

Survey Paper on Aeroponics

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Abstract- Almost all plants need soil for their growth. Nutrients present in soil help in the development of plants. Aeroponics is the method of growing plants in a medium without the use of soil. Here the plants are provided with a nutrient solution which circulates in the medium that holds the plant. The nutrient solution contains macronutrients and micronutrients which contribute to the healthy growth of plant. The Aeroponics is based on the opportunity of cultivating fruits & vegetables whose roots are not implanted in a bedrock (the case with hydroponics) or soil, but in ampules in which practices for spraying plant nutrition is delimited. In these containers, in our case pipe, roots can find the best ailment concerning oxygenation and moisture. These circumstances allow for healthier plant nutrition assimilation in a more balanced way, with consequential faster growth of the cultured plants.

Keywords- Aeroponics, Hydroponics, Aquaponics, Aeroponics system, Aeroponics roots, Aeroponics growth.

I. INTRODUCTION

Aeroponics is the process of growing plants without using the substratum of soil. Aeroponics is a combination of two words 'aero' and 'ponic'. 'aero' meaning air and 'ponic' meaning labour/growth. Therefore, aeroponics in whole suggests growing of plants in air. The plant is suspended in air using aeroponic system i.e. the roots are open and are in direct contact of air. Aeroponics culture varies from both the conformist hydroponics and aquaponics. Unlike hydroponics and aquaponics which utilises water for their growth, aeroponics does not require water as the key requirement. Instead, it requires the aeroponics roots to be sprayed with nutrient solution. Plants which grow in soil are at a risk of improper growth. These plants largely depend upon the weather condition of the environment in which they are growing. The use of pesticides and fertilisers increases since weed formation and pest attacks are common issues which in turn affects the quality of the soil by depleting the nutrients present in it. Space is one criteria for proper growth of plants. Many soil-dependent plants die due to insufficient space and overcrowding of plants due to lack of apt space. Talking about the land space, plants need fertile soil for their growth and not just any soil, bringing in another criterion. Due to these aforementioned shortcomings of soil as a medium of plantation we have moved to new techniques of plantation among which Aeroponics is the best solution. The paper discusses various methods of plant cultivation and a brief comparison between them.

II. OBJECTIVE OF SURVEY

The prevailing world population [2] of 7.2 billion is predictable to increase by nearly one billion individuals in the following twelve years, reaching 8.1 billion in 2025 and 9.6 billion in 2050, conferring to a new United Nations report. As the world population remains to grow, the intensifying mandate for agricultural production is momentous. More than half of global inhabitants' growth between now and 2050 is expected to occur in Africa. According to the UN's medium-variant projection, the population of Africa could expand more than double by mid-century, increasing from 1.1 billion today to 2.4 billion in 2050, and potentially reaching 4.2 billion by 2100. High population numbers are putting further strain on natural resources, fuel supplies, employment, housing and food supplies. In addition, an increased demand for biofuels could further increase pressure on inputs, prices of agricultural produce, land, and water and endanger a global food security. This survey gives overview information about progressive techniques and methods for producing green food with consideration for environmental factors and energy efficiency. The main idea behind the aeroponic greenhouse in intelligent space is full automation, scalability, anytime-anyplace access monitoring and fault diagnostics for home or enterprise farming.

III. LITERATURE REVIEW

Among the papers referred, the paper [1] titled "Monitoring of an Aeroponic Greenhouse with a Sensor Network" describes the proposal and enactment of a wireless sensor network for greenhouse environment monitoring. The sensor network was deployed in a commercial aeroponic greenhouse that produces lettuces in a tropical environment. The sensor protuberance was established using run-of-the-mill apparatuses and consists of sensors, a micro-controller and a low-powered radio unit. Real-time data permitted the operators to exemplify the operating limits of the greenhouse and also to retort instantly to any fluctuations in the meticulous parameters. The sensor network realised data broadcast rates of further 70%. "Aeroponic Greenhouse as an Autonomous System using Intelligent Space for Agriculture Robotics" [7] deals with providing an outline evidence about reformist techniques and approaches for producing green food with contemplation for ecological aspects and energy efficacy. The foremost inkling behindhand the aeroponic greenhouse in intelligent space is full automation, scalability, anytime-

anyplace admission monitoring and fault diagnostics for home or farming. "Use of aeroponics technique for potato (*Solanum tuberosum*) minitubers production in Kenya" [6] this paper discusses the production of potato minitubers using aeroponics in Kenya. Important considerations that should be addressed before setting up an aeroponics-based potato minituber production system are also discussed. Research areas to optimize production and improve field performance of mini-tubers produced through aeroponics are also presented.

IV. COMPARATIVE STUDY

In Geoponics or Conventional farming, plants are grown in soil with irrigation and active application of nutrients. In Hydroponics, plants are grown in certain medium containing added nutrients without soil. Aeroponics is a subgroup of Hydroponics except for the fact that it does not use any growing medium at all with nutrient rich solution provided to it at regular intervals. Growing plants by conventional agriculture method include the high and inefficient use of water, large land requirements, high concentrations of nutrient consumption, soil degradation and marginal returns [10, 11]. The knowledge about water and nutrient uptake by plants is crucial for developing control strategies which increase the possibility to supply the required amounts of water and nutrients for maximum crop growth and development [12]. Application of technology to agriculture results in higher efficiency with optimal use of resource. In Hydroponics and Aeroponics no nutrients are released into environment therefore possibility of nutrient pollution is made obsolete. Hydroponics uses only 10% of water resources when compared to conventional method of agriculture while Aeroponics reduces fertilizer consumption by 60%, the water consumption by 98% and pesticide by 100% while maximizing crop yields. In addition to this, plants grown in Aeroponics can be easily transplanted compared to that of Hydroponics as they do not suffer transplantation shock [13].

V. DISCUSSIONS AND CONCLUSIONS

Aeroponics seemed to be an extremely practicable method for the production of both airborne parts and roots as underdone materials for the herbal dietary supplement and phytopharmaceutical industries. In the controlled environment of the greenhouse, where growing seasons can be extended and all root material is easily accessible for harvest, biomass yields may be increased for some crops that have been historically difficult to grow and harvest using conventional horticulture in the field. Furthermore, using aeroponics, planting densities can be increased since plant-to-plant competition for nutrients and water is essentially eliminated. Planting and harvesting of plants can be conducted all year round without any form of interruption and contamination of soil, pesticides and residue. Plants grow fast because their roots have access to a lot of oxygen 24/7. The more confined the plant support is, the greater incidence and chance of increased disease pressure among plants and the Aeroponic system i.e. when the plants are grown in soil, aggregate or other media, spreading of diseases throughout the growth media is prevalent and thus, infecting many plants. Nevertheless, when grown in Aeroponic condition, since the environment is clean and sterile, chances of spreading of plant diseases and infection in soil and other growing media is greatly reduced and hence able to absorb more minerals and vitamins as the nutrient absorption rate is higher. For a plant to grow healthily and successfully, sufficient amount of air is required to be optimised and accessed to them by the air cultures. Moreover, the necessary materials and devices which support the growing plants must be devoid of disease or pathogens too. Since Aeroponic culture provides monomial plant support features, it will allow for the entire plants to be grown in air. Physical contact is minimized so that it does not hinder natural growth and root expansion or access to pure water, air exchange and disease-free conditions. Moreover, aeroponics system can circumvent the dry weather condition and provide the best means for growing plants effectively and at a faster rate.

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