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Soil water content evaluation in the field by electronic measurements

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The purpose of the present paper attempts to show authors experience in organisation of express and continuous field electronic measurements for soil water content evaluation in the field. Number of authors (Warrick et al, 1986; Bazza et al., 1988; Vereceen et al, 1989; Popova et al, 1999) illustrate, by field data, the influence of crop type, canopy height and structure on the soil surface and profile moisture. Kolev et al (1996), Castrignano (1998) and other authors show that the contact measurements have to carry out in the representative places on the field. Space distributed surface soil water content evaluation can be carried out by remote sensing radiometers and infrared thermometers along measurement lines across the field and using a geostatistic method moisture and thermal maps of the soil surface can be obtained.

The author considers his main task to be the proposing of applicable methods of approach to optimum organization and control of the field electronic measurements, both express and continuous, by using special-purpose sensors, and measuring devices and systems.

Soil water content at 0.2 m, 0.4 m, 0.7 m and 1.0 m depths for different representative plots was measured and soil surface moisture and temperatures along four measurement lines across the field were collected two or three times daily.

There are showed data by numerous conducted contact and remote sensing spatial distributed measurements on the cotton field in South Bulgaria during the growing seasons of 2005 and 2006, using soil moisture meters with electroresistance gypsum blocks and with using a method based on the relationship between the heat dissipation rate and water content or water potencial of a porous body, TDR meters and aircraft radiometer and infrared thermometer.

The soil properties have different values in different zones of the agricultural field. No effective method for evaluating one or other property distribution is established, but there is an opportunity to use a pattern for an ordered set of closed isolines and it is possible to consider the unhomogeneous field as numerical homogeneous zones, a concept first suggested by Uchitomi and Mine (1988). The maps showed, that areas with high radiation temperatures correspond with low soil water content areas.

Canopy structure is another factor setting restrictions on the homogenity of the soil propertiescand the soil water content differ under the plants and between the rows of row-crop canopies, and depend on the fraction of soil surface exposed to direct sunlight. The area of this fraction can be calculated based on the relationship between the sunlight transpiration, leaf area index and leaf angle distribution. The maps showed, that areas with high radiation temperatures correspond with low soil water content areas.

A way to evaluate soil water content at heterogeneous fields based on tree-root method and representative plot areas has been presented. The measurements in single representative areas, combined with space distributed soil surface measurements done by an aircraft radiometer and infrared thermometer can be widely used to evaluate the main components of soil water balance budget of the heterogeneous agricultural fields.

Thermal maps of the soil temperatures show relation between surface temperature of the soil on one hand and soil water content on the other hand, expressed by relative irrigation depths application.