MONITORING AND MANAGEMENT OF AGROECOSYSTEM WATER STATUS FOR PROTECTING ENVIRONMENT AND ESTABLISHING SUSTAINABLE AGRICULTURE

The monograph, entitled **MONITORING AND MANAGEMENT OF AGROECOSYSTEM WATER STATUS FOR PROTECTING ENVIRONMENT AND ESTABLISHING SUSTAINABLE AGRICULTURE,** reveals the necessity of fundamental deterministic approach to build the complete scientific basis for solving agrarian and ecological problems through application of high-scientific technologies. Integrated management of water and nutrient statuses of agroecosystem (soil-plant population-ground layer of atmosphere system), based on these technologies, is the objective prerequisite for both further development of sustainable agriculture and environment protection.

CHAPTER 1 deals with the problems existing up to now and concerning the water status of each agroecosystem. It considers its solution on the base of last top scientific and technological attainments. It reveals the ecological and economic importance of their putting into the wide agricultural practices. It points out the cardinal steps, which should be made for overcoming the common difficulties to be solved by farmers, their cooperatives and agrarian associations. It substantiates an innovation approach for applying the top attainments.

CHAPTER 2 reveals the present tasks of water status management of each agroecosystem through the basic requirement to create a suitably chosen energy level of soil moisture in each agricultural field. From present-day point of view, it formulates and analyzes the shortcomings of the previous "scientific" base and practical activity for regulating the water regime in Bulgaria and some other countries.

CHAPTER 3 presents *an improved scientific basis for monitoring and managing the water status of each agricultural field.* This scientific basis consists of universal regularities for calculating: (a) the changes in transitory and maximum-allowed water deficit in the root layer of soil during growing season; (b) the actual and reference evapotranspiration; (c) the dew point for each day-and-night; (d) the daily solar radiation; (e) the reduction of measured wind speed at different heights toward 2 m; (f) the biological function of each crop; (g) the changes in thickness of soil root layer for different crops during growing season; (h) the part of close underground water in evapotranspiration process; (i) the expected date and rate for watering in each field; etc. We use a coefficient of watering efficiency for each field. We introduce two new indices for determining the drought power.

CHAPTER 4 deals with the input and output information, which is necessary for technology for monitoring and managing to function through the current creation of irrigation schedules, corresponding to fixed energy levels of soil moisture to be created in the field. We present an organization scheme for practical application of the technology and its versions. We point out the advantages of this technology, which are compared to the previous methods applied in the Bulgarian agriculture.

CHAPTER 5 reveals the impact of agroecosystem water status on the contents of nitrogen, phosphorus and potassium in soil after the creation of different energy levels and obtaining the corresponding amounts of maize grain yield. We present experimental data obtained under field conditions.

CHAPTER 6 shows experimental results on the nutrient losses from the agroecosystem with the surface (water and soil solid) runoff under conditions of different fertilization rates.

CHAPTER 7 describes the experimental scheme under field conditions and the model for simultaneous movement of water and nitrates in soil profile. We applied the model and obtained data on the rates of total nitrate exchange between layers of soil profile, as well as the rates of convection and dispersion. We determined the total rate of nitrate absorption by plants and nitrate transformation by microorganisms for different soil layers.

CHAPTER 8 reveals the dependence of nutrient content (nitrogen, phosphorus and potassium) accumulated in over-ground maize biomass on the created energy levels of agroecosystem water status.

CHAPTER 9 analyzes the influence of agroecosystem water status under irrigation and non-irrigation on the productivity for different ways of carrying in the nitrogen rate. Precise field experiments to take into account the susceptibility of reducing crop yield to water shortage at different (extreme-critical, critical and important) stages of ontogenesis.

CHAPTER 10 shows the impact of basic meteorological factors on evapotranspiration process and agroecosystem water status. It analyzes the link between evapotranspiration under natural water status (no irrigation) and the established equivalent energy level of soil moisture.

CHAPTER 11 discusses the inexpediency of the traditional design solution for irrigation schedules. It considers the application of *the new precise management of crop water status* in wide agricultural practices as *a new reserve of productivity*. We present specific exploitation schedules of irrigation, which are obtained using the new technology. Implementing these schedules, we practically created the energy levels (5, 10 and15 $J^{1/2}/kg^{1/2}$) of soil moisture in field during growing season of many years. We analyze the variability of schedules for creating one and the same energy level of soil moisture in many years. We apply newly introduced terms and indices for identifying the drought start and its degree of deepening. We make the readers acquainted with interesting data on "reference" schedules of irrigation, which are based on averaged (over a period of 10 years) day-and-night meteorological indices.

CHAPTER 12 and 13 deal with experimental data obtained from two multi-annual complex field experiments, as well as with the regularities concerning the impact of agroecosystem water status on the amount and quality of bioproductivity. We introduce the new biophysical terms: *differential and total susceptibilities of crop population*.

CHAPTER 14 introduces a new ecological index of precipitation, as well as two quantitative terms: *physical and biological utilization of each precipitation* , and methods for their determination. We develop and elucidate a new biophysical conception on the link between water status and productivity of agroecosystem. We offer a new classification for estimating the maize agroecosystem productivity.

CHAPTER 15 offers new scientific bases for integrated management of water and nutrient statuses of an agroecosystem. We present improved equations for calculating the fertilization rates, taking into account the soil water status to be created during the growing season for the first time in the agricultural sciences and practices.

CHAPTER 16 makes the readers acquainted with the established climate changes and their influence on the agroecosystem water status. We reveal some basic regularities in the formation and pollution of water with nitrates.

The offered scientific monograph is addressed to research professionals and lecturers working on water status of agroecosystems and their productivity, as well as to students and post graduate students (M.Sc. and Ph.D.) in the areas of *ecology, soil science, soil physics, biology, plant science, agrometeorology, hydrology, hydro-amelioration and applied mathematics*.