

## PROBLEMS AND STRATEGIES IN GREEN HOUSES OF NORTHERN GREECE (MACEDONIA)

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### Introduction

Greenhouses in Northern Greece (Macedonia) cover an area of about 570 ha. Vegetable crops are grown in 540 ha of them and commercial ornamental crops in the rest 30 ha.

**Table 1:** Greenhouse area by Crop in Macedonia

Prefecture	Total (ha)	Tomato (ha)	Cucumber (ha)	Pepper (ha)	Bean (ha)	Rest (ha)	Ornamental (ha)
THESSALONIKI	230	230	60	20	30	30	25
PELLA	155	130	40	-	10	-	-
IMATHIA	135	20	15	120	-	-	-
CHALKIDIKI	50	40	40	5	5	5	5
TOTAL (ha)	<b>570</b>	420	155	145	45	35	30
<b>800 ha</b>							

560 ha of the vegetable and ornamental crops are grown in soil and the rest 10 ha in hydroponic media.

In most of the 540 ha, two (spring, fall) and sometimes three vegetable crops are grown within a year (one more in winter). So, annually, the area covered with vegetables is 800 ha.

The most important problems in vegetables grown in greenhouses of Macedonia are caused by the following:

#### 1. Soil fungi.

*Rhizoctonia solani*

*Pythium* sp.

*Phytophthora* sp.

*Fusarium solani*

*Verticillium dahliae*

*Sclerotinia sclerotiorum* (See **Table 2**)

#### 2. Nematodes

*Meloidogyne* spp.

#### 3. Weeds

*Stellaria media*, *Portulaca oleracea*, *Setaria viridis*, *Chenopodium album*, *Cyperus* spp. etc.

#### The most commonly used methods for soil sterilization in Macedonia are:

Fumigation with methyl bromide. It is used in about 250 ha every other or third year.

Steam sterilization. It is applied in about 5 ha every other or third year.

Solarisation. It is used in about 4 ha every other year.

Several other new methods in 1-4 ha annually. These are evaluated by Agrochemical Companies.

In the rest of the area, growers do not apply any sterilization method, but they use various plant protection products such as fungicides, nematicides, insecticides and herbicides. These are used either to prevent, according to the history of soil, or to suppress the pest when there is evidence to do that.

#### Methyl bromide

It has the advantage over the other methods used in Macedonia, due to its broad spectrum of activity against the soil pests and weed seeds, although it is more expensive, very toxic, very dangerous to the users and it has detrimental effect on soil, environment and food products (residues).

#### Metham Sodium

It is less effective against pests than methyl bromide, and this is the reason for its limited use.

#### Steam sterilization

In contrast to the results published, this method did not produce in most of the cases acceptable control of pests. It is worth to be said that the steam application was performed by the agronomist expert of the Company. Another disadvantage of this method is its higher cost compared to the other methods.

#### Solarization

It has given a good efficacy against broad spectrum of pest and particularly when it was combined with Calcium Cyanamid. However, the greatest disadvantage of this method is the fact that soil can not be used for cropping for at least two months.

#### Replacement of the greenhouse soil used.

It is an encouraged method from us, and it contains a replacement of the already greenhouse used soil to a depth of 25-30 cm with a new mixture one (one part of uncultivated soil, one part of sterilized manure and one part of sand).

This method keeps the soilborn pathogens for 4-5 years at very low levels, which means less crop damages and less pesticide applications.

The replacement of the soil takes place about every 6-8 years, but research is needed to determine precisely the time for soil replacement.

#### Hydroponic media

Very few farmers are interested in applying this method due to the higher cost along with the lack of specialized knowledge.

### **Non fumigation methods**

Some growers do not use any of the above mentioned methods but they apply experimentally various pesticides or biological agents. Among the new methods tested were the antifungal bacterium *Pseudomonas cepasia*, the fungi antagonists *Trichoderma harzianum*, some saprophytic fungi, various amino acid materials, and bacteriocins. However, our growers do not accept easily to apply new methods and rely their effort to produce vegetables on old methods.

To control or to minimize soilborn problems in greenhouses, the following should be taken into account:

- The continuous use of the greenhouse soil increases the populations of the soilborn pathogens and consequently the crop damage.
- Main target during growing should be the decrease of the pathogens at level lower than the economic threshold (ICM's basic condition).
- The effectiveness of any soil sterilization method depends on the:

#### **A. SOIL FACTORS**

1. Texture
2. Organic matter content
3. Porosity
4. Temperature
5. Soil moisture
6. Conductivity (salinity)

#### **B. APPLICATION TIME**

#### **C. STAGE OF PATHOGEN**

It is well known that susceptibility or sensitivity of the pathogens to soil fumigation or to pesticides depends on their stage at application time of the method used. So, a pathogen is more susceptible when it is grown vigorously, and becomes more tolerant in the form of oospores, chlamydospores, sclerotium or dormant mycelium.

#### **D. TRAINING LEVEL OF GROWERS**

Growers should be trained very often in order to become familiar with the new methods and to learn more how to put into practice the following:

- **Seed bed or nursery.** It is important for the growers to know that seed bed and nursery are not allowed to be established in the greenhouse, since this would become a significant primary cause of contamination (infestation). The seed bed or the nursery should be established in a separate place.
- **Disinfectant product**
- There must be available for use before of any entry in the greenhouse.
- **Insecticide and acaricide application**

These must be performed before of the removal or destruction of the plant remainings from the previous crop. Also, the wooden structure of the greenhouses should always be sprayed with disinfectant immediately after the removal of the crop remainings.

#### **E. SCIENTIFIC KNOWLEDGE OF THE AGRONOMISTS**

Agronomists of the Ministry of Agriculture should also be trained very often as the greenhouse growers. This is necessary because most of them got their degrees 20 years ago and since then they have been working for the EU programs and not as agronomists in Agricultural Extension Service.

### **CONCLUSIONS**

The above mentioned information allow the following conclusions to be drawn:

1. Research should be carried out by the experts to reevaluate the effectiveness and consequently the possible use of both steam sterilization and solarization methods.
2. Subsidies should be given to the growers that are using one of these two methods.
3. Research should be carried out about the possibility of applying the soil replacement as an alternative to methyl bromide method.
4. All possible alternative methods should be included in the Integrated Pest Management Protocols, which are enforced by the Ministry of Agriculture to be applied by the greenhouse growers.