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Implementation of Forward Chaining Estimation of Ideal PH for Plant in Hydroponics Assistant Based on IoT

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Abstract

Hydroponics is a method of planting crops through a medium of water that can live indoors or outdoors, hydroponic plants using NFT techniques (Nutrient Film Technique), where water and nutrients can circulate through plant roots. PH is the measurement of nutrient solution in acid or base state. Water pH can affect plant growth rates in hydroponic cultivation. In the PH study can survive at the value of 5.6-5.7, but some plants require different PH values. Therefore, a tracking is needed to determine the ideal plant type used in PH value between 5.6-5.7. This study aims to determine the ideal PH for plants on hydroponics. Forward Chaining is a forward search that begins to collect some facts by searching for the same rules with the existing hypothesis to the conclusion. This model is used to determine the type of plant in hydroponics that corresponds to PH that can survive in previous studies. Observations showed good PH values for hydroponic plant species. This research is used to find out the ideal PH for plant type in hydroponics using Forward Chaining method.

Keywords: NFT, Hydroponics, Forward Chaining, dan PH

1.   Introduction

The global population is estimated at 9 billion by 2050, mostly urban dwellers, requiring an increase in agricultural productivity by 70%.[1] Villagers moving from rural to sustainable cities are expected to encourage the expansion of urban landscapes and accelerate the loss of cultivated land around the city. Coupled with land degradation and loss of soil fertility.[2] The rate of population growth in the city of Bandung according to the Central Bureau of Statistics is currently 0.37%-0.71% per year, in 2016 the population reached 2,490,622 Souls. Therefore the agricultural land in the city of Bandung decreased, from data on the number of agricultural businesses in Bandung has decreased to 34,803.00 Ha by 2015.[3] While agriculture is considered an important part of life for human beings because it is a fundamental source Of food, other raw materials to meet the needs.[4] Agriculture provides the most important commodities needed to meet the needs. A number of vegetables, fruits, nuts and spices all continue to be cultivated with a variety of techniques.[5] Hydroponic techniques have the type to overcome land problems in urban areas, one of which is NFT (Nutrient Film Techniques) that can be arranged vertically.[6] Hydroponics is a widely used and often used the technique for growing plants without soil, providing considerable control over the elemental environment around roots,[7] and is a plant growth system that provides more precise control over composition growth media.[8] Ease of system setup, cost of system growth and flexibility to characterize and crop material harvests continue to be improved in hydroponic systems.[9] Hydroponics uses nutrients as a solution that provides all the essential nutrients for plant development. Hydroponics can be controlled by utilizing the Internet of Things (IoT) or known by machines to machines referring to various devices (things) such as sensors, actuators and other devices.[10] This tool can generate, receive, convey information, through wired or wireless communications between the same or different devices of information to the internet.[11] In the

IoT-based hydroponic development using PH, sensors are used to read the degree of acidity in water.[12]

One of the pHâĂŹs that affects each other different plants differently. [13] Nutrient uptake is generally proportional to the concentration of nutrients around the roots in a solution capable of producing good growth with various concentrations. [14] Experiments from Linyang are done with several types of plants such as lettuce (Lactuca Sativa), water spinach (Ipomoea Aquatica), grass (hydrological Sibthorpioides) grow well in the hydroponic system because it is influenced by nutrients and PH.[15] [15] In earlier studies PH may persist at the numbers 5.6 - 5.7, or the ability of plant roots to control nutrient uptake depending on the root structure and PH in the air on hydroponics. [16] Therefore at PH 5.6-5.7 does not yet know what plants are good on the PH.

The purpose of this study is to know the plants that can survive on PH 5.6-5.7 with a collection of facts and conclusions of the results of hypotheses using Forward Chaining method. [17] Results from the source code uploaded on GitHub to allow users to interact or collaborate in code review.[18]

2.   Related Works

Research by S. Tu PH (4.5 - 8.0) is used to understand individual and interactive effects. Plants and P and As uptake are influenced. Phosphorus is inhibited As the uptake at all for the Fern crop has a PH value of 5.87. [19], according to Sean D. water idea with PH 5.8 (standard hydroponic control condition for lettuce), with PH state raised to pH 7.0, and nutrient solution using water with high alkaline. Adjustment to PH is performed daily using 1 mol / L KOH or 1 mol / L HNO3. [20] Research by the Liopa-Sakalidi assessment of the impact of PH in the growth of zucchini in hydroponics cultivation is carried out every second day from the 33 days after the zucchinis are transferred to the hydroponic system and up to 68 days after planting Each time the dimensions and weight of the plant are measured, and females, length and width of fruit stalks and total dissolved solids of fruit. [21] Plant growth rates did not differ between nutrient solutions, but fertilized plants with high low pH solutions had greater greenish leaves and approached higher mean heights than fertilized plants with high pH solutions. [22] The trials of 15-day type lettuce seedlings (Lactuca Sativa 'Sucrine', Semailles, Faulx-Les-Tombes, Belgium) were put into hydroponics and harvested after 36 days. The hydroponic system is filled with a 100 L fresh solution each week to maintain a stable nutritional condition for better reproducibility and comparison between treatments. The nutrient content of the water from the one-week solution was sampled for analysis before the spill, and another sample of the fresh solution was taken immediately after refill. [23] According to Vandam plants grown in hydroponics over an 8-week period at Tanjung Peninsula University of Technology. Treatments of pH 4, pH 6 and pH 8 at 31, 90, 150 and 210 ppm of phosphorus were received by 12 groups of plants and replicated 10 times. The results showed that at pH 4, P fertilization significantly (P ¡0.05) induced higher chlorophyll production of S. plants grown on hydroponics than other pH treatments (pH 8 and pH 6).[24] Spinach (Spinacia oleracea cv Carmel) is grown in a conventional glass greenhouse under three different nutritional treatments. The lighting conditions and temperature are identical. Six growth systems were used to provide a duplicate bar system for each of these three treatments. Six trials are harvested from each system for a period of two months. Two treatments received hydroponic nutrition input, with one treatment at pH 7.0 and the other at pH 5. [25] The results of this study indicate that we can obtain optimal results and nutritional composition of leafy vegetable leaves grown on the substrate is well buried [26] hydroponic growth based on PH and environmental conditions for hydroponic growth Vegetables are a key factor that controls root development. [27] In this context, the motivation to apply the control of water sources of drip irrigation and nutrient solution to grow Daniela tomatoes based on hydroponic farming and Continuous variable monitoring using PH, and further monitoring may be seen through the web, in order to incorporate new technology to assist in decision making quickly. [28] It is important to identify an effective buffer chemical capable of adjusting the pH of the nutrient solution to the desired level for the production of the best hydroponic crops. Experiments were conducted to test the pH dynamics of altered nutrient solutions with various inorganic acids during hydroponic production and yield and

nutritive quality of the resulting plants. The typical nutrient solution (pH 8.2) was adjusted to pH 5.6. [29] Among the studied nutrients studied (N, P, and pH), increased phosphorus concentrations significantly increased the number of tubers of potato crops in the hydroponic sand culture. These nutrients improve net photosynthesis. [30] In this study, experiments with four levels of a nutrient solution of pH control of the upper limit were conducted to explore the optimal pH nutrition management scheme under hydroponics by evaluating the character of the nutrient solution, e.g. pH. [31] Blueberries are one of the few horticultural crops adapted to grow in acid soils. To assess the molecular mechanism, planted at a neutral pH of 6.5 and at a preferred pH of 4.5. [32] PH is evaluated every 2 days. Regarding the variation of pH of the nutrient solution, on transplantation day, pH values were 5.5 and 5.43 respectively in treatment with freshwater and brackish water. The PH value oscillates within the range recommended for hydroponic cultivation and correction is performed when necessary.[33]

The Forward Chaining method is a search method or a front tracking technique which begins by providing existing information and combining several rules to produce a conclusion or goal. [34] Forward Chaining is also called a search technique that begins with known facts, then compares. [17] This system instils expert systems using forward chaining methods to find out the solution of the nutritional conditions of the plant. [35] This system uses forward chaining method which means using some rules and actions to support using forward chaining method. [36] The operation of this forward chaining system begins by incorporating some known facts into working memory, and then generates new facts based on the premise rules which are then combined with some known facts. [37] This process continues until it reaches the goal or no longer regulates the premise in accordance with known facts. [38] The forward chaining method is implemented on an expert system inference engine.[39] Inference engine expert system is a computer program that answers questions from users. It processes all information from the knowledge base by shouting rules and facts. [40] One example is, for example, the proposed expert system already has a target disease (the main purpose) and then requires a set of rules to prove whether the target disease exists or not otherwise. This method of reasoning is recommended to use in expert systems as it may be of concern in the Diagnosis of a disease or a pest selected by plants. [41] Furthermore, grape growth is divided into eight stages as delayed sleep, budding period, rapid shoot growth period, and blooms into periods of veraison, veraison period, harvest period, post-harvest period and period of inactivity. For weather conditions, the three functional membership temperatures are defined as hot, warm and cold; the membership function for rainfall is defined as heavy, medium and light; and the membership function for moisture is defined as high, medium and low. Rules for Estimating the probability of Occurrence and the spread of pests and diseases of wine If Warm and High Humidity And High Temperature. [42] Forward chaining signifies the subject for the stages of doing the process as well: (step l) e.g. inserting parts l and 2 together, then step 2 place 1, 2, and 3 together are referred to as criteria, then step 3 place 1, 2, 3, and 4 together, next step is step 4 place part 1, 2, 3, 4, and 5 together 1 and 2, 3, 4, 5 [43] The Knowledge Representation Model is a model of knowledge representation used in this case. The system is based on production rules using IF-THEN patterns. Each symptom has determined the value of the weights (confidence factor) defined by the domain expert in the range of 0 ... 1, The example of forwarding chaining rule is as follows:

Rule 1: IF (Today Ali is fasting)

THEN (Ali hungry)

Rule 2: IF (Today Ali is fasting)

THEN (Ali tired) [44]

First example: Grape growth is divided into eight stages as delayed sleep, budding period, rapid shoot growth period, and blooms into periods of veraison, a period of veraison, harvest, postharvest period and period of inactivity. For weather conditions, the three functional membership temperatures are defined as hot, warm and cold; the membership function for rainfall is defined as heavy, medium and light; and the membership function for moisture is defined as high, medium and low. Rules for Estimating the probability of Occurrence as well as the dissemination of pests and diseases of wine If Warm and High Humidity And High Temperature. [45]

The second example by using the premise if and then: IF the name of the plant is pigeon pea then the stage of harvest is named podding, as well as the affected plant part is named after the pod, as well as eating habits is biting, and chewing is called the type, and Pest identification symptoms are larvae without white feet, brown pupa and black adult a flying. NEXT Insect Pests - Pod flies If the rule criteria include the symptoms or explanations of the pest (questions and answers). The bottom of THEN criteria is the rule that states the insect pest itself (diagnosis).[46] The process is similar to the human thinking process. Naturally, when performing a diagnosis, the first Symptom (or condition) is observed by the doctor then The problem is categorized and diagnosed. In the above example, the name of the plant, the stage of harvest, the affected part of the plant, the eating habits and the symptoms of pest identification represent questions, green beans, podding, pods, biting and chewing species and larvae without white feet, brown pupa and adult black fly.[47]

In the study, PH can survive at the value of 5.6-5.7, but some plants require different PH values. Therefore, a tracking is needed to determine the ideal plant type used in the PH value between 5.6-5.7. This study aims to determine the ideal PH for plants on hydroponics. Forward Chaining is a forward search that begins to collect some facts by looking for the same rules with the existing hypothesis to the conclusion. This model is used to determine the type of plant in hydroponics that corresponds to PH that can survive in previous studies. Observations showed good PH values for hydroponic plant species. This research is used to find out the ideal PH for plant type in hydroponics using Forward Chaining method. This model is used to determine the type of plant in hydroponics that corresponds to PH that can survive in previous studies. Observations showed good PH values for hydroponic plant species. This research is used to find out the ideal PH for plant type in hydroponics using Forward Chaining method.

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