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The Smart Management of Irrigation of Agricultural Crops

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Abstract: *This article provides an overview of the concept of "smart irrigation" and a review of the results of research conducted abroad on smart irrigation.*

Keywords: smart irrigation, WFD device, WiFi rotor, irrigation duration, irrigation norms, filtration, pre-irrigation soil moisture.

Introduction

Today in the world agricultural practice there are many terms such as "Smart agriculture - smart agriculture", "Smart farming – conducting of smart farming", "Smart irrigation - smart irrigation" [2].

From 2017 to 2022, the expansion of automated systems and technologies for "smart agriculture" around the world is projected. In particular, the VRT (variable speed technology) system and GPS receivers make a significant contribution to the growth of this network [1].

Materials and methods

So the question naturally arises, what is meant by "smart farming" or " conducting of smart farming"? "Smart farming" and farming is the management of latitude and temporal variability in order to increase economic efficiency and reduce negative impact on the environment (Figure 1). In this case, the full management of the farm involves "decision-making systems", ie increasing revenue by optimizing costs by saving resources, GPS, GNSS (Global Navigation Satellite System), drone imagery, using hyperspectral images mapping and monitoring of crop yields, soil organic matter, nitrogen and moisture content, soil salinity, water resources and other indicators.Smart farming is the management of information systems, the collection, processing, storage and dissemination (promotion) of data for the targeted implementation of work and planned systems in agriculture. [2].

In the field of agriculture in foreign countries, "Smart irrigation - smart irrigation" is widely introduced in large areas in the United States. "Smart irrigation" means making a clear decision on irrigation or intelligent management of irrigation. For example, using sensory moisture meters (TDR, Data Snap, WFD) and, in addition, information and communication devices (Web server, WiFi rotor) to determine the water demand of crops, it is possible to make a clear decision on irrigation by monitoring soil moisture. This will increase revenues by optimizing costs by saving water resources and manpower.

In order to ensure the implementation of the Resolution of the President of the Republic of Uzbekistan "On measures to organize the activities of the Ministry of Water Resources of the Republic of Uzbekistan" dated April 17, 2018, the Cabinet of Ministers adopted a resolution on September 10, 2018. Measures have been taken to ensure the rational use of water resources, the development and implementation of modern information technologies and programs for irrigation of agricultural crops [3].

Based on the above tasks, smart irrigation, ie automated control of water demand of crops with the help of new modern sensory devices based on information technology, will be achieved through the introduction of water and resource savings and high productivity in agriculture and water management.

According to the Australian scientist R. Stirzaker, the WFD tool was developed to answer the question "What is the simplest information for swimmers to make better decisions" because the implementation of developments developed by farms on irrigation schedules has been unsatisfactory [4].

In a study in Australia using the WFD tool, irrigation was carried out at intervals of 4 to 7 days with 4 WFD tools installed in a 15 cm layer of soil to irrigate lawn grasses. At the same time, irrigation was stopped automatically with the detection of 3 detectors that moisture reached the specified soil layer. The accuracy of this method has been proven to be surprisingly high. Each irrigation indicated that the marked layer was almost exactly moistened. In this case, it was proved that the soil in the 30–50 cm layer of the soil is dry and the lawn grass is not irrigated excessively, only the calculated layer of soil is moistened [5].

Result and discussion

According to observations by P.B.Charlesworth, there are more than 20 views of soil moisture monitoring, among which the question of which is the most accurate and precise method can certainly be answered as a method of determining soil moisture using a WFD instrument. In Australia, studies to determine soil moisture levels in vegetable crops have compared the use of reflectometers (TDR), vetting front detectors (WFD), and tensiometers. According to the data obtained by measuring the humidity in the unit of volume, the moisture content in the 40 cm soil layer decreased by 19.6 mm in 2–4 days, and by 11.6 mm in 5–7 days, and the difference between them was 6.5–3.9 mm per day. found to be Similar results were found in the third irrigation cycle,

When the tensiometer and vetting front detector were compared after irrigation in layers of 20 and 40 cm, 92% of the vetting front detector installed in the 20 cm layer was <15 kPa, and 74% of the installed vetting front detector was wet at> 15 kPa. was found to be active. When these values were analyzed over a 40 cm layer of soil, it was found that 95% of the vetting front detector was active when the tensiometer reading was <7 kPa, and only 28% of the installed vetting front detector was active at> 7 kPa [7].

R.J.Stirzaker noted that the results of a study conducted by P.A.Hutchinsons on irrigation control using a vetting front detector device when using sprinkler irrigation in a field setting showed that the interval of irrigation was one of the most important aspects in irrigation control [8].

A study by the International Water Resources Management Institute on the use of a vetting front detector to improve the use of irrigation water on small farms in Ethiopia found that a vetting front detector provides a basis for effective water use. It was found that the use of the Vetting front detector increased water efficiency by 9% and productivity by 13–17%. The reduction in the number of irrigations when using this tool also leads to a reduction in the labor force (11 working days per hectare) [9].

According to a study by Brazilian scientists, one of the key questions is "when" and "how much" to irrigate arid areas. The IrrigationTM system was developed to collect data using meteorological servers and organize irrigation based on plant water demand, soil characteristics and meteorological conditions. the data are aggregated into mathematical models, and agro-recommendations are given to farms through evapotranspiration calculations [10].

Conclusion

The use of information technology-based smart irrigation using a new modern WFD tool in making clear and accurate decisions on irrigation will pave the way for achieving high yields and efficiencies. In this case:

- It is advisable to install a total of 3 WFD devices at the beginning, middle and end of the field, where the average field uniformity is observed on farms, to monitor irrigation by installing a WiFi rotor on the edge of the field and sending data to a computer program.

- When using smart irrigation, the optimal duration of irrigation of crops and when to stop watering are clearly defined, saving 10-15% of water resources.

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