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## INNOVATIVE METHOD AGRICULTURAL DEVELOPMENT OF UKRAINE

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**Introduction.** There is a huge number of ways of cultivation of agricultural production in the world which are applied in our country everywhere. It both hothouse farms, soil cultivation, use of mineral bulk soil, aeroponik and many other things. However, the most developed and innovative method, by right, there is a hydroponics.

Nowadays the humanity is facing the issue of growing organic food in a short period and with the least expenditure of time and money.

That is why many scientists around the world attended the hydroponic method, which has a significant advantage over conventional methods of growing agricultural food crops.

The word "hydroponics" comes from the Greek words "water" and "work" and means a way of cultivation when the rootage of the plant may be grown not in the ground, but in the humid-air (water, well-aerated; hard, but humid- and air absorbency and quite porous) environment, well riched in mineral nutrients, due to special solutions [5]. The growing environment, which is used by hydroponics, assists the rootage in well oxygenation and gives an opportunity to supply the plants with required quantity of nutrients, that promotes their rapid and productive growth [6].

**The relevance** of the topic is that non-traditional methods of farming and production to compensate for the lack of fertile land and the risks associated with production in the agricultural sector. In addition, this eliminates the influence of external factors: depending on export, prices for agricultural products on the world market, etc., which is directly related to food security of the country. The use of hydroponics opens the possibility of more widespread use of automation, reducing labor costs for fertilization, watering, fertilizing, adding soil, disinfection, and helps to obtain earlier yields. It becomes possible to grow vegetables in areas with poisoned and ruined soil.

**Task.** The aim of this work is to show the advantages of the method of hydroponics before soil method of cultivation and study of its influence on the development of agriculture and agronomy.

**The basic material and results.** Significantly improves the agricultural efficiency of the agricultural sector:

1. Decreases the size of cultivated areas, and allows the cultivation of plants in regions of little or absolutely not suitable for the application of soil method.

2. Reduces production time and allows year-round production, which assists not only in one, but several harvests per year.

3. Improves product quality and improving productivity.

4. Increases the shelf life and getting high transportability of the products.

There are seven main types of hydroponic systems for growing plants:

1. The Drip System (reverse and nonreverse).

2. The Deep water Culture (DWC).

3. The Nutrient Film Technique (NFT).

4. The Ebb and Flow sub-irrigation (EBB).

5. The Wick Hydroponic.

6. Aeroponic.

7. The System of Floating Platforms.

The method of having the largest circulation in the world, and which is the best, there is a method using nutrient layer, which is based on the preparation of layers of nutrient solutions. The nutrient solution is prepared by diluting in water chemical salts containing nitrogen, phosphorus, potassium, magnesium, calcium, sulfur, manganese, boron, copper, zinc and other necessary for the

development of minerals. The solution should have all the elements in proportions not exceeding the rate of consumption of their plants, otherwise at a concentration that exceeds the optimal level, the plants may die [4].

Today the hydroponics is poorly widespread on Ukraine and it is generally applied only in hothouse farms while hydroponic cultivation of various cultures become more and more popular in the world.

Considering the advantages of this method include the following. Depending on the capacity and equipment for hydroponic, some water should be added from once in three days to once a month. Watch each day for watering is not necessary [6]. When hydroponic growing, the problems of deficiency or overdose of fertilizers does not occur. The plants take all necessary nutrients in the right quantity from the hydroponic solution.

Since the plant receives only necessary elements they do not accumulate any harmful and adversely affecting the human body elements, contained in the soil (high-density metal, toxic organic compounds, radionuclides, excess nitrates, etc.), which is very important for fruit plants. When soil cultivation, the plants often suffer from dryness and lack of the oxygen, in the case of wetlands, which is impossible for hydroponics. The use of drip irrigation significantly reduces water consumption.

The process of transplantation of perennial plants is facilitated greatly - no need to free the roots from the old soil and inevitably injure them. There is no need to buy new soil for planting, which greatly reduces the process of growing indoor plants. Through hydroponics, you can avoid problems such as pests and various types of fungi and diseases that occur in plants, growing in the soil, the question of the use of pesticides is no longer by itself, as there is no need [2].

From the practical point of view, these plants are easier to care for, no dirty ground, no odors, no pests, which may wind up in the soil and then spread to the building.

Because at the moment there is a question about the depletion and pollution of land, so with the help of hydroponics we can raise the required products even in areas where there is fertile soil and the land is unsuitable for growing agricultural products. The usage of hydroponics for commercial cultivation of vegetables and greens is more efficiently than traditional methods of cultivation because it conserves resources and makes the process more stable and manageable [7].

For example, if we compare the average productivity of strawberries in the area of 1 000 m<sup>2</sup>, based on growing using a hydroponic method and conventional soil cultivation, we obtain the following result which is evidently shown in the Table 1.

**Table 1**

**Comparison of hydroponic cultivation methods and the conventional soil cultivation**

Type of cultivation	Performance (kg) from 1 m <sup>2</sup>	Price per kilogram (UAH)	Proceeds (UAH)
Open soil	7	40	280 000
Hydroponics	37	40	1 480 000

In other words, the yield from the same area increases by 5 times. However, reducing the human factor, requires a higher qualification of the remaining staff. In addition, hydroponics saves space, because for it need two times less space than in the planting fields, while allowing to grow almost all crops.

The rapid turnover of harvest promotes the increase of productivity, it gives the opportunity to extend the growing season until the time of the price increase for the products. Production in hydroponics is considered rare and in demand.

In a hot climate, the availability of water to the roots better, it reduces water stress of plants, gives higher yields and long life to plants [1]. Plants that are susceptible to soil-borne diseases, give high yields, without loss consequently hydroponics is also ideal growing decision for the hot, dry countries, as water saving you can get a large number of crops at times. Hydroponics also shows excellent results in the presence of supplementary lighting system of the greenhouse it gives the opportunity to collect not one but several harvests per year.

Many plants (lettuce and strawberries), can be easily raised from ground level to a height more comfortable for planting, cultivation and harvesting. This promotes better working conditions and lower costs for manual collection [7].

A very important factor is the reduction and possibly the complete absence of weeds.

For this method Almost every plants, had been grown from seed or cuttings, are suitable. In the case of transplanting adult plants in favour plants with coarse, thick roots that are easy to clean from the earth. It is not recommended to use the hydroponics adult plants with delicate root system.

Hydroponics has been recognized as a practical and affordable method for commercial and home cultivation of plant foodstuffs. Currently, more than 70% of all greens and ornamental flowers sold in the world are grown by the methods of hydroponics. In addition, hydroponics is actively used in areas where traditional farming is impossible (Arctic or arid areas of the planet). From an environmental point of view, hydroponics can help to conserve water resources.

The introduction of hydroponic growing technologies will allow farmers to increase productivity and product quality to a higher level. This means only one thing - local vegetables will become more and agricultural business will become a profitable production.

One of the downsides of growing plants using this method is the high cost of equipment. However, the positive side and that will justify this minus is that the initial costs will be repaid with interest because the plant will begin to grow several times faster and take care of it will be much easier [3].

For clarity, the payback of this project, let's use an example. Based on the calculations follow the payback period of the greenhouse and the beginning of its work "for plus", that is for profit.

**Table 2**

**Commercial suggestion for a hothouse complex construction with the area of 1000 m<sup>2</sup>**

Options for the construction	Automation	Cost for 1 m <sup>2</sup>	Total price
Variant 1	partial automation of production and microclimate	135-140 EUR (with the currency rate of 25 UAN for 1 EUR)	3 500 000 UAN
Variant 2	minimal automation, mostly hand-work	90-110 EUR (25 UAN for 1 EUR)	2 750 000 UAN

\*The prices are given for a hothouse complex being built from the ground up.

**Expenses of production:**

Expenditure items	The number of tariff costs (per year)	Price costs (per year)
Electricity	246 632 kilowatt-hour	1 973 056 UAN
Gas	32 871 m <sup>3</sup>	65 742 UAN
Staff	–	227 000 UAN
Production expenses	–	540 000 UAN

**\*\*Payroll staff (with the average record of working of about 5 years) [8]:**

Position	The number of workers	Monthly salary	The sum of per year (for everyone)
Person on duty	3	1 500 UAN	54 000 UAN
Hothouse workers	4	2 100 UAN	100 800 UAN
Accountant	1	3 500 UAN	42 200 UAN
Driver	1	2 500 UAN	30 000 UAN
In total	9	9 600 UAN	227 000 UAN

Based on these calculations we can conclude that the largest item of expenditure is the very construction of the greenhouse complex. Now consider its performance, and return on the example of the cultivation of "Iceberg" lettuce:

The period of growth	Productiveness (amount)	Original weight	Price	In total (per year)
All year (with an interval of 5-6 days)	Minimum 1200 pieces (from one crop)	300-400 gram	20 UAN	1 752 000 UAN

***The approximate recoument of this project is 2 -2.5 years, maximum 3 years.***

In the year 600 B.C. the written mention of hydroponics was recorded. The famous hanging gardens of Semiramis in Babylon was the first historical fact of usage a large irrigation system, had been built into the building [3].

**A review of recent research and publications of sources.** Today, hydroponics is widely used all over the world, especially in those countries. It is also used there (including the USA), where soils have been so poisoned by fertilizers and steel toxic, that growing on them becomes impossible. In British Columbia (Canada) 90 % of all greenhouse industry is hydroponic now.

There will be a practical conference named "agro-Business 2015 - gardening and greenhouse business" in Israel in February 2015, dedicated to the issues of rational use of the latest developments of the Israeli companies in the field of greenhouse cultivation of vegetables, which is based on hydroponics.

In India it is planned the construction of eco-skyscraper, able to provide for all residents of the city with food, energy and water. In this building the technologies of "passive house" are used, reducing the impact of a skyscraper on the environment: hydroponics for growing agricultural plants, solar panels and wind turbines for electricity generation and advanced wastewater treatment system to ensure residents and watering plants with clean water.

The possibility of providing clean water, food and electricity to the residents of Noida in India with the help of eco-skyscraper was designed by architect Vikas Pavar.

Architect Charlie Baker is the author of the project of high - rise farm in Manchester. The idea was suggested to the organizers of the International festival " Manchester 2013", by Dikson Despommier, the Professor of the University of Columbia.

The vertical farm is the first created in the UK. In multi-storey greenhouse will become one of the abandoned office buildings in the center of Manchester. In this unusual agricultural office the most modern hydroponic and aquaphone technologies will work. The organizers of the festival hope to grow enough lettuce, peppers, cucumbers and tomatoes, to provide guests of the festival with these vegetables.

Baker believes that the use of anyone more unnecessary building in the city center is much more practical than building a vertical specifically. From his point of view, the chosen building is not suitable for food production, but if you manage to grow a multi-storey garden in Manchester, it will be good everywhere. From the success of the first project vertical farm depends largely on future directions in the UK and other countries.

**Conclusions.** Practical application of this method is the replacement of the soil solution in the first place is that the cultivation of plants in a short time and a rich harvest will allow individual cities or even countries that do not have soil suitable for vegetable, grow valuable crops in the right quantity. Also hydroponics is a great way to reduce costs and time to care for the plants and makes it possible to reduce the growing period, while not only maintaining, but increasing the quality of manufactured products, both at home and in industry. Products produced when using this method has great retention and is highly transportable quantities.

The high quality of products grown using this method, stems from the fact that the plant spends a minimum of forces in the search for nutrients, and can use their resources for the development of above-ground (of the fruit) part. Also, increased productivity, less sick plant and longer fructifies that have a definite plus for a cost-benefit analysis method of hydroponic cultivation of plants.

Today there is the prospect of further studying of this method, improvement and implementation of its wide use in industry and in everyday life, as a constant population growth of cities and countries meet the increasing needs primarily in fresh food.

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**Moltusov Valeriy Alekseevich**, Candidate of Historical Sciences, Senior lecturer in Economic Theory and Regional Economics. **Batyuta Maria Yurievna**, a student. Poltava National Yuri Kondratyuk Technical University. **Innovative method agricultural development of Ukraine**. In work are given the characteristic and justification of an innovative method of cultivation of agricultural production – hydroponics. This technique is poorly extended to territories of Ukraine though, in recent years, it gained popularity in the leading countries of the world. Its application gives the chance to grow up quality plants with high transportable abilities, despite of a season, existence of the areas of lands and a large number of the personnel. The hydroponics has the future and has to find application in our country as the progressive method which is widely used in world practice.

**Keywords:** agriculture, innovations, hydroponics, efficiency, "the protected soil", automatic equipment.

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**Молтусов Валерий Алексеевич**, кандидат исторических наук, старший преподаватель кафедры экономической теории и региональной экономики. **Батюта Мария Юрьевна**, студентка. Полтавский национальный технический университет имени Юрия Кондратюка. **Инновационный метод развития аграрного сектора Украины**. Предоставлен инновационный, прогрессивный метод выращивания сельскохозяйственной продукции – гидропоника. Он не достаточно распространен на территории Украины, однако, в последние годы, приобрел популярность в ведущих странах мира. Его использование дает возможность выращивать растения высокого качества и с высокими транспортабельными возможностями, невзирая на сезон, наличие большого плодородного земельного участка и огромного количества персонала. Гидропоника есть наиболее прогрессивным методом, который используется в мировой практике и который в ближайшее время найдет свое применение на территории нашего государства.

**Ключевые слова:** гидропоника, капельный полив, «защищенный грунт», автоматика, питательный раствор.

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**Молтусов Валерий Олексійович**, кандидат історичних наук, старший викладач кафедри економічної теорії і регіональної економіки. **Батюта Марія Юрїївна**, студентка. Полтавський національний технічний університет імені Юрія Кондратюка. **Інноваційний метод розвитку аграрного сектора України**. Наведено інноваційний, прогресивний метод вирощування сільськогосподарської продукції – гідропоніка. Він не досить поширений на території України, однак, останнім часом набув популярності в провідних країнах світу. Його використання дає можливість вирощувати рослини високої якості та з високими транспортабельними можливостями, незважаючи на сезон, наявність значної ділянки родючої землі і величезної кількості персоналу. Гідропоніка є найбільш прогресивним методом, який використовується у світовій практиці та який найближчим часом знайде своє застосування на території нашої держави.

**Ключові слова:** гідропоніка, крапельний полив, «захищений ґрунт», автоматика, живильний розчин.