**UDC 631.432**

# Justification irrigated farming technologies on the example of moistures behavior in soil

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**Summary**
This article presents research results on the problem Southern Urals irrigated black earths rational use on the in-depth knowledge basis of their water properties.

***Keywords****:* black earth, lowest moisture content, humidity rupture capillary connections, sustainable wilting humidity, active range of moisture, irrigation regime.

One of the ways of black earths rational use that maintain their stability at high agrogenic load are soil conservation and water saving technologies development on the basis of in-depth study water properties and moisture behavior in soil profile. These data are not only theoretical and experimental feasibility study but also forecast performance of technologies eliminates possibility of soils degradation under irrigation.

Irrigated agriculture is actual in South Urals. Studying features of moisture behavior in soil becomes important at the same time. Methodologies offered by M.M. Abramova [1] and A. A. Rode [3]. However current methodologies doesn't account for these features [2].

The phenomena retention and downward movement of water has the lowest moisture capacity (LWC) used to determine irrigation regimes as the upper limit of moisture. For the lower limit of moisture availability adopted sustainable wilting humidity (HW).

On the black earths of Southern Urals leached heavy loamy with favorable properties performed revealing reasons of low crop productivity under irrigation technologies adopted. To do this thoroughly studied soil and its hydrological constants characterizing the retention, movement of moisture in the soil and its availability to plants (see Table 1).

Table 1 - Soil and its hydrological constants

| Soil hydrological constants | Soil layer, sm | Moisture | | Moisture stocks, mm |
|---|---|---|---|---|
| | | %, by soil weight | % by LWC | |
| LWC | 0-50 | 28,3 | 100 | 171 |
| | 0-100 | 28,0 | 100 | 362 |
| HRCC | 0-50 | 20,9 | 73,9 | 125 |
| | 0-100 | 20,4 | 72,9 | 262 |
| HW | 0-50 | 13,0 | 46,0 | 78 |
| | 0-100 | 11,0 | 39,3 | 153 |
| AMR | 0-50 | 15,3 | 54,1 | 93 |
| | 0-100 | 17,0 | 60,7 | 209 |

Nature moisture retention corresponding HRCC are capillary forces of nature. Due to the pressure difference of upper and lower meniscuses water retained in the soil pores. By increasing curvature of upper meniscus during evaporation pressure difference arises therefore reducing their surface pressure as a result of emerging humidity and suction pressure gradient causes water to the soil surface. If moisture accumulation suspended HRCC move together with the moisture adsorbed by surface of soil particles which has a higher suction pressure than capillary moisture, therefore less mobile than capillary water. The HRCC value is the limit of optimum soil moisture below which (up to HW) availability moisture plants decreases sharply. The moisture consumption in a root layer as a result of desucktion, transpiration and physical evaporation can cause moisture capillary subcurrent from reserve layer of 50-100 cm to root layer if humidity in it exceeds HRCC.

Having information about rising water movement phenomenon in a particular soil and using experimentally derived constant humidity rupture capillary connections (HRCC) in developing irrigation mode you can know, can whether the moisture rising from the reserve layer in the root and calculate the optimal threshold preirrigation reduce soil moisture by state HB (table 2).

Table 2 – Preirrigation threshold of decrease in humidity of the soil

| Soil layer, sm | Limit moisture reduction | | | | | | Inaccessibility of moisture | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | used in practice (LWC-HW) | | | optimal (LWC-AMR) | | | | | | |
| | %, by soil | % by | mm | % by soil | % by | mm | % by soil | % by | % by | reserves, |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | weight | LWC | | weight | LWC HB | | weight | LWC | AMR | mm |
| 0-50 | 15,3 | 54,0 | 93 | 7,4 | 26,1 | 46 | 7,9 | 27,9 | 51,6 | 47 |
| 0-100 | 17,0 | 60,7 | 209 | 7,6 | 27,1 | 100 | 9,4 | 33,6 | 55,3 | 109 |

Although active moisture range (AMR) in this black earth wide, hard-to-plant moisture in it in the form of individual cups in the capillaries of the soil has a high performance and is in the layers 0-50 cm and 51.6 cm, respectively 0100 and 55.3% from AMR

If the moisture flow from the 0-50 cm layer at optimum moisture reduction shall be 46 mm, in practice 93 mm and inaccessible plants moisture reduces productivity, is 47 mm. This reason for the low efficiency of irrigated agriculture, when watering appointed at lower soil moisture below the HRCC, up to HW.

**Conclusion.** Evidence-based humidification modes to control irrigation norms, power humidified layer must be built in compliance with the optimal threshold preirrigation reduce soil moisture, soil corresponding constant HRCC.

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