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NEW TRENDS IN AGRICULTURE - CROP SYSTEMS WITHOUT SOIL

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Abstract

The paper studied new system of agriculture - crop systems without soil. The culture systems without soil can be called also the hydroponic systems and now in Romania are not used only sporadically. In other countries (USA, Japan, the Netherlands, France, UK, Denmark, Israel, Australia, etc..) they represent the modern crop technology, widely applied to vegetables, fruits, fodder, medicinal plants and flowers by the experts in this area. In the world, today there are millions of hectares hydroponics, most of the vegetables, herbs, fruits of hypermarkets are coming from the culture systems without soil. The process consists of growing plants in nutrient solutions (not in the ground), resorting to an complex equipment, depending on the specifics of each crop, so that the system can be applied only in the large farms, in the greenhouses, and not in the individual households. These types of culture systems have a number of advantages and disadvantages also. Even if today's culture systems without soil seem to be the most modern and surprising technology applied in plant growth, the principle is very old. Based on him were built The Suspended Gardens of the Semiramis from Babylon, in the seventh century BC, thanks to him, the population from the Peru"s highlands cultivates vegetables on surfaces covered with water or mud. The peasant households in China, even today use the millenary techniques of the crops on gravel. .This hydroponic agriculture system is a way of followed for Romanian agriculture too, despite its high cost, because it is very productive, ecological, can cover, by products, all market demands and it answer, increasingly, constraints of urban life. The concept of hydroponics agriculture is known and appreciated in Romania also, but more at the theory level.

Key words: *agriculture, culture, hydroponics, soil*

INTRODUCTION

During this period, the world population is forced to find solutions to one of its biggest problems, namely nutrition. Providing the needed feeding for a population of over 6 billion people represents a priority with wide implications of economic, social and cultural nature.

Biological material has an important role in achieving crop production. There were created varieties and hybrids with yield potential increasingly high and more closely correlated with this, there were developed and promoted appropriate crop technologies.

MATERIALS AND METHODS

Given that culture hydroponic plant systems, is a relatively new field of research in our country material is used in making the papers is quite low. Most of the information and knowledge on these plant culture systems we have obtained and acquired in the course of activity in agriculture in Spain, the country where the plant culture systems are known only to us. Working methods used for this research is the analysis and observation.

RESULTS AND DISCUSSIONS

High growth rate of world population requires of a more efficient exploitation of existing opportunities, identifying and promoting new solutions which are more efficient to increase crop production.

This requirement of the tendency to achieve the highest possible productions per unit area as conventional soil culture systems are limited in terms of production. However, these new systems require as well to solve technical and economic issues, in order to deal with competition increasingly fierce. The most commonly used conventional culture systems worldwide are: the mineral wool based culture system and wool crop system and nutrient film based culture system.

Extending these culture systems have some drawbacks such as: the wool culture based system involves enormous quantities of this material, which is subsequently back into circulation with high difficulty, and the system.

The nutrient film culture based system implies rearranging the production spaces by installing gutters, this process being highly expensive financially [1].

Given the issues mentioned above, there is necessary to develop some technologies that are not expensive, that can be done with inexpensive and handy materials, but at the same time to ensure a high productivity both quantitatively and qualitatively.

In the view of meeting the desiderata presented and adapting them to the economic potential of farmers which are part of an underdeveloped economy, there is an increasingly requiest for the application of the crop on organic substrates. This culture system has two main advantages: it is very accessible from economically point of view and it suits the global trend, which is toward to a more organic culture[3].

The procedure used in hydroponic cultures consists of growing plants in nutrient solutions (and not in the ground), resorting to a complex devices that automatically adjusts nutrient concentration and distribution of liquid nutrients, depending on the specifics of each crop, and this is the reason for which the system can not be applied but in large farms, in greenhouses, and not in individual households.

Fig. 1. Hydroponic plant culture system

Hydroponics is the art of growing plants directly in water. The term comes from the Greek words "hidros" which means water, and "ponos", meaning work. This concept has been rediscovered in the 30's of last century, within the University Berkeley of California, by Dr. Gericke; we mention "rediscovered" because, in reality, this method of cultivation has existed since the earliest times [4].

Fig. 2 Culture of lettuce in hydroponic system

Hydroponic culture systems involve building a plant rooting medium other than soil, which can be mineral wool (very used lately), gravel, sand, quartz, perlite (a sponge material, made from volcanic rock) expanded clay, polyurethane, etc. The used materials for supporting substrates, whether natural, whether industrially produced, should allow the roots to breathe, to have the ability to retain the solution (but provide a good drainage too), not to interact with the various components of nutrient substances. The materials are wetted at regular intervals with nutritional solution which must contain, in certain proportions, all elements (minerals and trace elements) which the plant normally extract them from the soil: calcium, magnesium, sodium, potassium, iron, etc. The water containing nutrients is spread by an ultrasound device, with ceramic membrane and having the ability to vibrate at a certain frequency (1.65 MHz), which means more than 1.5 million vibrations per second. When water passes over this membrane, it is sprayed so soft that resembles a kind of fog, fueling plant roots in a favorable growth rate. This fog is permanently ventilated, stimulating its uptake by the plant that is growing more

quickly under these conditions. Those who practice this type of hydroponic cultures have developed solutions recipes depending on species (for tomatoes, cucumbers, carrots, mushrooms, etc.) of a certain phase of vegetation and in accordance with the ambient temperature and humidity, which are held under automated control.

That between the volume of water in the basin, the density of fish per m3 of water, the amount of food taken daily, the amount of manure produced by the fish and the size of hydroponic cultivation can provide effluent treatment there is a strong correlation, we decided to classify different systems known currently on volume criterion for fish breeding ponds so:

- small capacity systems with a smaller volume of 3000 l;
- medium capacity systems with volume ranges from 3,000 to 10,000 l l;
- high capacity systems, or commercial, whose volume exceeds 10,000 l.

This classification refers to a single module system, and by installing a larger number of modules can increase system capacity thus created directly proportional.

Small capacity systems: These systems can be used as a hobby or for subsistence. In general hydroponics is performed on solid substrate (gravel, granite ede clay, etc..) Construction is simple and the investment cost varies between 100 and 500 EUR.

Medium capacity systems: they were designed to produce a quantity of fish and plants to ensure family consumption in a rural household and a small surplus for marketing.

High capacity systems: These systems were designed to produce greater quantities of fish and plants than systems above so that it becomes a source of income for those who implement them. The system that opened the series this category and has been replicated in different versions worldwide, was conducted by Professor James Rakocy the University of the Virgin Islands (UVI) in the Virgin Islands, USA. With this system were carried out, for years, the average production of 4.5 tons of fish (Tilapia species) and 70 tons of vegetable products (lettuce, basil, okra, tomatoes, cucumbers, melons, flowers, etc.), which produced revenues of approx. 100.000 USD / year from the sale of plant and about. 35.000 USD / year from selling fish.

One embodiment of soil- free culture systems is aeroponic, it consists in the introduction of plant roots inside some plastic tubes, in which nutrient solution is sprayed. There can be grown plants based on nutrient film as well, more exactlly in containers placed in some conduits at the base of which the solution circulates in the form of very fine pellicles. Also, for accelerating the ripening process of vegetables and fruits, "ultraponie" is increasingly used, being a process based on the follow-up of cyclical variations of some plants biological functions within a period of 24 hours, in order to stimulate them through various processes.

The advantages of hydroponic culture systems

Higher productivity compared to traditional systems. Superior quality of agricultural products obtained. The yields are not dependent on weather conditions, neighter on natural light, due to the fact that the adequate artificial light can replace the former one. There are not used chemical fertilizers nor pesticides. It provides rapid growth of the plants (plants grow twice as fast in hydroponic culture than in soil). There are obtained more harvests per year. There are made substantial savings in water consumption (90% less water than crops with soil) and some performing systems even allow used water recycling. It eliminates the phenomenon of "fatigue" of the soil, the same culture can be repeated on the same carrier, more than once per year (for example, about 20 salad crops can be obtained per year). Maximum hygiene conditions. The specific facilities of these hydroponic culture systems do not pollute [7].

The disadvantages of hydroponic culture systems

The high costs of electricity improvements. Depreciation is done during a long time. Using of some large amounts of plastic materials for substrate, which usually are not recyclable. Plants are very sensitive to

temperature variations, Auto Adjustment is no longer interfering as when roots grow in the soil, which requires sophisticated systems of ventilation and temperature control. Even though today, hydroponic culture systems seem to be the most modern and surprising technology applied in plants growth, the principle is as old as mankind. Based on its principle, Hanging Gardens of Babylon were raised in the seventh century BC, due to it, the population of the highlands of Peru is cultivating its vegetables on surfaces covered with water or mud. Peasant households from China, even today are using the millenary techniques of gravel cultures [7].

Antipodal, in the early third millennium, keeping the ancient idea for thousands of years of soil -free cultures, a hypostasis of the Hanging Gardens of Babylon could represent the "vertical farms," the boldest idea of contemporary agriculture, a concept launched in 1999, in the United States. With a large horizontal area saving, there farms located in or near cities, turning to bunk hydroponic culture systems could be the answer to the increased needs of food in the world, and would bring an additional quality[8].

CONCLUSIONS

Hydroponic farming is a way to follow as well by business in Romanian agriculture, despite its high cost, because it is very productive, can cover, by its products, all market requirements and increasingly meets the constraints of urban life. Hydroponics farming concept is known and appreciated in our country likewise, but at a theoretical level.

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