CALCULATION OF SCANNING BRANCHES USING DATA FOR MAIN BRANCHES OF HYSTERETIC WATER-RETENTION CAPACITY ON THE EXAMPLE OF SANDY SOILS

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A description of the mathematical model of the soil water-retention capacity is proposed taking into account hysteresis in the framework of fundamental physical concepts of the structure and capillary properties of the soil pore space. The computer program «Hysteresis» was developed on the basis of the model. This program has a friendly interactive interface, as well as a number of options that allow to develop scenarios for computer experiments, visualize the experimental data, identify the parameters of the model by the method of fit approximating the measured data with use the optimizing algorithm, implement the graphical presentation of the branches of the hysteresis loop of the soil water-retention capacity (in manual and automatic modes). Computational experiments were carried out to verify the possibility of identifying the parameters of the model from data on the main drying and wetting branches and the accuracy of the predictive calculations of the scanning branches of the hysteresis loop. For the experiments, literature data on two sandy soils were used. The absence of undesirable «artificial pump effect» was proved. For both soils, the accuracy of the prediction of the scanning branches of the hysteresis loop was quite high. The practical significance of the proposed mathematical model and computer program was to ensure the calculation of precision irrigation rates for crops. The application of such rates in irrigation farming will prevent the draining of the excess water beyond the root layer of the soil under the influence of gravity and, thus, minimize unproductive loss of irrigation water, fertilizers, ameliorants and plant protection products. It will also reduce the risk of groundwater contamination with agrochemicals and eutrophication of water objects.

Key words: soils, water-retention capacity, hysteresis loop, scanning branches, irrigation rates.