iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8177

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Experimental Investigation on Drip Irrigation using Moisture Sensor

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Abstract: The continuously increasing population in India demands for the rapid improvement in food production technology. Indian economy is mainly based on agriculture. Water is the main resource for agriculture. Production can be increased through the adoption of technologies like drip irrigation and plastic mulching, which increases the water use efficiency and fertilizer use efficiency. The conventional drip irrigation system is fully controlled and monitored by the farmer. This paper presents a fully automated drip irrigation system which is controlled and monitored by using moisture detecting sensors and water required for the crops is automatically supplied with the help of sensors. It reduces the manpower needed and the same time increases the yield with less amount of water.

Keywords: Automated drip irrigation system,moisture detecting sensor,plastic mulching,irrigation

I. INTRODUCTION

Water is a resource that all living species need. Agriculture is an industry that uses a lot of water. Most of the time, this resource is not used efficiently and substantial amount of water are wasted. Adoption of modern irrigation techniques which are simple, easy to operate and increase the efficiency of water usage. Drip irrigation is the most effective way to supply water and nutrients to the plant, which not only saves water but also increases yield of crops . In this technique, most significant advantage is that water is supplied near the root zone drip by drip due to which enormous amount of water is saved. At present, the farmers in India have been using irrigation technique through the manual control. This process sometimes consumes more water and sometimes the water reaches late due to which the crops get dried. This problem can be perfectly solved by adopting automated drip irrigation system. Automated drip irrigation system uses sensors, that are installed in the root zone at the undisturbed soil. The soil moisture sensor is connected to an irrigation system controller that measures soil moisture content and valves of the system are turned ON and OFF automatically for different interval of time. It also helps in saving time, removal of human error in adjusting soil moisture levels and to maximize the yield with consuming less amount of water.

Mulching is used to cover soil surface around the plants to create congenial condition for the plant growth. Polythene mulches are widely used in the cultivation of vegetables. Weed control, temperature moderation, salinity reduction etc are the desirable effects of plastic mulching. Drip irrigation along with plastic mulching is effective in increasing the yield with proper management of water resources and nutrients

II. OBJECTIVE

The main objective of this paper is to study about the field characteristics and to adopt the suitable irrigation system. To increase the yield by incorporating efficient irrigation system and to reduce the water requirement considerably. To recycle the plastic waste from the solid waste and it can be used as a plastic mulching in the irrigation system to protect the soil fertility.

III. SCOPE

The scope of this project is the water requirement for the crops is reduced considerably by incorporating auto irrigation system. There may be increase in the yield of crops. Involvement of manpower is reduced which paves the way to save agriculture in the future.

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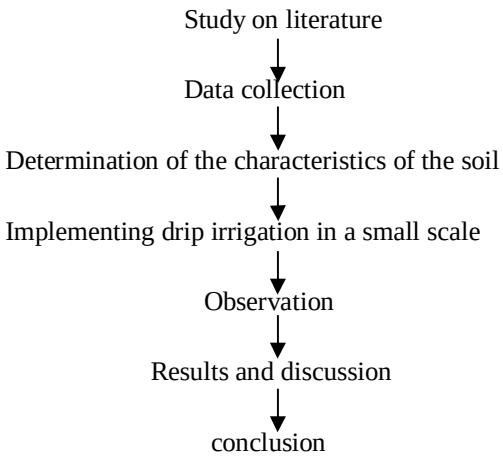
IV. METHODOLOGY



V. LITERATURE SURVEY

R.Vagulabranan et al., (March 2016) "Automatic Irrigation System on Sensing Moisture Content". This project is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the soil. The author concludes that, the main advantage of employing these techniques is to decrease human interference and still making certain appropriate irrigation. Also, in agricultural lands with severe shortage of rainfall, this model can be successfully applied to achieve great results with most types of soil.

Aniket H. Hade et al., (April 2014) "Automatic Control of Drip Irrigation System and Monitoring of Soil by Wireless". In this study, the author has investigated that proper method of irrigation by drip is very reasonable & proficient. The author made a temporal monitoring of soil moisture at different growth stages of the crops which would help to prevent water stress and improve the crop yield. Various environmental parameters such as Soil temperature, Soil moisture, Relative humidity, pH, Light intensity, fertilizing property of the soil, etc., have been detected for better agricultural output. This method minimizes the use of inorganic fertilizers also.

Gayatri Londhe et al., (May 2014) **"**Automated Irrigation System by Using ARM Processor**"**. The main objective of this paper is to design a fully automated drip irrigation system. It has an important advantage of reducing soil erosion & nutrient leaching. The system values are turn ON or OFF automatically depending upon the moisture content. This system also provides efficient information regarding soil nutrients like nitrogen.

VI. SUMMARY OF THE LITERATURE

From the literature survey, it is noted that proper irrigation method is very reasonable and proficient. The automated drip irrigation system helps to prevent the water stress and improves the crop yield. The practice of plastic covered agriculture (also known as plastic mulching) is used to protect crops from unfavorable growing conditions. Mulching is a cultural practice that can significantly decrease the amount of water that needs to be added to the soil. It is known that the soil moisture sensor can reduce the water application by 50% and water saving have been measured between 5% to 88%. By implementing these techniques, human interference is decreased but still making certain appropriate irrigation. This principle can be extended to create fully automated gardens and farmlands. This method can also be applied to any type of soil. Moreover, soil erosion and leaching can be completely avoided using this system.

VII. CONVENTIONAL DRIP IRRIGATION SYSTEM

This project deals with the implementation of drip irrigation system in a small scale by making two models of drip irrigation systems and comparing the efficiency of both the conventional and automated drip irrigation system.

The drip irrigation requires about half of the water needed by sprinkler or surface irrigation. Plants can be supplied with more precise amount of water. Disease and insect damage is reduced because plant foliage stays dry. Operating cost is usually reduced. Fertilizers can be applied through this system. This can result in a reduction of fertilizer and fertilizer cost. When compared to other irrigation systems, drip irrigation leads to less soil erosion.

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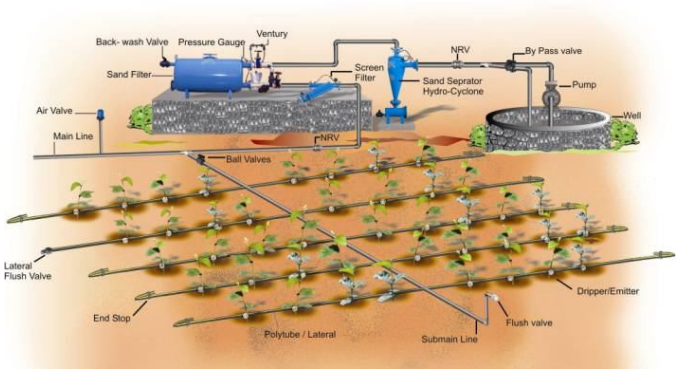
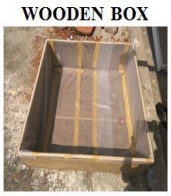
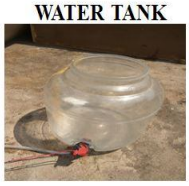
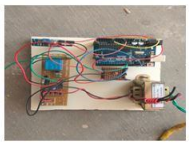


A. Automated Drip Irrgation System

1) Materials used

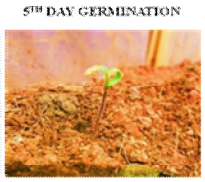


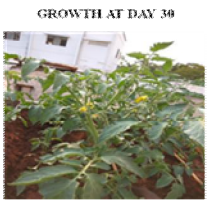




VIII. EXPERIMENTAL SETUP

Automation of the drip irrigation system is gaining importance as there is need to use water resources effectively and also to increase the field productivity. The moisture detecting sensors are fixed in the soil and the system is used to turn the motor ON or OFF automatically as per the water requirement of the plants. If the moisture content in the soil is very low and the temperature is high, then the motor will automatically turn on and watering the plants. If the moisture content is higher than the optimum moisture content, then the motor will switch off automatically. Hence for different temperature range and moisture content level in the soil the land will be irrigated continuously for different intervals of time. Along with the moisture detecting sensors, mulching also improves the conservation of soil moisture during dry period and minimizes soil erosion, weed problems and nutrient loss. Beneficial effects of mulching like earliness in yield and reduction in insect and disease problems. Black plastic mulch is most commonly used in agriculture. It was the most effective in weed control in tomato, brinjal and resulted in more crop growth and higher yield when it was compared to organic mulches. Using this system, it is reported that irrigation requirement met through automatic drip irrigation along with plastic mulch gave the highest yield with 72% increase in yield as compared to conventional drip irrigation.





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IX. RESULTS AND DISCSSION

A. Observations

Two small scale drip irrigation systems have been installed; one is the conventional drip irrigation system and the other is the moisture sensor detected automated drip irrigation system. Two parameters such as the average height of plants and the daily water requirement of plants are noted and the observed data is tabulated below.

Table 1. Difference in the average height of the plants

Day	Conventional drip irrigation(cm)	Automated drip irrigation(cm)
5	4	4
10	8.6	8.6
15	12.5	13
20	16	17.9
25	19.4	21.4
30	23.5	26.3
35	27.4	30.5
40	30.7	35.4
45	34.4	39.3
50	38.9	45.6
55	43.7	49.3
60	47.3	51.6

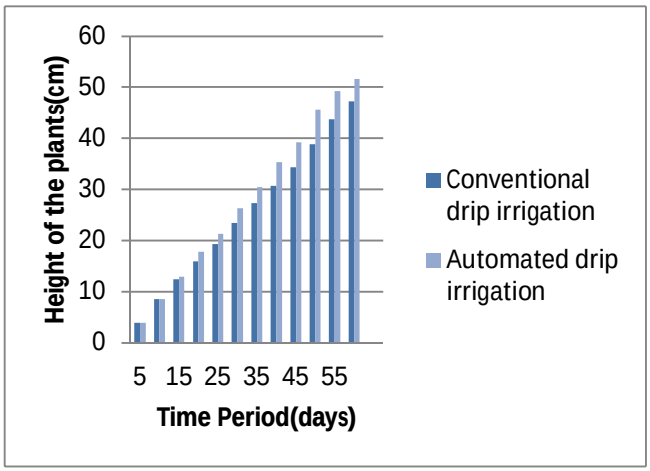
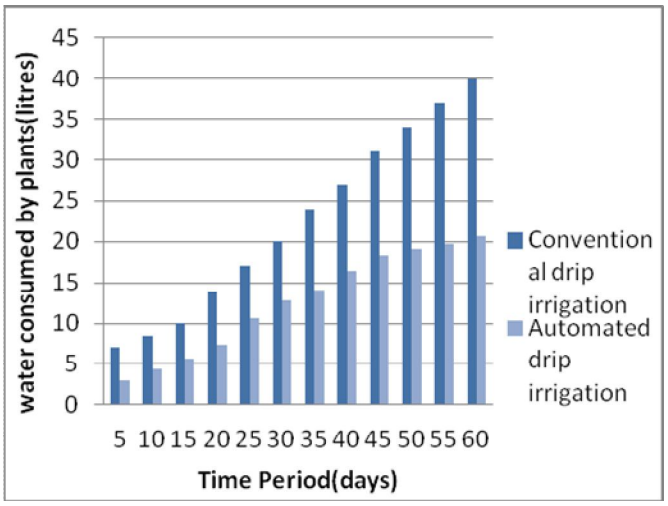


Table2 . Difference in water consumed by plants

DAY	CONVENTIONAL DRIP IRRIGATION (Litre/day)	AUTOMATED DRIP IRRIGATION (Litre/day)
5	7	3
10	8.5	4.4
15	10	5.6
20	14	7.3
25	17	10.6
30	20	12.9
35	24	14.1
40	27	16.5
45	31	18.3
50	34	19.1
55	37	19.8
60	40	20.6



B. Results obtained from the Study

1) Water consumption of plants is reduced by 50% in automated drip irrigation system compared to conventional drip irrigation system.

2) Mulching can improve the soil moisture conditions and minimize soil erosion, weed control, nutrient loss.

3) Yield/Production of crops is increased considerably.

4) Regular monitoring of plants is not needed and the manpower is also reduced.

X. CONCLUSION

The main objective of this paper is to design a fully automated system. A small scale drip irrigation system is installed and the difference between the conventional drip irrigation system and the automated drip irrigation system were observed. Mulching can make effective change in increasing horticultural crop production and has the advantage of attaining earliness in production and increasing the total yield. It is noted that the yield of crops in the automated irrigation system along with mulching is increased considerably by using less amount of water when compare to the conventional irrigation system. The water required by crops is reduced to about 51.5% in automated drip irrigation system compared to conventional drip irrigation system. By incorporating these techniques in a large scale, the demand of water for agriculture will be reduced considerably.

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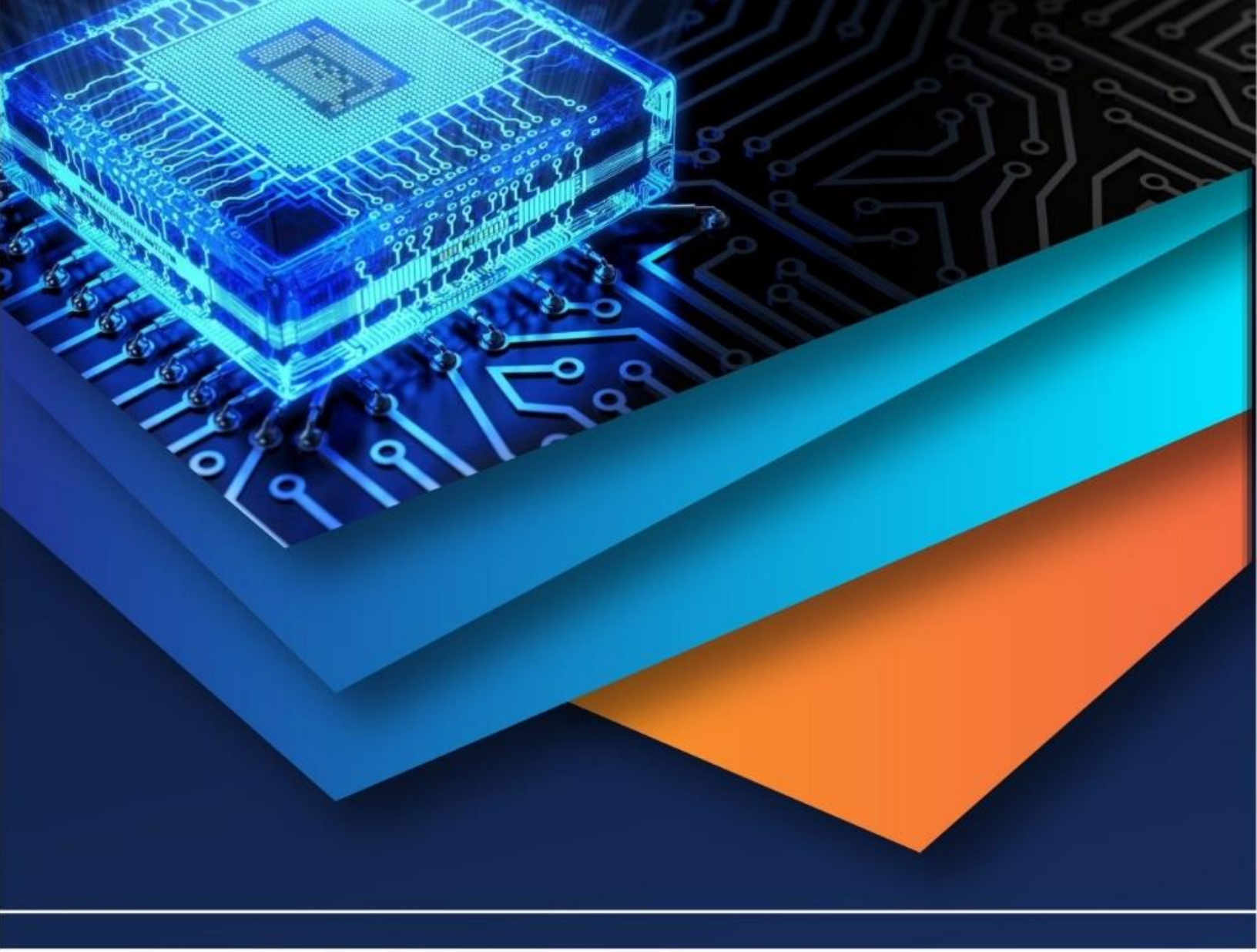

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