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PHYSIOLOGICAL CHARACTERISTICS OF PLANTS CULTIVATED IN HYDROPONIC CONDITIONS AND CULTIVATION TECHNOLOGY

Abstract

The article describes the physiological properties of plants grown in hydroponics and the effect of this method on their productivity. Currently, growing plants using the hydroponic method is a very important issue..Hydroponics are not limited to indoor farming. As mentioned previously, it is usually better to grow in more soil than it is to build hydroponics. But if soil is limited, and temperature permits - namely in a desert - then hydroponics can be viable as a farming tool. When grown hydroponically, the plant is fed by roots in moist air, highly aerated water, or a solid but porous, moist and air-entrained medium, rather than in soil, which promotes root respiration and requires relatively little nutrition. frequent (or constant drip) watering of workers. A solution of mineral salts prepared according to the needs of this plant. As a substitute, gravel, gravel, as well as some porous materials - expanded clay, vermiculite, etc. can be used. n static solution culture, plants are grown in containers of nutrient solution, such as glass Mason jars (typically, in-home applications), pots, buckets, tubs, or tanks. The solution is usually gently aerated but may be un-aerated.. If un-aerated, the solution level is kept low enough that enough roots are above the solution so they get adequate oxygen. A hole is cut (or drilled) in the top of the reservoir for each plant; if it is a jar or tub, it may be its lid, but otherwise, cardboard, foil, paper, wood or metal may be put on top. A single reservoir can be dedicated to a single plant, or to various plants. Reservoir size can be increased as plant size increases. A home-made system can be constructed from food containers or glass canning jars with aeration provided by an aquarium pump, aquarium airline tubing, aquarium valves or even a biofilm of green algae on the glass, through photosynthesis. Clear containers can also be covered with aluminium foil, butcher paper, black plastic, or other material to eliminate the effects of negative phototropism. The nutrient solution is changed either on a schedule, such as once per week, or when the concentration drops below a certain level as determined with an electrical conductivity meter. Whenever the solution is depleted below a certain level, either water or fresh nutrient solution is added. A Mariotte's bottle, or a float valve, can be used to automatically maintain the solution level. In raft solution culture, plants are placed in a sheet of buoyant plastic that is floated on the surface of the nutrient solution. That way, the solution level never drops below the roots The nutrient solution is changed either on a schedule, such as once per week, or when the concentration drops below a certain level as determined with an electrical conductivity meter. Whenever the solution is depleted below a certain level, either water or fresh nutrient solution is added. A Mariotte's bottle, or a float valve, can be used to automatically maintain the solution level. In raft solution culture, plants are placed in a sheet of buoyant plastic that is floated on the surface of the nutrient solution. That way, the solution level never drops below the roots.

Keywords: *hydroponics, nutrient medium, plant physiology, cultivation, technology, aeroponika sistemi, drain, hydroponics system*

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Hidroponika şəraitində becərilən bitkilərin fizioloji xüsusiyyətləri və becərilmə texnologiyası

Xülasə

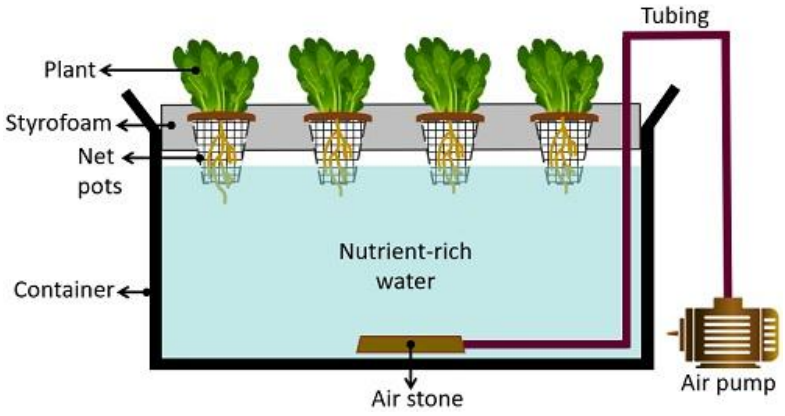
Məqalədə hidroponika şəraitində yetişdirilən bitkilərin fizioloji xassələri və onların məhsuldarlığına bu üsulun təsiri haqqında verilmişdir. Hal-hazırda hidroponika üsulu ilə bitki becərilməsi çox aktual məsələdir. Hidroponik üsulla yetişdirildikdə bitki köklərlə torpaqda deyil, nəmli havada, yüksək aerasiyalı suda və ya bərk, lakin məsaməli, nəm və hava tutumlu mühitdə qidalanır ki, bu da köklərin tənəffüsünü təşviq edir və nisbətən qidalanma tələb edir. işçilərin tez-tez (və ya daim damcı) suvarması. Bu bitkinin tələbatına uyğun hazırlanmış mineral duzların məhlulu. Əvəzedici kimi çınqıl, çınqıl, həmçinin bəzi məsaməli materiallar - genişlənmiş gil, vermikulit və s. istifadə edilə bilər. Statik məhlul tətbiqi ilə bitkilər şüşə Mason (adətən, evdə tətbiqlər), qablar, vedrələr, çəlləklər və ya çənlər kimi qida məhlulu olan qablarda yetişdirilir. Məhlul adətən yumşaq şəkildə havalandırılır. Əgər havalandırılmırsa, məhlulun səviyyəsi kifayət qədər aşağı səviyyədə saxlanılır ki, lazımi qədər köklər məhlulun üstündə olsun ki, onlar adekvat oksigen əldə etsinlər. Hər bir bitki üçün anbarın yuxarı hissəsində bir çuxur kəsilir (və ya qazılır); banka və ya çəlləkdirsə, onun qapağı ola bilər, əks halda üstünə karton, folqa, kağız, taxta və ya metal qoyula bilər. Tək bir su anbarı tək bir bitkiyə və ya müxtəlif bitkilər üçün istifadə edilə bilər. Bitki ölçüsü artdıqca qabların ölçüsü artırıla bilər. Evdə hazırlanmış sistem, fotosintez vasitəsilə akvarium nasosu, akvarium hava borusu, akvarium klapanları və ya hətta şüşə üzərində yaşıl yosunların biofilmi ilə təmin edilən aerasiya ilə qida qablarından və ya şüşə konserv bankalarından hazırlana bilər. Mənfi fototropizmin təsirini aradan qaldırmaq üçün şəffaf qablar da alüminium folqa, qara plastik və ya digər materiallarla örtülə bilər. Qida məhlulu həftədə bir dəfə və ya konsentrasiya elektrik keçiriciliyi ölçən cihazla müəyyən edilən müəyyən səviyyədən aşağı düşdükdə dəyişdirilir. Məhlul müəyyən səviyyədən aşağı düşdükdə ya su, ya da təzə qida məhlulu əlavə edilir. Şüşə və ya float valve, məhlul səviyyəsini avtomatik saxlamaq üçün istifadə edilə bilər. Bitkilər qida məhlulunun səthində üzən üzən plastik təbəqəyə yerləşdirilir. Beləliklə, onun səviyyəsi heç vaxt köklərin altına düşmür.

Açar sözlər: *hidroponika, qida mühüti, bitki fiziologiyası, becərilmə, texnologiya, aeroponika sistemi, drenaj, hidroponika sistemi*

Introduction

Hydroponics Hydro "water" + ponos work is a method of growing plants in artificial environments without soil. Plant food is obtained from the nutrient solution that surrounds the roots. Hydroponics allows you to adjust the conditions for the growth of plants - create a nutrition regime for the root system that fully satisfies the needs of plants for nutrients, the concentration of carbon dioxide in the air most favorable for photosynthesis, and also regulates the temperature of the air and root space, air humidity, intensity and duration of lighting. Creating optimal conditions for the growth and development of plants ensures a very high yield, better quality and in a shorter time (Aliyev, 1985). Cultivation of plants in this way requires less labor than soil culture, water and

nutrients are spent more economically. Feeding of nutrient solution is easily automated. In hydroponics, the fight against weeds is practically eliminated. When grown hydroponically, the root system of plants grows in non-nutritive solid substrates, water or humid air (aeroponics). An example of an organic substrate is coconut fiber: it is ground husk and coconut shell. Iron and magnesium salts are washed from it. In the natural environment, coconut fiber serves as the primary soil for the roots of a newborn palm tree ((Encyclopedic dictionary of a young chemist, 1982: 52).

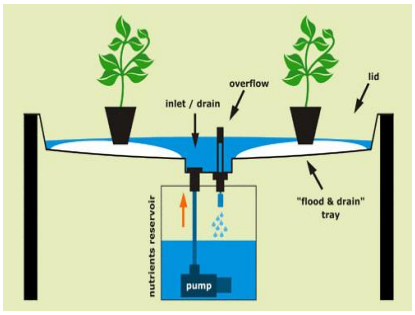


Coconut fiber is lighter than water, so it does not sink like soil during irrigation, but is filled with air. Each fiber contains a large number of pores and tubes in its thickness. Due to the force of surface tension, the tubes are filled with the working solution, but root hairs sprout nearby and drink the contents.

Figure. ***Growing plants in hydroponic conditions***

The smooth surface of the fiber allows the root to slide freely through the porous micropores next. Through a network of microtubules, coconut fiber distributes water and air throughout the volume. Coir fiber as a fully regenerated, environmentally friendly substrate is used in many Dutch

hydroponic farms to grow perennials such as roses. In the Netherlands, despite the climatic features, industrial hydroponics is widespread - light-loving plants are replaced by special HPS lamps and Grow Led (Aliyev).



Deep Sea Culture System ***Aeroponika sistemi*** ***drain, hydroponics system***

Soil depletion and pollution are not yet clear, but water shortages are already acutely felt in some regions, such as the UAE, Israel, and Kuwait. The problem of irrigation in these regions is acute. Currently, up to 80% of all vegetables, herbs, and fruits in Israel are grown by hydroponic method [source 4069 days not specified]. The US Army always has what it takes to set up hydroponic greenhouses for vegetables and herbs in the field. Hydroponics is an ideal solution for hot, dry countries because you can harvest a lot of crops in a year with significant water savings. In northern latitudes, greenhouse cultivation, hydroponics also show excellent results in the presence of artificial lighting.The development of hydroponics in Russia is associated with the so-called growing interest. "Small farms" where herbs, vegetables, flowers and berries can be grown in a small area. Drip irrigation systems are becoming increasingly popular. They allow you to create an irrigation system for both traditional soil cultivation and hydroponic devices such as drip irrigation in a short time and at a low cost. Advanced crop production technology - indoor cultivation of edible greens and vegetables is gaining momentum (Shahmuradova, Sardarova, 2023).

Basic hydroponic systems.There are several types of hydroponic systems. In general, they can be divided into two main groups: "Passive" and "Active". In "passive" systems, the nutrient solution is not subjected to any mechanical influence and is delivered to the roots due to capillary forces. Such systems are called wick systems (Gasimov, 2004: 550). All "Active" systems, in one way or another, require the circulation of the feed liquid, which is achieved using pumps. Most of them need a parallel aeration system (oxygenation of the nutrient solution). There are hundreds of modifications to hydroponic systems, but they are all variations (or combinations) of six basic types (Hydroponics Journal, 2010):

A powered hydroponics basin acts as a terrain with 280% soil fertility, twice that of rich soil. The exact speed boost depends on the Fertility Sensitivity of the plant in question. For example, rice gets the full 280% effect, while potatoes won't benefit nearly as much. Hydroponics basins are placed on the ground, and work both indoors and outdoors. In order to function, they require 70 watts of power, day and night. This is absolutely critical, as when unpowered, its plants will wither very quickly. They can't be uninstalled, only deconstructed for half their value as usual. Each basin has a cleanliness value of -3, making a large hydroponics farm a very "dirty" prospect. They do not short circuit in the rain. Hydroponics only provides soil fertility, so all other plant growth conditions must be met (Berezina, 1984: 360).

This isn't a problem in the growing season while outdoors, but in order to regulate temperature, you must grow indoors, under a mostly complete roof, and use buildings like a heater. The sun lamp is required to provide light in the absence of sunlight (due to the roof). Note that standing lamps

aren't suitable for crop growth: plants require at least 51% light, while standing lamps provide a maximum of 50% lighting and do not "stack". Colonists will automatically plant only 1 type of plant per basin (Akbarov, 2012). By default, this is rice. The following plants can be grown in hydroponics basins: Hydroponics are most useful if you have limited fertile grow space - whether your colony is inside a mountain, or in an extreme biome like a desert or ice sheet. If there's plenty of fertile soil, then hydroponics can be useful, but more limited in scope. In terms of yield, 1 tile of hydroponics is equivalent to 2.8 tiles of regular soil. Since soil is free, it is usually more cost effective to plant in more soil (when available) rather than build hydroponics. Once cost doesn't matter, hydroponics can be used in any biome to save space and therefore walking distance. See #Indoors for more analysis. Not all crops may grow in hydroponics. The following plants can't be grown in a hydroponics basin (Suleymanov, 2009):

Research methodology.

When making a "greenhouse", you must consider other plant needs. Sun lamps are required to grow crops in a roofed room. You need a mostly roofed room in order to control the temperature for heaters and possibly coolers. Sun lamps, consuming 2900 W of power for 13 hours, are very power demanding. You also need to power the hydroponics themselves. A sun lamp and 24 hydroponics set up would cost 4580W at day and 1680W at night. Given that sun lamps are on only 13.2 hours a day, this equates to an average of 1595w for a sunlamp and 3275w for a sun lamp + 24 basins (Gurbanov, 2009).

Figure. ***24 hydroponics basins inside a sun lamp***

For indoor farming, hydroponics should be compared to placing extra sun lamps and building generators. Hydroponics can be used to grow crops with a sun lamp, but a lamp can also be used to grow indoors without hydroponics. You can fit up to 24 basins per sun lamp, for a total of 280% growth for 1 sun lamp. Alternatively, you could place 2 more sun lamps, for a total of 300% growth (relative to 1 sun lamp) (11).

24 hydroponics basins would cost Steel 2400 Steel, Component 24 Components and 1680 W.2 extra sun lamps would cost Steel 80 Steel for the lamps, and Steel 400 Steel, Component 12 Components for 4 solar generators used to power the lamp. Outside of the planet's poles, these generators are enough to power 2 sun lamps with a battery or two (12).

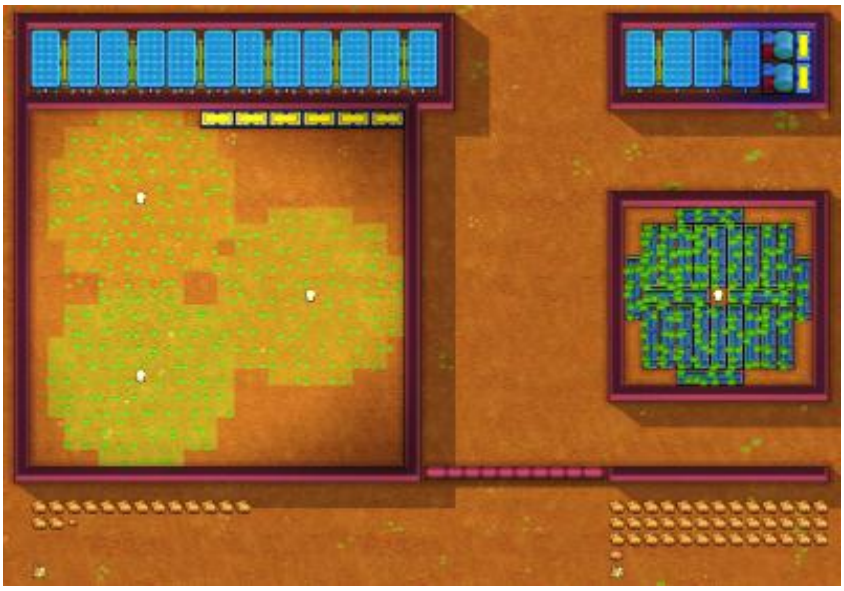


Figure. ***Full hydroponics setup vs 3 sun lamps, including power & resources. Resource cost includes generators and batteries shown***

Conclusion

As 3 sun lamps are much less expensive than 1 sun lamp with a full hydroponics set up, placing sun lamps will be the preferred option for many stages of the game. Even c In the late game, when steel and components are trivial to obtain, then hydroponics have a few key advantages over sun lamps. They take up less space, meaning they are easier to defend. As they take up less space, colonists will need to walk less, which increases efficiency. Because hydroponics isn't dirt, it can save on cleaning time. Finally, hydroponics are more stable - if a blight takes out the greenhouse, then only 1.98 days of growth is lost. Even when considering solar flares, rice in hydroponics grows so fast that it remains a consistent source of food.onsidering the cost of extra batteries and heaters, this is still cheaper (Fitilnaya sistema, 2017).

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