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Review on Application of automated Monitoring Water System in Red Chilli (*Capsicum Annum* L.) Production

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Abstract

In righteous book of Al-Quran, water is mentioned as the main source for life survival epecially for the plant's growth in the earth. Providing enough water in plants like a chilli pepper (*Capsicum annum* L.) at the appropriate times is among the most crucial components of chilli cultivation. Growing chilli, on the other hand, takes a significant investment of time, effort, and physical work. It also calls for a great deal of attention and care, in addition to an appropriate supply of water and nutrients. Existing methods for example semi-automated system that uses a scheduler for fertigation, have significant limits. These shortcomings may be discovered in the exiting technique. The constraints include the need for human involvement, which is bothtime-consuming and expensive, and the fact that the method somehow does not take into consideration environmental or soil conditions. As a result, its resource management and chilli production become less efficient as a result of this. In order to get over this challenge, this paper review was suggested involvement of automated monitoring system in chilli production. The automated monitoring systems in chilli fertigation system need cutting-edge technology such as the Internet of Things (IoT), together with the backing of dependable communication technology. The constant sensor readings that are obtained, together with the automated system for fertiliser application and watering system that were based on the actual soil and nutrient range data, which resulted improvement in effectiveness of the water and nutrients management in chilli production. As a result, the use automated monitoring system and the data analysis is intended to cut down on the amount of cost, energy, and manual effort required in order to assist chilli producers in increasing their crop yields.

Keywords: Chilli; Irrigation System; Technologies; IoT; Automated Monitoring System

Introduction

Red chili or known as *Capsicum annuum* L., is one of the most important high-value vegetable crops in Malaysia and grown mostly for its spicy taste. The current level for chilli SSR in Malaysia was only at 30.9% and for import dependency ratio was 72.4% [1]. Since advancements in agricultural technology and the promotion of agricultural products thru agribusiness, chilli has developed into a crop with great demand but, its production is not particularly environmentally friendly [2]. The red chilli plant is very delicate and easily damaged by too much water. According to Tariq, et al. [3], decreases of the chilli yield was causes increased the cost of chilli production, and one factor that affecting the low level of chilli

yield is lack of water and irrigation management system [3]. High quality of the water and irrigation system in red chilli production is very important in ensuring the quality of the red chilli yield. When soil moisture rate is low, and the rate of evapotranspiration is high, additional water irrigation systems of the plants after they have been transplanted will dramatically enhance the rate at which they will survive.

One of the methods that can be use in managing problem regarding water and irrigation system in red chilli production is by introducing uses of automated monitoring water system.

Automated water system is a mobile application-based automated water management system that aims to simplify and improve the quality of everyday living by improving efficiency of field irrigation system Mahfida, et al. [4]. By utilizing sensors and the results of the data they provide, it is able to manage the distribution of water and take action for any current problem in the crop field which that has been formed in the water tank storage according to the field water's surface [4]. Using wireless sensor nodes, an automated water monitoring system offers a practical solution for effectively preventing the waste of water in chilli crop field. By using wireless sensor nodes, the Internet of Things (IOT) concept is applied to continually monitor and measure how much water is being consumed for planting crop [5].

Therefore, the purpose of this review paper are to; i) identify component involving in automated monitoring water system in chilli production, ii) justify automated monitoring water system in reducing water losses in redchilli production, and iii) investigate economic important in automated monitoring water system in chilli production.

Literature Review

Irrigation System of Red Chilli Production

Irrigation was a significant factor in the expansion of the world population's access to increase the productivity of chilli production [6]. In this part of the world, where there is very little to no precipitation throughout the growing season, the growth of chillies is impossible without the assistance of irrigation. As a result, it is essential to determine the right irrigation demand of the crop together with the correct irrigation period for the purpose of optimizing the crop's potential yield while also minimizing the amount of water that is wasted [7]. Below are types of irrigation system and effect to the chilli production (Table 1).

Type of Irrigation	Effect on Chilli Production	Sources
Drip Irrigation System	Increases 33 to 48% of chilli yield and reduced 34 to 50% of water usage.	(Nijamudeen, et al. 2002) [8]
Sprinkler Irrigation System	The yield of chilli is increases 24% and water saving was increase 33%	(Rajeshkanna, et al. 2013)
Drip Irrigation System	Saving around 58.6% of water consumption	(Gulshan, et al. 2007) [9]
Smart Irrigation System	Higher in chilli dry weight.	(Boutraa, et al. 2011) [10]
Smart Irrigation System	Reduces fertilizer application and the cost of chilli production	(Prabha, et al. 2018) [11]
Drip irrigation	Saving water consumption around 54.91% to 60.55% in chilli production.	(Suvitha, et al. 2021) [12]

Table 1: Effect of Difference Irrigation System in Chilli Production.

Component Involving in Automated Monitoring Water System in Red Chilli Production

According to Gultom, et al. [13] was purposed that a smart water sprinkling and automated monitoring system for chilli plant crops with the goal to reducing the amount of water needed by the plants through the use of Internet of Things technology (IoT) to control and monitor the chilli plant field [13]. In this system consist of four main components which are pH meter, Electrical Conductivity (EC), soil moisture and temperature meter. The application of water to chilli crops through automated monitoring water system is based on the soil condition which is that was detected first by these four components. The pump valve that regulates the amount of water that is delivered to the chilli plants crop is connected to an automated control system that operates the irrigation system. The usage of this system led to a reduction in the amount of water and fertiliser that was used in chilli crops field.

From previous finding by Prabha, et al. [11], the kind of precise and regulated irrigation not only boosts productivity but also ensures that the most efficient use of water and other resources is achieved in chilli production. Because of this technology, chilli production is able to make the most efficient use of water and maintain consistent soil humidity [11]. The Internet of Things (IoT) is combined with cloud

computing and the use of various devices and sensors in order to bring about a modernization in chilli production for the benefit of farmers. A GPS link is used, as well as a system which has a real-time monitoring for the chilli field. Through the use of an electronic and automated monitoring water system, the system is able to monitor the effectiveness of the use of energy, measure the amount of moisture, and identify leaks at field.

This smart chilli system regulates all of the sensors, which is including the temperature, the soil moisture, electrical conductivity value, and water level in the tank. These sensors activated the water pump, fertilizers pumps, mixer, fertigation, and water valve, to be operational depending on the range value of the sensor in chilli field. The design of this system is showed as Figure 1 below.

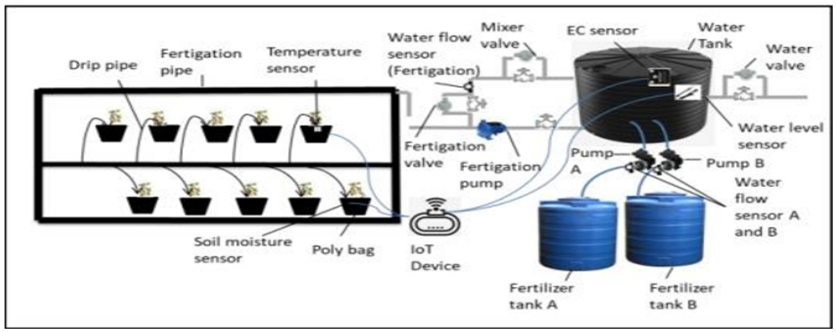

Figure 1: Automated Monitoring Water System in Chilli Production [14].

Automated Monitoring Water System in Chilli Production

An automated monitoring water system enabled more timely irrigation selections, which led to an increase in productivity and quality of red chilli yield by up to 30 percent [15]. The application of an automated monitoring water system in chilli irrigation system, which included a microcontroller, a weather sensor, a soil sensor, and a blue tooth module, and the subsequent report that the test group had better performance in terms of chilli growth parameters such as chilli leaf number, chilli fresh weight, and chilli dry weight [16].

The automated monitoring water system for soilless culture of chilli production were found that the average of the red chilli fresh weight per plant which is using automated monitoring water system is at least 16.60 percent and 11.37 percent higher than under manual control irrigation at different growth stages during the spring and summer seasons [17]. This may be due to the low of water holding capacity of the substrate, as well as the fact that the automated monitoring water system method can detect and irrigate in real time, thus maintaining the water content at the plant root zone to fulfil the needs of the plant compared with manual irrigation method.

Methodology

The purpose of this research is to conduct a review of the information that is presently available on the situation concerning the implementation of automated monitoring water systems in chilli production. We were able to uncover relevant content from a range of sources, such as journals, papers, conferences, and other related documents that link with the issue as a result of an intensive search. When doing literature searches using a range of key phrases relevant to the implementation of automated irrigation systems in chilli production, the journals such as Science direct, Springer Link, Environmental Science and Safety, and Researchgate are the most useful. This study conducted a literature review on the topic of automated monitoring water systems in chilli production. The literature review included discussions as well as demoted data, findings, and evidence.

Discussion

Economical important of Automated Irrigation System in Chilli Production

From previous finding by Kumar [18] was carried out an experiment to assess the performance evaluation of an indigenously built automated system on red chilli crops while subjecting them to various types of irrigation [18]. He observed that water production rose while using an automated monitoring water system. The findings showed that the automated drip irrigation system reported the highest of BCR and had the highest net revenue of red chilli production [18]. An automated monitoring water system that delivers water on demand was developed with the help of time-based, volume-based, sensor-based, and tensiometer-based drip irrigation. This type of irrigation system

demonstrates to be a real-time feedback control system that effectively monitors and regulates all activities associated with drip irrigation systems. The results will be used to improve farming operations on a larger scale in addition to saving money, personnel, and water in chilli production.

Operation of the Automated Irrigation System in Chilli Production

The operational of automated monitoring water system does not need or requiring the focus of the operator, except for the regular inspection and routine maintenance. The irrigator may decide when and for how long to irrigate, as well as how much water should be introduced into the system and red chilli field. Additionally, the irrigator may switch on programmed controllers in order to start the automated operations. When the amount of water in the soil falls below a certain threshold, fully autonomous systems may make use of soil moisture sensors like tensiometers or thermistor blocks to operate electrical controllers. This occurs when the soil water level falls below the threshold. Timers that are pre-programmed, soil moisture sensors, or surface and groundwater sensors in red chilli field may be used to manage the length of an irrigation cycle. A water supply that is readily accessible on demand, such as that which is provided by wells or farm tanks, is essential for these systems.

Advantages and Disadvantages Application of Automated Monitoring Water System in Red Chilli Production

Advantages

Comparing with the manual irrigation method, an automated monitoring water system reduces the amount of labour involved, as well as the amount of water, energy, and money wasted. The automated monitoring water system begins watering precisely at the amount of moisture content that has been specified, and it ceases watering when the intended level of the soil moisture content has been reached. In order to plan irrigation, this system includes the analysis actual of rainfall, does away with the need of making frequent trips to the red chilli production, and guarantees that the soil water level in the plant root zone is at optimal level. This removes the long-term negative consequences of excessive watering, which leads to the formation of salinity, and avoids the loss of minerals and nutrients that are essential for the proper growth of the red chilli plant crop. This system is helpful in both dry and humid regions, particularly those places where unpredictability and uneven distribution of rainfall upsets an otherwise consistent irrigation schedule.

Disadvantages

Raise the cost of chilli production, which includes expenses associated with the purchase, installation, and maintenance of automated equipment. Can the irrigation worker rely on an automated system to perform as intended each and every time? There will be moments when the workers are unsuccessful. Human error in the process of configuring and managing the systems is often to blame for these errors. When things go wrong, having a system that can collect any extra runoff might be a valuable kind of insurance. Also, it I Increased the channel maintenance in chilli production, not only is there a need for an increase in the maintenance of channels, but there is also a demand for an increase in the maintenance of equipment. In order to prevent damage to the automated units caused by livestock, the channels need to be recorded.

It was discovered in a previous study by Evan & King [19], was found that the majority of the work done on or before the focused on evaluating the improvements in red chilli crop yield and water savings in field that were achievable with automated monitoring irrigation system. Furthermore, it was speculated that the highest savings are likely to take place in humid climates as a result of the increased utilisation of storage moisture and in-season precipitation. They found that using automated monitoring water system tactics might result in water savings ranging from 0% to 26% when applied to well-watered crop production. These findings came from both simulation and field-based case studies. According to the reports, the use of precision irrigation did not result in any appreciable increases in agricultural production.

They went on to remark that the potential economic advantage of using automated monitoring water system for large-scale in red chilli production is somewhat limited. This is due to the fact that the costs of equipment, maintenance, and administration are far more than the benefits in income that may be realised as a consequence of increased yield and less water use.

Sustain Environment Through Used Automated Monitoring Water System in Red Chilli Field

The concept of sustainability is built on the assumption that the needs of the current generation should be met, but then this should not be done at the expense of the capacity of the future generations to satisfy their own needs. The development of agricultural methods that are both harmless to the surrounding environment and do not have any negative effects on it is the primary emphasis of sustainable agriculture [20]. It is generally accepted that the most important factor in determining how much progress can be made toward improved sustainability in the agriculture irrigation system especially in red chilli production is the amount of water that is used effectively and efficiently. Because of this, less water will be needed to irrigate the red chilli crops, and the quality of the water sources will be preserved as well.

Water is distributed evenly throughout a field by the use of conventional irrigation methods, which results in a significant amount of water being used. It is possible that, by using conventional method may result in over irrigation, which in turn could cause nitrates and nutrients to leech into the water ground sources.

The use of automated water monitoring systems offers a promising basis for enhancing the sustainability of red chilli production that relies on irrigation. This is particularly dependent on the potential of eradicating the negative environmental consequences related to traditional irrigation techniques through use of automated monitoring irrigation system. However, one of the most essential aspects to take into account is the financial benefits that may be gained by using an automated water monitoring system. This will be evident in the form of greater crop yields as well as increased water savings, together with the related decrease in energy consumption that will follow from an optimum balancing of the irrigation inputs towards the spatial water needs of the red chilli field, which will lead to a reduction in costs of production [21].

Conclusion

The use of the automated monitoring water system in red chilli production helps to maximise the efficiency of water consumption by lowering the amount of water that is wasted in chilli production. The suggested controller does away with the existing manual switching technique that the farmers have been using. The system is also capable of being configured to function as a cooling system for temperature-sensitive plants that is based on temperature sensors. The application of this technology will also be able to make a contribution to the socioeconomic growth of the country, and it has a very quick reaction time and is very environmental-friendly in increasing the production of red chilli. In order to make the most efficient the used of the limited water resources, technological advances that may make irrigated agriculture more sustainable. It has been shown to be such an invention that precision irrigation, despite the fact that the economic gain associated with the implementation of this irrigation system at the field-scale level of crop production is now low. This is due to the fact that there is a possibility that the potential for improved yields and savings in water will not cover the expense of the technology necessary for its implementation.

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