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STUDY OF EXISTING SITUATION OF CUCUMBERS IN KOSOVO

(Evaluation of current management of indoor cucumber production in Kosovo)

Horticultural Promotion in Kosovo

inter cooperation
Natural Resource Management
Rural Economy
Local Governance and Civil Society

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Executive Summary

This research was commissioned by the Project on Horticultural Promotion in Kosovo, funded by the Swiss and Danish governments and implemented by "Intercooperation". It took place during last week of April and the beginning of May 2009.

The research was aimed at analyzing the situation of cucumber production in protected environments in Kosovo and providing necessary recommendations regarding its future development consistent with Kosovo's conditions.

Producers and other parties concerned with this sector were visited in order to attain the necessary data. These visits included 18 farmers in different regions of Kosovo, agronomists working in the field (those who work for municipalities or different projects), as well as agricultural input merchants. Various relevant sources were also used relating to the subject[1].

Cucumbers, along with tomatoes, are the main cultivated plant in protected locations in Kosovo. It is cultivated in almost all regions where vegetables are being grown but it is concentrated (both in open field and protected environments) in the triangle between Gjakova, Rahovec, and Prizren, as well as several villages of the Municipality of Suhareka.

Cucumber production in protected environments is mainly organized in the simplest forms of tunnels covered by different plastic covers, and which in most cases are without heating. The low height of the tunnel and insufficient aeration are among the main limitations to the growth of the plants. The insufficient aeration leads to favourable conditions for diseases.

Long fruit cucumbers (for salads) are mainly demanded from early spring to autumn while the cornichon type (with small fruit) is primarily used for making preserves in late autumn.

Cucumbers are cultivated (in most cases) through seedlings for early production in the spring, and for later production, the common practice is to sow directly in the greenhouse.

Unlike with other vegetables, hybrid seeds are always used in the case of cucumbers in greenhouses. Most of the hybrids are with a long embryo and are of the long fruit type, except Lvina F_1 and Marinda F_1, which are usually cultivated as the crop and have shorter fruits.

Drip irrigation is normally used and irrigation and fertilization are conducted on the basis of the farmers' individual judgement – but soil testing is not carried out. As a result, it is normal to see symptoms of a lack of different elements (especially magnesium, calcium and potassium) as well as an excess of several elements (particularly nitrogen). Producers are often not able to distinguish these symptoms from diseases and, as a consequence, they often use chemical control of diseases that do not exist in their greenhouses. In general, cucumber protection in greenhouses from diseases and pests is being done without a previously defined programme.

The main disease present during the seedling phase is *phytium spp*. In other phases - from transplanting until the end of vegetation, the main disease is late blight (*Pseudopernospora cubensis*). Powderly mildew is not often present – but some rotting occurs.

Pesticide use on cucumbers is much higher than for other vegetable crops – and farmers pay no attention to pre-harvest intervals.

[1] Data from MAFRD, Reports from Intercooperation, and from other Projects.

1. Current crop management practices for indoor cucumber production

Cucumber production has an important role in overall vegetable production in all types of greenhouses. The cucumber is estimated to be the main plant cultivated in greenhouses after the tomato plant.

Cucumbers are cultivated in an area of about 532 ha in Kosovo (MAFRD). There is not any complete data about cucumber cultivation areas in protected locations. However, if there are 154 ha[2] of commercial greenhouses in Kosovo and the fact that the cucumber cultivation takes place in about 30% of these areas[3], then it can be considered that the cucumber cultivation areas are about 46 ha.

Cucumbers are cultivated in almost all regions in Kosovo where vegetables are being grown, but they are concentrated (both in open field and greenhouse) in the triangle between Gjakova, Rahovec, and Prizren, as well as several villages of the Municipality of Suhareka (especially in the village Nepërbsht). In small areas, they can be found in the region of Peja and Anamorava. However, there are limited numbers of commercial producers in these regions.

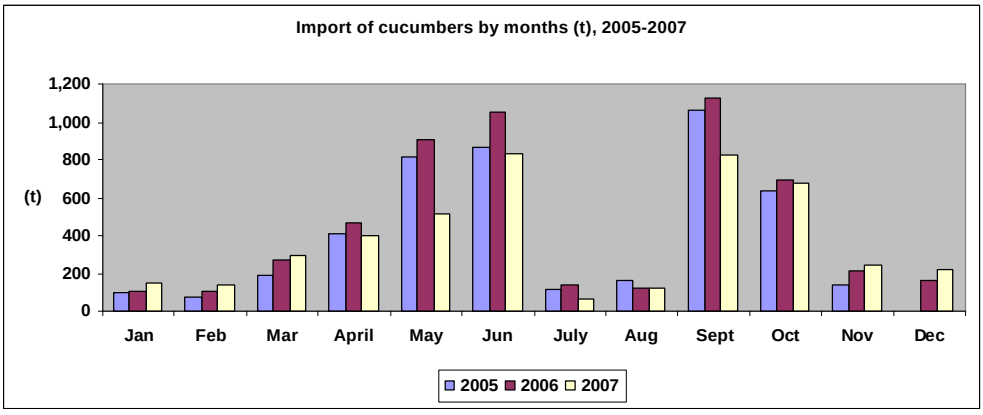
Yet, the processing industry highlighted cucumber demand, especially the cornichon type, almost the entire quantity for processing comes from imports.

Cucumbers are one of the most important vegetable crops. The cucumber's fruits are used as fresh and preserved food. The cucumber's fruits are also a very important raw material for the processing industry. In addition to its importance as human food, the cucumber is of great economic importance as well.

Cucumbers are one of the most important plants cultivated in greenhouses. Its cultivation is delicate. However, if technologies are strictly applied, a good quality production can be achieved. They are cultivated in both open field and plastic greenhouses in Kosovo.

Cucumber imports are very high. 5.373 tons with a declared amount of € 1,214,268 were imported last year. The imports are dominated by Macedonia (77%), while the rest was imported from Greece and Turkey.

The highest imports occur in early spring and late autumn.



Therefore, compared to such large imports, exports are symbolic, because only a few tens of tons are exported, which does not show any value compared to huge import.

[2] Inercooperation/HPK
[3] Estimation by the Author of the report

1.1 Weather conditions and locations where indoor cucumbers are expanding

The region where the indoor cucumbers are mostly located is the region with the mildest climate conditions in Kosovo. The region of 'Rrafshi i Dukagjinit', which includes the area expanded through the White Drin river, because it is much more affected by a hot climate coming from the Adriatic Sea. Average temperatures during winter are 0.5 °C, but can drop as low as - 22.8 °C.

The average of annual rainfall in this area is evaluated at 700 mm. In general, in this climate zone winters are characterized by dense snowfalls[4]. This vegetation timing in this area begins at least 2 to 3 weeks earlier than in other regions of Kosovo. Based on this data, cucumber productions as well as other vegetables are cultivated mainly in early spring until late autumn.

The overall analyses of this sector shows that the region of Prizren, potentially, could be a very competitive producer of cucumbers (as well as other vegetables), not only for the local market, but also for the entire Western Balkans.

1.2 Type and quality of greenhouse infrastructures

In general, the greenhouse sector is one of the fastest developing sectors in Kosovo. Based on the latest statistics, the total area of greenhouses in Kosovo is about 154 ha[5]. This area has doubled since 2005, which counted 73 ha. Most of the greenhouses in Kosovo are high tunnels, constructed with wood, or combinations of wood and metal bars by improved models of individual tunnels. They are widely identified in Kosovo as "mid level technology greenhouses".

There are only a few greenhouses constructed with higher standards of quality (including galvanize steel, good aeration, etc.) and their total is about 3-4 ha[6]. Construction of such greenhouses was supported by different donors through various projects, but rarely through private investment. It is important to mention that most of the improved high-level technology greenhouses are used for cultivating flowers and in some cases for the vegetable seedlings. Vegetable cultivation in such greenhouses is rarely found.

Production in greenhouse is mainly organized through the simplest forms of tunnels covered by plastic, which in most cases are without heating systems. In such a situation, the products are usually on the market a few days earlier (usually from two weeks up to a month earlier).

It is an obvious tendency to increase greenhouses areas throughout Kosovo. This can be justified by the fact that the greenhouse areas were doubled in 2008 compared to 2005. However, most of the greenhouses in Kosovo are constructed based on the principle of a closed "box". The aim of the existing models is maximizing the accumulation of solar energy and to keep the heat in the greenhouse without a way to remove the excess energy from the greenhouse.

The dominant greenhouses in Kosovo belong to the type of simple individual tunnels, including combined structures of wood and metal bars. In general, low quality and short-term use plastic are used for coverage (mostly one year). Currently, exceptions from this general view are rare, but there are significant efforts by small local companies to develop and promote improved models adapted by them.

Different organizations efforts are commendable to promoting improved models, providing a higher level of aeration, and exploiting opportunities for a longer period of time. Although there is a trend of continuous expansion of greenhouses area, it should

[4] http://www.kosovo-mining.org
[5] Intercooperation. Greenhouse inventory of Kosovo, 2008.
[6] Estimation by the Author of the report

be mentioned that such productivity is still accompanied by many difficulties, which could be included in two main ones:

- Construction of the greenhouses not functional enough in most cases,
- Such production is still based only a little bit on the most recent scientific achievements in this area.

1.3 Microclimate conditions in greenhouses

The greenhouses, in which cucumbers are produced in Kosovo, are not equipped with heating and aeration systems. The low altitude of the greenhouses and insufficient aeration are among the main limitations on growing plants in such conditions. Low temperatures and relatively high humidity of the air are very common phenomena, which have consequences on the fruit productivity. In general, farm workers are concerned about potential damage to plants caused by low temperatures, but they do not pay attention to damages, which could be even more serious, due to high temperatures. The aeration only takes place through the front side of the simple tunnels. There are no sideways or top aeration vents, which creates unfavourable conditions during the cultivation of vegetable crops (especially very high temperature and humidity).

In some cases, top of the greenhouses do not exceed 2 m, because of low altitude; average coefficient of the greenhouse volume in Kosovo does not reach $2m^3/m^2$. Due to this, fluctuations of temperature in the greenhouses are very high. Relative humidity of the air in most cases is beyond the acceptable limits and it is also insufficient space inside the greenhouses to grow crops, especially when temperatures are high (from mid of May to late August).

The yield production in greenhouses depends to a large extent on the human control over the environment within the greenhouse. Growers' purpose of controlling the environment within the greenhouse is to increase the photosynthesis intensity of the sowing crops. The best way to do this is through control and balance of temperature values, lighting, and the concentration of carbon dioxide.

2. Cucumber cultivation

2.1 Production timing

The cucumber production timing in greenhouse depends on:

- Cucumber biological characteristics (requirements to external environment conditions),
- Specific market demands, and
- Types of greenhouses (with or without heating).

Long fruit cucumbers (for salad) are mainly demanded from early spring to autumn, while the cornichon type (with small fruit) is primarily used for making preserves in late autumn.

Sufficient heat should be provided during cucumber cultivation in greenhouses, because **the cucumber is a typical plant of hot climates**. In greenhouses with heat and additional lighting facilities, crop timing can be easily adapted to specific market requirements. However, due to high heating costs, the indoor cucumber is usually cultivated in greenhouses during late summer and early spring in Kosovo (including even those with heat).

In Kosovo, the schedule for cucumber cultivation in greenhouses is the following: planting of seeds takes place from 05 to 20 February and transplantation of seedlings takes place during the second half of March, depending on the region and greenhouse conditions

2.2 Seedling production

Cucumbers are cultivated (in most cases) through seedlings for early production in the spring, and for later production the common practice is to sow directly in the greenhouse. Unlike with other vegetables, hybrid seeds are always used in the case of cucumbers in greenhouses. Most of the hybrids are with a long embryo and are of the long fruit type.The cornichon type (with small fruit) is primarily used for making preserves in late autumn, but in more limited areas than that of cucumber type with long fruit.It is obvious that some hybrids used in some cases are not very productive (e.g. Darina type).

There are different types of substrates used for the seedling production. Some producers use peat compost suitable for seedling cultivation which is imported from various countries of Europe. Although such substrates are relatively new to these producers7, their expansion is very fast. More than 50% of the cucumber producers use these substrates for the seedling production8. Actually, when such substrates are used, they offer more favourable conditions for seedling production. In other cases, producers use substrates processed in their farms. The preparation of such substrates is usually processed through mixing the decomposed manure of stalls with soil. The content of such blend is different (1: 1 or 2 (soil): 1 (decomposed manure). In some cases producers also add a significant amount of mineral fertilizer to this blend. In some cases (not always) disinfection of such substrates is mainly done by Fungicide including Previcur, Ridomil, etc. Such work is usually conducted through free evaluation by farmers. These substrates are not sent to the laboratory for analysis and treatment.

Crop timing of seeds usually takes place from 05 to 15 February, but in the regions of Prizren, and Rrafshi i Dukagjinit, it takes place at least a week earlier. Growers sow seeds from 05 - 10 February in the villages of Mamusha, Malësi e vogël, and Nepërbisht. While other producers in the region called Rrafshi i Kosovës (contacted producers in Mitrovica, Shtime, Ferizaj and Gjilan region) the crop timing usually takes place around February 15th. Of course, such data are approximate and cannot move more than + /- 2 or 3 days.

Seed sowing is done in modules, and some growers use different flowerpots for this purpose (primarily yogurt bowls). The producers who themselves prepare such peat compost usually plant in plastic bags which have greater volume than the holes of the module.

Most growers use no heating systems. For this reason, they put the seed modules in flowerbeds inside the greenhouse, and cover them with low tunnels, thus providing double protection of seedlings from low temperatures.

Care measures during the preparation of the cucumber seedling by these producers are based on:

- protection from low temperatures (in some cases also used double coverage),
- aeration,
- irrigation,
- nutrition and protection from pests and diseases, and
- hardening of seedling.

There is no rule on how to best apply these measures by the producers, but rather apply such methods on the basis of free evaluation by farmers. Farmers have no knowledge about modern methods on seedling production, but they mainly learn from other farmers as well as from input dealers, who provide them with agricultural inputs.

[7] Mainly start to apply 3-4 years before
[8] Estimation by the Author of the report

There is no extension service for such growers in the field. The only exception is the professional assistance provided by several projects (mainly HPK implemented by Intercooperation), and vendors of agro-inputs. Seedling irrigation is mainly conducted through water from wells, which in most cases is very cold. The aeration of greenhouses which produce seedlings usually takes place at midday by opening the front side of the greenhouses (which are mostly in the form of tunnels). Seedlings nutrition is conducted through liquid fertilizers before irrigation. There are usually 1-2 re-fertilizations.

Farmers' difficulties and also their biggest mistakes are regarding protection from diseases and pests. Farm workers usually have not improved any protection program, but the treatments are based on their free evaluation. In some cases, they receive instructions from vendors of products in agricultural pharmacies[9].

Tempering of seedlings (the seedling preparation to be transplanted to a new greenhouse) often causes delays.

These defects do not require large investments to be made. Prevention is done only through professionalism and better care for seedlings.

2.3 Main types and hybrids of cucumbers

Most of the hybrids are with a long embryo and are of the long fruit type fruit type, except Lvina and Marinda, which are mainly cultivated as cover crops, and have shorter fruits.
The main hybrids of cucumbers in greenhouses are:

Dinero F1	Darina	Solverde F1	Marinda F1
Darina F1	Flaming F1	Evans F1	
Avalon F1	Mirabelle F1	Levine F1	

Other hybrids can rarely be found at some growers. However, the hybrids which have been cultivated for a long time are: Darina, Levine, and Marinda.

2.4 Transplantation of seedlings

A well-prepared soil is essential for normal cucumber growth. The soil is processed in a depth of 30-35 cm immediately after harvesting the previous crops. Growers usually prepare flowerbeds in order to create an environment suitable for the cucumber cultivation. Thus, the preparation of the soil is very important in early planting. After soil preparation, the irrigation pipes are stretched along flowerbeds.

Hereafter, some producers cover the surface between flowerbeds with plastic mulch in order to minimize the loss of soil humidity and to prevent weeds. According to free evaluation only less than 30% of the growers apply such method.

The cucumber seedlings are transplanted when they get 3 to 4 real leaves. The seedlings are transplanted at different distances depending on growers. In case of planting in flowerbeds series, distances between flowerbeds range from 70 to 100 cm (most often from 80 to 90 cm) and from 40 to 50 cm among plants in a flowerbed.

In some cases (especially in Mamusha), they are planted in two flowerbeds, and the distance between them is 60 to 70 cm, then is left a distance of 0.8 to 1 m and then is continued with other flowerbeds series.

2.5 Crop rotation

In most cases, farm workers have not properly rotated crops. We have noticed that farmers are aware of the consequences of not respecting such rule. However, there are some factors that limit them to directly apply crop rotation. Most important are:

[9] For more information about these issues, see the topic for cucumber plant protection in greenhouses

- Limited greenhouse areas,
- The cucumber production and some other vegetables in the protected environments, despite difficulties, are still considered a profitable activity.

Crop rotation is applied less with cucumbers, but often in various vegetables including tomato. Some producers who have more advanced greenhouses, plant spinach or green salad (as cover crops) after harvesting the primary crop in late autumn and early spring. However, considering the approximate requirements of these crops for nutrients, and their potential of being attacked by diseases and pests, this rotation in essence is not very different from that of mono-culture cultivation.

Despite these limitations, cucumber cultivation for several years in the same area is accompanied with many consequences such as unilateral use of nutrients as well as difficulties in protection from diseases and pests.

The crop rotation has to be applied more rigorously in order to avoid harmful impact.

2.6 Crop timing

The following needs to be considered for crop timing of cucumbers, regardless of greenhouse type:

- crop timing lasts from 4-8 days
- from the crop to its bloom, 30-60 days are needed
- from the bloom to the first harvest, 7-20 days are needed.
- The harvest may take 36-90 days.

Sufficient heat is very important for cucumber cultivation in greenhouses, because the cucumber is a typical crop of hot climates. In the greenhouses equipped with heat and additional lighting, the crop timing can be appropriate to market specific demands.

However, indoor cucumber production in greenhouses is cultivated in late winter and early spring, due to high costs of heating.

Table 1. Crop timing of cucumber cultivation in greenhouses in Kosovo

Type of construction (greenhouse)	Period of time	Sowing of seeds	transplantation of seedlings	Start of harvesting
Greenhouse	spring	05. – 10.II.	15– 20.III.	25.IV – 05.V.
	autumn	05– 15.VII.	5– 10.VIII[10].	10 – 15.IX.

2.7 Irrigation methods

Irrigation is generally applied according to farmers' individual judgement. There are not any strict rules for irrigation. Irrigation is mostly used in regions provided with irrigation systems. Most producers apply drip irrigation. Although this system has started to be used only recently (since 3-4 years), the distribution of this system is quite large. Less than 30% of producers use irrigation through channels - grooves[11].

In some cases, irrigation is conducted through pumps (which work with oil or electricity). Both methods of irrigation greatly increase the production cost[12]. A small number of farm workers (mainly in the regions of Lugu i Baranit, Istog and Klina), use water flowing from various canals. This kind of irrigation is cheaper than the first two methods incurring mainly the construction cost. The shortcoming of this method is that often during the summer (when temperatures are higher) these canals may not have water (dry up).

[10] In most cases during autumn, cucumber production in greenhouses is conducted through direct planting of seeds.
[11] Estimation by the author of the report
[12] Usually this kind of irrigation for a season costs 300 Euro/0.5ha

A special problem is the inappropriate irrigation of cucumber crops and a disregard for the actual water demand. It depends on the stage of growth and development of plants, soil type, and temperatures within the greenhouse.

2.8 Nutrition

The fertilizers are applied on the basis of farmers' individual judgement. The majority of farmers have never tested their soil. In some cases soil tests have been carried out but such tests were initiated through different projects or Municipal Assemblies (directorate of agriculture). Therefore, the use of fertilizers is often not-rational and un-suitable for the plants' direct nutrition. As a result, defects and symptoms of insufficiency of various nutrients often occur.

Most producers use organic fertilizers every 1-3 years, depending on the farmers' potential. They usually use 5-6 kg fertilizer / ha.

The NPK type fertilizers are spread during the extra preparation of soil (before transplantation of seedlings). Some producers use a large quantity of fertilizer (about 150 kg/1000 m2, in the regions of Prizren and Suhareka). These quantities differ among regions and producers. Growers of cucumber in Mitrovica use fertilizers more professionally as a result of support by the different projects.

Application of soluble fertilizers (crystalline fertilizers) is still not satisfactory. It can be considered that only 40 to 50% of producers use these types of fertilizers.

Re-fertilization lasts until shortly before the end of the harvest. Re-fertilization takes place every 7 to 10 days. Farmers apply fertilizers with high dissolubility to balance nutrients directly.

The fertilizers are tossed out by hand. The fertilizers are spread before irrigation or cultivation. Nutrition of plants through the leaves occurs very rarely in some cases.

There are symptoms caused by the lack of different elements (especially magnesium, calcium and potassium), but also excess of several elements, particularly nitrogen can be noticed almost every time in the greenhouse, as a result of a non-professional use of fertilizers. Producers often are not able to distinguish the symptoms from diseases. Due to this, they often use unnecessary chemical preparations because they think that their plants are diseased rather than fulfilling nutritional demands.

Cultivation between flowerbeds is a regular method applied by producers of cucumbers who do not use black plastic mulch. Approximately 2-4 cultivations among flowerbeds are processed. Depending on producers, the cultivation between flowerbeds is conducted by hand or by using different tillers. This method is applied until the area among the flowerbeds is not closed. This method is very useful not only because it affects well enough the rake of soil but also for the fact that almost none of the farmers use herbicides.

During cucumber cultivation in greenhouses, it is continuously processed **corona adjustment of the cucumber plants**, which represents a kind of «paring» of cucumbers. The aim of this method is to provide early fruitiness, providing the best lighting of plants through adjusting its corona, the fruits growth as much as the plant is able to supply with necessary nutrients, etc.

In most cases, farmers cultivate the cucumber at a bough. The fruits of the first floor are almost never cleaned, but the first harvested fruits belong to this area. The cucumber plants grow until they reach the top of the plastic tunnels (2 - 2.5 m height). Linking of plants is usually done with string at the greenhouse constructions, while the "shpalir" system is rarely applied.

3. Harvest and yield production

The begining of the cucumber harvest varies depending on the region in which they are cultivated. In the region of Prizren, Suhareka, and Rahovec, some growers start

the first harvest from last week of April to early May. Although first harvest begins at this time, the harvesting capacity is small in this period[13]. The largest harvest capacity starts about a week to ten days later.

In other regions (Rrafshi i Kosovës), the first harvest begins later, usually from 10-15 May. The harvest in most greenhouses lasts until the end of July. At this time the cucumber plants are removed in most of greenhouses and the area is prepared for planting other crops. When the cucumber is cultivated as a cover crop, its harvest usually takes place in the last week of August and continues until the plants are not damaged by low temperatures. Yield production efficiency depends on the greenhouse, hybrid, and cultivation conditions. There are only a few producers who record notes about the number of cucumbers harvested and efficient yield production (including other vegetables as well).

However, it can be calculated that most farmers achieve productivity (average) of 6-8 ton / 1000 m^2, of the hybrids with long fruits and 2.5 to 3.5 t / 1000 m^2, of short fruits hybrids (cornichon type).

Selling cucumbers produced in the spring differs from the common sale of other vegetables by producers (especially those of the region of Prizren), and also including the late production of cucumber. These types of vegetables are sold in the village where wholesale merchants buy products, which they resell at retail in the larger urban centres. Sometimes even the producers sell their products in urban markets.

4. Pests and diseases

Protection of cucumbers from pests and diseases is the basis of a successful production. Prevention is very important and optimal applications of preventive agro-technical measures (proper crop rotation, good aeration of greenhouses, etc.) are necessary. Such measures are applied a bit. In general, the cucumber plants in protected environments are protected from diseases and pests without any previous defined programme.

Another problem related to prevention is non-professional nutrition of plants, which causes the plants to lack important nutrients. Farm workers often are not able to distinguish such symptoms from diseases. As a result, they often use unnecessary chemicals believing that the plants are diseased instead of fulfilling nutritional needs. Also, improper aeration of greenhouses due to their non-functional construction often creates conditions conducive to the introduction of diseases during the cucumber cultivation in protected locations.

During the seedling stage, the disease called *phytium spp, Fusarium spp* occurs. In other phases, until the end of vegetation period the main disease is blight (*Pseudopernospora cubensis*). It is less displayed even the ash. There are also putrefactions introduced besides of such ones.

The most frequent pests are aphids and in a lesser extent, they are the red spider and trips. Fighting lice is somehow easier, but spiders cause more damage. They are not seen in producing regions (at least at this stage of cultivation, while the report is being drafted). It is worth mentioning that spiders were seen in three greenhouses in proximity to each other in the region of Vushtrria last year.

The main solutions used by cucumber producers in Kosovo differ. Spraying with agrochemicals is more frequent in region of Prizren - Rahovec - Suhareka (where there is the highest concentration of cucumber production). They usually start applying insecticides for soil pests. The pesticides are used: Galation G5, Foksim G5, and Terbufos, in order to combat such pests.

[13] Producer, who could bring its products on market before other, is always mentioned in that region. For this reason start their competition and sometimes start to harvest before ripen and enough fruits for harvesting.

2-3 spraying times, mainly previcur and sometimes with ridomil, take place during the seedling stage. Spraying continues even more frequently after transplantation. Spectrums of chemical used are as follows: Previcur, Ridomil, Antrakoll wp, Aliete, Dithane M-45, Champion 50WP, Galben-C, Baylaton, and rarely other preparations.

Insecticides including Decis, Mospilan, Fastak, Confidor, etc are used for combating insects. The chemical preparations are used on the basis of farmers' individual judgement. In general, farmers receive advice from agricultural pharmacies regarding the principle information about chemical preparations (including terms of use, and doses). To a great extent they do not carry out expiration dates (some of them even do not understand enough the importance of it). It is quite common for most of these producers that the above mentioned Fungicide should be used for each 5-7 days.

Even though farmers sometimes are reluctant to accept it, there are cases that the use of such preparations is more frequent[14].

This situation is a consequence of a lack of control of the quality of these products (especially left-over pesticides) and lack of farmers' knowledge about the problems of protection from pests and diseases and proper use of agrochemicals.

5. Opinions and Trends the most common practices

In general, cucumber cultivation techniques in greenhouses tend to advance; however, there are some problems that effect productivity, which are as follows:

- microclimatic conditions in the greenhouses (plastic tunnels) are not favourable (especially in terms of relative air humidity and temperatures,
- irregular nutrition of plants (there is no preliminary soil testing, the dose of fertilizer is applied based on farmers' individual judgement,
- Paring and non-adjusting,
- Disrespect of crop rotation,
- Improper attention to water quality, irrigation doses,
- **The main problem is the improper protection from diseases** and pests, especially extremely non-professional use of pesticides,
- There is no good production planning in order to be consistent to the specific requirements of the market.

All these results are as a consequence of lack of farmers' knowledge, but also a result of lack of financial[15] resources in order to improve their greenhouses.

6. Improved practices and why and when adopted

There are improvements as mentioned before. First of all:

- The assortment of used hybrids is relatively rich and may not be considered as a problem,
- Use of peat compost (suitable) for the seedling production is increasing ,
- While only 3 to 4 years ago, the use of the drip irrigation system was very rare, now almost all commercial producers of indoor cucumbers in greenhouses use this irrigation system,
- Use of soluble fertilizers although by a small percentages, however, such a trend is going to increase.

Farmers are generally concerned with promoting the new products continuously, because they are interested in it. Some producers have had a major impact on the promotion of these new techniques through their facilities (more advanced

[14] Data are gathered from agronomist working in those regions.
[15] Lack of financial resources is one of the biggest problems for farmers. Interest rates are very high (11-14%) also farmers do not get any other supports from institutions.

greenhouses), and they have basic knowledge in the field of such productivity. It is also affected by various projects which operate in these regions.
The improvement of all care actions is very important in order to increase the productivity and the early production of cucumbers. It is important to avoid:

- Non – qualitative preparation of seedlings,
- Improper use of fertilizers and,
- Non-professional use of pesticides.

It is necessary to provide farmers with information about such issues. On the other hand, ignorance about greenhouse microclimatic conditions is a consequence of the inability of farmers to improve the quality of these greenhouses.

The issue with crop rotation is different. In general, farmers are aware of the shortcomings of the lack of crop rotation. Regarding the fact that the cucumber crop provides much more income, growers are somehow "forced" to cultivate plants year after year. The lack of knowledge in these aspects of cucumber cultivation is a result of the lack of promotion of these cultivation methods. Farmers are not informed enough, so they have the impression that each new method of production is very expensive. As a result they are reluctant to accept new methods of cultivation.

7. New techniques to be adopted over the next five years (ie .expected trends)

The application of good agricultural practices to cucumber production means the proper application of modern agro-technique actions in the production of this plant. Proper application of these actions, without any doubt, would be the best way to increase the productivity of this crop. It is significant that farmers, in general, understand the importance of the proper application of these techniques.

Improvement of microclimatic conditions in the greenhouses, and the possibility to control them, will be farmers' targets.

Despite the use of several actions that might be considered well enough for the production of cucumber seedlings, it can not be assumed that it is in such a stage to ensure successful cucumber production.

Production quality of seedlings means the preparation of seedlings in modules, using suitable peat compost for certain types of vegetables. Other measures (temperature, light, humidity, and nutrition) should be in accordance with the seedling requirements.

Proper land preparation is an important precondition to successful cucumber production. Land should be prepared in such a manner as to create optimal water-air regime.
Much attention should be paid to **crop rotation**. Cultivation in the same area for several years increases the risk of the diseases, pests, and affects the partial use of nutrients.

The use of plastic mulch

Surface coverage between the flowerbed lines has serious advantages. Effects of application of this method are:

- Risk elimination of the bad herbs growing
- Humidity conservation (reducing need for water and the plants' rational water use), and
- Fall of temperature change in the soil.

In case there is a danger of high temperatures, it is preferred that the folio on the upper side be white in colour, while the bottom side be black.

Cucumber requirements for **nutrient** doses and the intensity of assimilation are determined experimentally for each individual case. Cucumber plants grow well in a

certain level, specific to each stage of growth and progress. Good application of nutrients doses is essential to achieving good quality production. Cucumbers require a considerable amount of the macro and micro elements.

Regarding good agricultural practices, a regular action is plant nutrition through the use of fertilizers with high dissolubility. These fertilizers are distributed through drip irrigation systems enabling plant nutrition in accordance to their needs, depending on plant stage and progress.

However, this method requires better knowledge regarding the plants physiology and soil characteristics. It is very important to make the distinction between disorders caused by pathogens and disorders caused by a shortage or excess of certain plant nutrients.

What is the interviewees understanding of, and interest in, the hazards posed by indiscriminate pesticide use?

It is important that farmers understand that good cucumber protection from diseases and pests is the basis for a successful production. Preventive protection is very important which means the optimal application of agro-technical preventive actions (proper crop rotation, proper soil preparation, and coverage). Unfortunately from the data collected in the field, it is noted that farmers pay little attention to preventive protective actions. The issue of the use of pesticides for cucumbers in protected facilities for farmers is very obvious.

No doubt the use of pesticides on cucumber plants is much larger than on other vegetable plants. Farmers almost never pay attention to pesticide expiration dates (with a few exceptions such as the visited farmer in Shipol, Mitrovica and the one in Godanc, Shtime).

The non-professional and uncontrolled use of pesticides is dangerous, not only for customer's health but as well as for the farmers themselves who apply these pesticides. Almost no farmer uses any protective tools while using these pesticides. Pesticides often are kept in places which endanger human and animal health[16]. Also during the sprinkler cleaning many mistakes are made risking the environment.

The main issue is that farmers believe that without such a use of pesticides, it is impossible to protect cucumbers from diseases and pests. Therefore, any plan to improve this situation requires a very deep and patient intervention in order to achieve results. Also the visited farmers had no information about applied integral protection for cucumbers.

It is important that, through various forms (field visits, training, various publications, etc), farmers understand that the integrated pest management of plants is the basis for healthy production. That is based on the timely and proper application of all the agro technical actions, with the proper choice of cultivation, and with a minimum use of chemical medicines.

This activity should be a concern not only for the different projects or organizations, but also to all other relevant institutions (especially MAFRD). Of course, we are talking about cucumbers (where there is an excessive use of pesticides), but attention should also be paid to the other vegetable plants (especially those cultivated in the greenhouses) where the situation is not much better.

[16] There are only a few farmers who have special places to keep the pesticides. They are kept in places like (inside the greenhouse, other farm premises etc) which easily can be reached by people (especially children) and animals.

8. Recommendations

Generally cucumber cultivation techniques in protected locations have a tendency to be advanced. However, there are many problems with this production, and should be the focus of finding a solution:

- Capacity building of farmers so that they are able to implement and practice modern techniques of cucumber cultivation in protected locations. For this purpose, a greater technical support is needed (various professional publications and new demonstration techniques in cucumber cultivation).
- The assortment of hybrids is relatively rich and it can not be considered an issue.
- Farmers should better understand the importance of improving the microclimatic conditions in greenhouses (plastic tunnels), especially in terms of relative humidity and temperature.
- Nutrition of plants should be based on preliminary soil tests as well as the stage of growth and progress of the plants.
- It is very important for farmers to know how to distinguish between disorders caused by pathogens and disorders caused by a shortage or excess of certain nutrients for plants.
- It is very important that farmers understand that the good cucumber protection from diseases and pests is the basis for successful production. Preventive protection is very important, which means optimal preventive application of agro - technical actions (proper crop rotation, proper soil preparation, regular paring, and coverage).
- The main problem is the improper protection from diseases and pests, and especially the extreme, non-professional use of pesticides. The solution to this problem (or at least the beginning of a solution) is urgently required.
- Farmers believe that without the use of pesticides, cucumber protection from diseases and pests is impossible. Therefore, bear in mind the fact that any plan to improve this situation requires a very deep and patient intervention in order to achieve results
- It is important that through various forms (field visits, trainings, various publications, etc) farmers understand that the integrated production of plants is essential for a healthy production. That is based on timely and proper applications of all the agro technical actions, with the proper choice of cultivation, and with a minimum use of chemical preparations.