CORRELATION OF WATER CONSUMPTION DURING IRRIGATION OF COTTON WITH THE DYNAMICS OF FLOOD WATER LEVELS MATHEMATICAL MODEL

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DOI: 10.5958/2249-7137.2022.00740.6

ABSTRACT

This article provides information on the creation of a mathematical model of water consumption in the irrigation of cotton, depending on the change in the level of seepage water during the movement of salts and soil moisture. The world has 1,500 million hectares of drylands and 932 million hectares of saline soils, of which 32 million hectares are directly affected by salts. . A similar situation was observed in the Jizzakh and Khorezm regions, and it was noted that, respectively, the increase in the level of flood waters has changed.

KEYWORDS: *Groundwater Level, Mathematical Model, Elements, Soil, Soil Moisture, Soil Saturation, Equation, Aeration, Formula.*

INTRODUCTION

As a result of global climate change in the world, changes are taking place in all geosystems, an increase in the level of the world's oceans, melting of ice and permafrost, an increase in the unevenness of precipitation, a change in the regime of river flow and other changes associated with climate instability. According to the International Food and Agriculture Organization (FAO), the International Institute for Environment and Development and the World Resources Institute, about 30% of the irrigated area in the world is lands with varying degrees of salinity. They are mainly distributed in dry (arid) regions (China, India, Mexico, Pakistan, USA, Australia, etc.). The world has 1,500 million hectares of drylands and 932 million hectares of saline soils, of which 32 million hectares are directly affected by salts.

In connection with global climate change, shortage of water resources, deterioration of the reclamation state of lands, world scientists are conducting scientific research in certain areas to create additional water reserves and introduce water-saving technologies. In the world, agriculture on saline and saline soils, the use of the phytomeliorative effect of plants to improve land reclamation, improve physical properties and soil salinity without disturbing the ecological balance, increasing its productivity.

Availability in our republic 4.3 Of the one million hectares of irrigated land, about 2 million hectares, or 45 percent, are saline areas of varying degrees. Therefore, it is important to conduct research aimed at developing phytomeliorative measures in order to reduce the negative effects of low water on saline lands, ensure a stable and high crop yield, reduce chemical reclamation measures while improving land reclamation, and increase the efficiency of using water resources for salt washing and irrigation.

The level of knowledge of the problem. Extensive scientific research on the procedure and methods of irrigating crops in irrigated agriculture, reclamation of saline soils, the timing of salt leaching, norms and technology, biological drainage and phytomeliorative measures on the water-physical properties of the soil, nutrition, plant growth, development, productivity and quality were carried out in our Republic by such well-known scientists as S.N. Ryzhov, V.E. Eremenko, M.P. Mednis, A.E. Nerozin, R. Akhmedov, A.A. M.Mirzazhonov, F.M.Rakhimbaev, R.K.Ikramov, Sh.Nurmatov, M.Kh.Khamidov, A.E.Avliyakulov, B.Mambetnazarov, O.R.Ramazonov, F.A. Murodov, U. Norkulov, A. Isashev, A. S. Shamsiev, S. Kh. , David Molden, Liu H, Al-Nadi, [1, 2, 3,4, 5, 6, 7, 8, 9, 10, 11, 12].

However, to date, in conditions of low water, sufficient research work is being carried out to prevent soil salinization, save water resources and improve reclamation conditions, increase the efficiency of the mathematical model in the regions, at different depths of water seepage, when irrigating cotton, and increase the efficiency of using water resources when irrigation was not carried out.

The purpose of scientific work is creation of a mathematical model by analyzing the theoretical foundations soil moisture and soil saturation depending on the saturation of the soil with water used for irrigation cotton , taking into account global climate change.

Object of study. Scientific researches are different degree of salinization of soils of Khorezm, Jizzakh and Syrdarya regions, the level of water supplied to cotton, the level of seepage water, the type of cotton.

Subject of study. Development of a mathematical model of water consumption for cotton irrigation in conditions of different levels of salinity in our republic, the effect of soil moisture on cotton yields depending on regions with different water content.

Experimental methods: Field experiments at the Research Institute of Agrotechnologies of Cotton Growing and Seed Growing "Methods of agrochemical, agrophysical and microbiological research in irrigated cotton areas " (PSUEAITI , 1963), "Methodology of field experiments with a breadmaker " (PSUEAITI , 1981) and field experiments were carried out (Tashkent, 2007).

Research results

We summarize formula (1), formula (3) and formula (11) into one system:

$$\left.\begin{aligned} h &= \left[g\frac{l}{V_0^2}Fr + \lambda\frac{V}{l\cdot V_0}\cdot Re\right]\cdot l \\ W(x,t) &= k_0\frac{h+H_k+l}{l} \\ \mu_0\frac{\partial H}{\partial t} &= \Pi_x\frac{\partial^2 H}{\partial x^2} + W(x,t) \end{aligned}\right\} \qquad \text{(one)}$$

As a result, formula (1) was obtained in the form of a system of mathematical equations describing the interaction of surface and ground waters.

We transfer the first and second equations of the system of equations of formula (1) into equation (1), as a result, we obtain a mathematical model expressing the relationship between the depth of water flow in the aeration zone, the intensity of saturation in the aeration area and the dynamics of the depth of water infiltration:

$$\mu_0\frac{\partial H}{\partial t} = \Pi_x\frac{\partial^2 H}{\partial x^2} + k_0\left\{\frac{H_k+L}{L} + \frac{l}{L}\cdot\left[g\cdot\frac{l}{V_0^2}\cdot Fr + \lambda\frac{\nu}{l\cdot V_0}\cdot Re\right]\right\} (2)$$

Now let's carry out a numerical experiment of equation (2).

For this, first $x = L\bar{x}$we introduce dimensionless parameters of the form and $t = \frac{L^2}{V}\cdot\tau$Then equation (2) takes the form:

$$\mu_0\cdot\frac{\nu}{L\cdot V_0}\frac{\partial H}{\partial t} = \frac{\Pi_x}{L\cdot V_0}\cdot\frac{\partial^2 H}{\partial x^2} + \frac{L}{V_0}W \qquad (3)$$

both sides of equation (3) $\frac{L}{V_0}$multiply by —and —take into account the criteria, In equation (3) will look like this:

$$\mu_0\frac{1}{Re}\frac{\partial H}{\partial t} = \frac{1}{Pe}\frac{\partial^2 H}{\partial x^2} + \frac{L}{V_0}W (4)$$

In formula (4) to solve the equation, we introduce a function of the following form:

$$H(\bar{x},t) = e^{\gamma\tau}\cdot f(\bar{x}) (5)$$

Equation (4) from formula (5) takes the form:

$$\frac{1}{Pe}\frac{\partial^2 f(\bar{x})}{\partial x^2} - \mu_0\cdot\gamma\cdot\frac{1}{Re}\cdot f(\bar{x}) + e^{+\gamma\tau}\cdot\frac{L}{V_0}\cdot W = 0 \quad (6)$$

Let's write down $f(\bar{x})$desired function as follows:

$$f(\bar{x}) = e^{\beta\bar{x}} (7)$$

Formula (7) formula (6) _ let's let's take this is:

$$\frac{1}{Pe}\beta^2 - \mu_0\cdot\gamma\cdot\frac{1}{Re} + \frac{e^{-\gamma\tau}}{e^{\beta\bar{x}}}\cdot\frac{L}{V_0}\cdot W = 0 (8)$$

или же

$$\left.\begin{aligned}\beta_1 = -\sqrt{\mu_0\gamma \cdot Pr - \frac{e^{-\gamma\tau}}{e^{\beta\bar{x}}} \cdot \frac{L}{V_0} \cdot Pe \cdot W}\\ \beta_2 = -\sqrt{\mu_0\gamma \cdot Pr - \frac{e^{-\gamma\tau}}{e^{\beta\bar{x}}} \cdot \frac{L}{V_0} \cdot Pe \cdot W}\end{aligned}\right\} (9)$$

If the expressions of formula (9) are transferred to formula (7), then the function will have the following form:

$$f(\bar{x}) = B_1 exp\,(-D\bar{x}) + B_2 exp\,(D\bar{x}) (10)$$

Here$D = \sqrt{\mu_0\gamma \cdot Pr - exp\,(\beta\bar{x} + \gamma\tau) \cdot \frac{L}{V_0} \cdot Pe \cdot W}$

$$\left.\begin{aligned}f(\bar{x})|_{\bar{x}=0} = 1\\ f(\bar{x})|_{\bar{x}=\bar{h}} = exp\,(\lambda\bar{h})\end{aligned}\right\} \quad (11)$$

Using formula (11) of the boundary conditions, we obtain a system of equations for finding the coefficients in formula (10) of the expression:

$$\left.\begin{aligned}B1 + B2 = 1\\ B_1\exp(-\mathrm{D}\cdot\bar{\mathrm{h}}) + \mathrm{B}_2\exp(\mathrm{D}\cdot\bar{\mathrm{h}}) = \exp(\lambda\bar{\mathrm{h}})\end{aligned}\right\} (12)$$

Formula (12) solving linear algebraic equations by the Cramer method, V_{one} and V_2 find the values of the coefficients:

$$\left.\begin{aligned}B_1 = \frac{1}{\Delta_0}\left[exp\,(D\bar{x}) - exp(\lambda\bar{h})\right]\\ B_2 = \frac{1}{\Delta_0}\left[exp\,(\lambda\bar{h}) - exp(-D\bar{h})\right]\end{aligned}\right\} (13)$$

From formula (13) we find the expression of the function of formula (10):

$$f(\bar{x}) = \frac{1}{\Delta_0}\left\{[\exp(D\bar{x}) - \exp(\lambda\bar{h})] \cdot \exp(-Dx) + \left[\exp(\lambda\bar{h}) - exp(-D\bar{h})\right] \cdot\cdot\, exp(D\bar{x})\right\} (14)$$

Formula (12) is transformed into formula (5), and as a result, we obtain a mathematical model representing the dynamics of the level of seepage water in the soil saturation zone during irrigation:

$$H(\bar{x}, \tau) = \frac{e^{\gamma\tau}}{\Delta_0}\left\{[\exp(D\bar{x}) - \exp(\lambda\bar{h})] \cdot \exp(-Dx) + \left[\exp(\lambda\bar{h}) - exp(-D\bar{h})\right] \cdot exp(D\bar{x})\right\} (15)$$

A mathematical model has been developed that represents the change in the level of seepage waters at the water saturation of the soil at an arbitrary point in time spent in the research. Numerical experiments of the formula of the mathematical model (15) were carried out on the basis of the parameters of the research complex carried out in the conditions of the Syrdarya, Jizzakh and Khorezm regions and compared with the results of experimental studies.

The level of seepage water in the conditions of the Syrdarya region is 2 meters, the level of seepage water in the conditions of the Jizzakh region is 2.5 meters, the level of seepage water in the conditions of the Khorezm region is 3 meters. According to the results obtained, in the conditions of the Syrdarya region, the increase in the level of flood waters for the first decade of February averaged -8.5 cm, and for the five-day period of June -27.4 cm. A similar situation was observed in the Jizzakh and Khorezm regions, and it was noted that, respectively, the increase in the level of flood waters has changed. In the Jizzakh region, with 2.5 m of precipitation, it was 46.9 cm (in the 3rd decade of June), and in the Khorezm region, with 3 m of precipitation over the same period, 29.6 cm. The average rise in water level was -15.2 cm, in July - 43.6 cm and in September - 32.3 cm. It was established that it was 28.2 cm, in August and September - 23.4 cm.

CONCLUSION

Based on the parameters of the research complex conducted in the conditions of the Syrdarya, Jizzakh and Khorezm regions, a mathematical model has been developed that reflects the change in the level filtration water when the soil is saturated with water.

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