UDC 001.891:631.674.6
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BASIC REQUIREMENTS, FEATURES AND DIRECTIONS OF FIELD STUDIES IN THE SETTING OF DRIP IRRIGATION

General requirements, features and prospective trends of field studies in the setting of drip irrigation are given. The list of the works to be carried out before laying a field experiment when using drip irrigation is recommended.
Keywords: *field studies, drip irrigation, requirements, trends of conducting*

Introduction. In Ukraine the study on the effect of drip irrigation on the system "soil -plant-environment" was started in the late 60 's - early 70th of the 20th century by the Ukrainian Research Institute of Irrigated Horticulture, Ukrainian Scientific and Research Institute of Hydraulic Engineering and Land Reclamation and the Institute " Ukrdiprovodhosp". More than 40-year time experience in this field allowed the native scientists to clearly define the benefits of drip irrigation over the traditional methods of irrigation, the scientific basis of technology, design and maintenance of drip irrigation system were developed as well as a broad range of irrigation technics was produced. Stationary field studies were conducted for the most fruit, vegetables, melons and gourds, grapes, potatoes and peanuts.

For today the network of field experiments to study drip irrigation rather large and as a coordination center of the research on these issues is the Institute of Water Problems and Land Reclamation NAAN (IWPLR). Besides IWPLR and its research network (Kamyansko – Dniprovska and Southern ES), the studies on drip irrigation are carried out by the Institute of irrigated agriculture, Mykolaivska ES IIA, Melitopolska ES IH, STC "Institute of Soil Science and Agricultural Chemistry named after O.N. Sokolovsky", Institute of Vegetables and Melons, Dnepropetrovsk and Kherson State Agrarian Universities , National University of Water and Nature Management, Uman National University of Horticulture, Kharkiv National Technical University of Agriculture and others.

The main distinguishing feature of drip irrigation as against sprinkling and surface watering is a local character of soil moistening. It is this and some other features of drip irrigation make allowances to the methodological approaches to the research in the setting of irrigation. Obviously, to obtain reliable, scientifically based experimental data and to develop on their base practical recommendations a unified methodology of field research when using drip irrigation is needed.

The purpose of the article - to cover major issues and focus on the methodological differences when conducting field experiments in the setting of drip irrigation.

The main material. The basic methodological requirements for conducting field studies in the setting of drip irrigation meet the same requirements that are designed for non-irrigated conditions or for sprinkling conditions [1-10]: meeting the principle of a single logical distinction, typical nature of the experiment, carrying out the experiment in a dedicated area with a known history, feasibility of the experiment, yield recoding and determining the reliability and accuracy of the experiment. However, in experiments when using drip irrigation, there are some features that are determined by the specificity of this method of irrigation, namely by the local water supply. Among them the following should be specified: 1. Reference variants (without irrigation) have to be placed from irrigated variants at not less then 5 meters apart, due to the influence of drip irrigation to temperature and moisture of surface layers .

The study of this question was carried out in the testing area of drip irrigation for vegetables of Kamyansko – Dniprovska ES IWPLR in 2006. For this purpose daily thermographs and

hydrographs were set up at different distances from the irrigated variants of the experiment. Based on the experimental data (measurements of air temperature and moisture) it was specified that the effect of drip irrigation on the microclimate levels out at a distance of 5 meters. Therefore the method described by O. Antonov, S. Dudnyk and S. Vaneyan (2001) [2], which proposes placing the variant without irrigation at a distance of 50 m from the irrigated variants, requires to be defined more exactly.

2. The method of watering terms setting is chosen for the following main criteria: efficiency, accuracy and reliability. It was specified that the commonly adopted thermostat - weighting method does not fully meet the criteria of "efficiency", so it should be used only as a reference method for soil moisture determining.

3. Field experiments should be laid on a flat or carefully leveled plot. First of all it refers to the studies that use drip pipes with non-pressure compensation trickles, since the relief type has an influence on trick discharge, that affects the results.

4. Adherence to the principle of a single logical distinction should not lead to the restriction of the conditions under which a particular factor can show their maximum effect. For example, it refers to the density of plants, the number of inter-row tillage and fertilizers and chemicals applying along with irrigation. Plant density on the variations of experiment, both the reference (without irrigation) and irrigated ones should provide maximum productivity of plants. For example, when studying the levels of antecedent soil water for grain maize the optimum plant density on the irrigated variants is 70-95 thousand plants / ha, while in the variant without irrigation it is only - 35-45 thousand plants / ha. The same situation can be observed with inter-row tillage and fertilizers and chemicals applying system: conducting these agronomic practices will differ in irrigated and non-irrigated conditions.

5. For the ground water observation a network of wells is laid.

6. For the accounting of irrigation water volume on the variants the water meters of various designs are used, which should be sealed and calibrated during the study.

Before laying field experiments in the setting of drip irrigation the following activities should be performed:

1. Studying the history of land use, including the degree of weed-infested soil by rhizomatous perennial weeds.

2. Fulfilling a topographic survey at 1:1000 scale with drawing the contours through 0.5-1 m.

3. If it necessary, the surface of the plot have to be leveled with the preservation of the upper fertile topsoil.

4. After leveling it is necessary to carry out a comparable sowing of cereals with farther yield accounting on some This procedure allows to estimate the diversity of productivity indices for the research field and to determine the optimal plot size, plot allocation and the number of repetitions in future [3].

5. Conducting a detailed soil survey, during which the characteristics of soil from the soil pitched are described and specified its fertility. For this purpose, considering the genetic horizons, the soil samplers are sampled with the interval of 10 (20) cm using a solid column. The following parameters are determined from the soil samples:

- soil density in accordance with ISO 11272;
- minimum moisture-holding capacity using the pouring method for a plot [7];
- grain size classification according to ISO 4730;
- structural and aggregate composition according to ISO 4744;
- PH saline, pH water according to ISO ISO 10390;
- hydrolytic acidity according to GOST 26212;
- content of absorbed cations according to ISO ISO 11260;
- organic matter content according to ISO 4289;
- contents of nitrate, ammonia and total soluble nitrogen, labile compounds of phosphorus and potassium according to ISO ISO 14255 , ISO 4405 , ISO 4114 , ISO 4115;

- content of carbonates according to ISO ISO 10693.

6. Determining the hydrochemical composition of irrigation water from the sources, including groundwater, provided their close occurrence (less than 3 m). Hydrochemical composition of irrigation water involves determining pH, soluble forms of NO2, NO3, NH4, P2O5, K2O , Fe, Na, Ca, Mg, Cl, SO4, CO3, HCO3, mineralization, gross forms of N, P2O5, K2O and a content of water-soluble salts.

7. If experimental variants differ in irrigation regimes, it is necessary to organize on them further observations on the dynamics of groundwater through the networking of equipped observation wells.

8. Conducting the monitoring of key meteorological parameters: rainfall, temperature, relative air humidity, wind direction and strength. Directly at the experimental site the amount of rainfall, the temperature of surface layers of air, soil temperature at depth and relative air humidity are measured.

The directions of field research in the setting of drip irrigation.

The entire complex of research related to drip irrigation can be divided into two directions: technical and technological. In the technological direction the most carried out field researches involve the study:

- irrigation regimes and crop water consumption;
- terms, rates and doses of fertilizers, pesticides, growth regulators and of chemicals applying along with irrigation water;
- the influence of local moistening, fertilizing and water of different quality on the soil properties;
- formation patterns of soil moistening zones;
- methods of term setting of vegetation watering;
- layup schemes for drip irrigation pipelines sowing (planting) schemes;
- reaction of varieties and hybrids of crops to the developed technology for irrigation.

Conclusions. It was determined that the effect of drip irrigation on the microclimate levels out at the distance of 5 m. Therefore, the method [2], which proposes placing a variant without irrigation at a distance of 50 m from the irrigated variants was specified . It was also found that the thermostat - weighting method does not meet the criterion of "efficiency", so it should be used only as a reference method for determining soil moisture. The features and perspective directions of research in the setting of drip irrigation are proved. The list of activities to be carried out before laying a field experiment in the setting of drip irrigation is recommended.

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Анотація

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Основні вимоги, особливості та напрями проведення польових досліджень в умовах краплинного зрошення

Наведено загальні вимоги, особливості та перспективні напрями проведення польових досліджень в умовах краплинного зрошення. Рекомендовано перелік робіт, які необхідно виконати перед закладанням польового досліду на краплинному зрошенні.

Ключові слова: *польові дослідження, краплинне зрошення, вимоги, напрями проведення*

Аннотация

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Основные требования, особенности и направления проведения полевых исследований в условиях капельного орошения

Приведены общие требования, особенности и перспективные направления проведения полевых исследований в условиях капельного орошения. Рекомендовано перечень работ, которые необходимо выполнить перед закладкой полевого опыта на капельном орошении.

Ключевые слова: *полевые исследования, капельное орошение, требования, направления проведения*