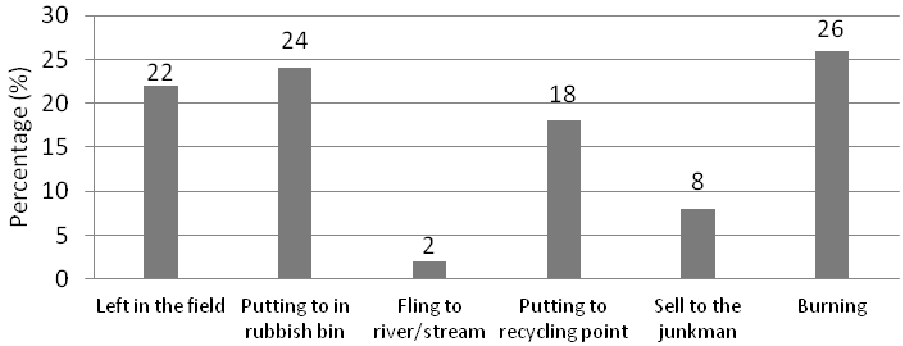

Fig. 4.**Treatment of fertilizer waste products within the surveyed enterprises**

Pesticides can also pollute the environment through air. The pesticides, which can evaporate, constitute dangers for human and environmental health through air pollution. The evaporability of the active ingredients causes detrimental effects on all living creatures around areas where intense pesticides are used. This subject carries a bigger importance especially for human beings living in areas where intensive agriculture is made [7].

It has been determined through studies that unconscious applications are used also by discarding the pesticide wastes. Producers have stated that, the mostly preferred (25.3 %) method is burning (Fig.5). Producers also expressed not having any special equipment for preparing chemical pesticides and that, they would rather use any plastic material or a plastic bucket. They have also stated not having any precaution to protect themselves. According to an investigation made in USA in 1989, active ingredients of fertilizers such as 2.4 D, atrazine, MCPA, parathion methyl, molinate, malathion and thiobencarp have been detected in the atmosphere in residential areas [7]. Therefore, the importance of using the chemical ingredients carefully and not leaving their wastes on the environment unattended ensues.

Two-way table is used on the study for education levels and waste cover material recycling methods, waste fertilizer recycling methods and waste heating material recycling methods. Likelihood Ratio Chi-Square values are found 19.038, 24.848 and 10.627 respectively, which are statistically not significant values and education levels are independent. Two-way table is used between education

levels and waste product recycling methods and Likelihood Ratio Chi-Square value is found 32.468 and it is statistically significant ($p < 0.01$). Education level and waste product recycling methods are not independent ($p < 0.01$).

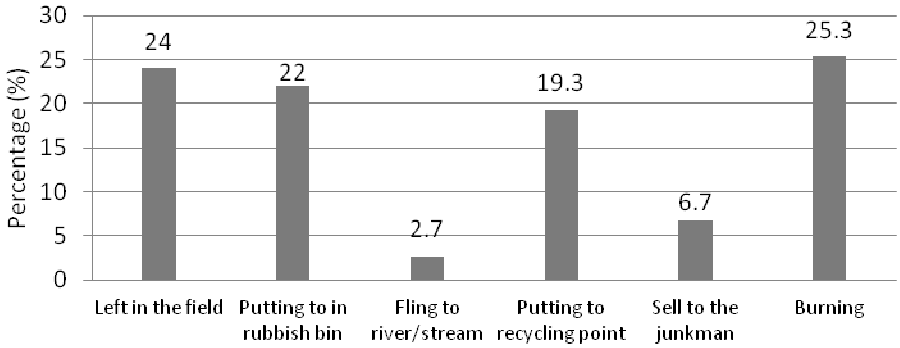

Fig. 5. **Treatment of pesticides within the surveyed enterprises**

In enterprises where traditional production methods are used, it has been determined that environmental awareness is not taken into account, the education level of the producers is not on a sufficient level and the required support is received through hearsay information instead of qualified staff. In modern greenhouse enterprises, production is made under the control of agricultural engineers. In traditional enterprises on the other hand, information about production is received through various sources. According to a study done by Canakci and Akinci (2007) [1] it has been determined that, in traditional greenhouse production methods, producers receive the information they need about production and environment through sources such as; suggestions of fertilizer sellers, experiences of their own and of other producers.

Conclusion

As an outcome of this study, pollution parameters have been tried to be identified through the information gathered from the enterprises. These parameters have been defined as; plastic material as a result of post production cover material or material used for other purposes, agricultural waste discarded as a result of harvesting, chemical wastes and plastic bottles as a result of disinfection, over fertilization and other resulting wastes. We believe that unless these polluting elements' recycling methods are not changed, source pollution and losses will increase.

As a conclusion we believe that protecting the environment, preventing the pollution and sustainable improvement principle will only be possible through on-site solutions. To put this into practice the producers need to be in contact with the universities as well as the universities with the producers.

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