ABSTRACT

The purpose of this study is to use the laser technology in applicable for automating drip irrigation systems, to manage and operate the drip irrigation system, and to save water and energy and high production. In this research a new instrument of Laser Control Unit (LCU) is design and built in laser institute Cairo University. The new instrument is consists of laser sours, sensor and micro control unit. The use of LCU depends on the optical properties of leaf such as transmittance, reflectance and absorption of laser beam. The correlation between leaf water content and laser beam transmitted from leaves (LBT) was used to detect when the automate irrigation system operate and how much water applied. Three experimental was carried at laboratory, greenhouse and open field.

The first experimental was carried in lab of laser institute to test the LCU, with use of many leaves for different plant, vegetable crop (cucumber and squash), fruit and decoration plants. The values of laser beam transmitted from leaves which recorded in micro controller unit was used to establish the value of LBT by mV which used to operate the automate drip irrigation system for fully, moderate and deficit water regime to irrigate different plants.

Secondly experiment was carried in greenhouse for vegetable crop (cucumber and squash) used the LCU and the values of LBT by mV which the automate system. The data of LCU was recorded in data logger in said the LCU, on the same time two either instruments were used to calibrated the data recorded by LCU. These instruments were infrared thermometer (IRT) and soil moisture meter (SMM). The three instruments were used to measure and recorded the data each 2 – 4 hours day of six day in the week, form week 4 to week 9 for plant stage of cucumber and squash.

The compression study for the data recorded by the three instruments exhibited that, there are similar trend for values according to the measure unit. The low LBT 65 mV in face of high SMC was 16% and low value of dt -2.5 ^{0}C.

Third experiment was carried in open field, using the LCU and automates drip irrigation system in the same soil and water resource of greenhouse; also the same three instruments were used in open field.

The data of three experiments were discussion and analysis, from the three experimental the values by mV which recorded LCU to operate automate drip irrigation system for cucumber and squash were 65, 75 and 85 mV for fully, moderate and deficit irrigation respectively.

The crop water use efficiency (CWUE) for cucumber was 40, 32.5 and 30 kg/m^3 for greenhouse, while it was 13.4, 10.8 and 10 kg / m^3 in open field for water regimes of 100, 85 and 75 % respectively, comparison with Traditional method it was 8.55 kg / m^3.

The crop water use efficiency (WUE) for squash was 40, 37.9 and 36.4 kg/m^3 for greenhouse, while it were 10.3, 8.7 and 7.9 kg / m^3 in open field for water regimes of 100, 85 and 75% respectively, comparison with Traditional method it was 8.3 kg / m^3.

Finally it can be concluded that, the best value of LBT is 65 mV for water regime of 100 %.

Key words: Laser, Sensor, Control, leaf water content, Optical Properties, Irrigation Control

List of Contents

List of Figures

List of Tables