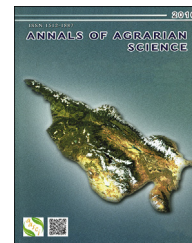


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Determination of optimal irrigation rates of agricultural crops under consideration of soil properties and climatic conditions

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ABSTRACT

In conditions of increasing water shortage, further development of irrigated agriculture production is impossible without improving the methods of cultivation of agricultural crops, primarily irrigation technology. In 2015 the experiment have been conducted on the territory of irrigation farming area of village Tamarisi (Marneuli Municipality), according to which comprehensive study of local climatic and soil conditions were conducted. Received data were used for computation crop water requirements for tomato and melon under the different irrigation treatments. Obtained results have shown the possibility of water use efficiency and obtaining sufficiently high yields of crops that participated in the experiment that became possible in a case of usage of drip irrigation technology in combination with plastic mulch.

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Introduction

According to the soil and climatic conditions, the territory of Georgia is specific, hence it is divided into 22 agricultural zones. This explains the different character of agriculture and, accordingly, necessity for considering an appropriate land reclamation (ameliorative) measures.

Optimal management of water resources in agriculture, which mainly considers selection of optimal parameters of irrigation regime in order to get the regular and sustainable yield, while maintaining of the ecological balance, stays as one of the actual problem nowadays.

Errors while selection of irrigation regime is mainly stipulated in the models describing the soil moisture dynamics due to the negligence of some physical or mechanical properties of

soil, water and air modes data, evapotranspiration, agro-climatic indicators, etc.

Therefore in irrigation farming, development of existing or new areas for some of specific hydrogeological, rheological landscape and other conditions, require scientific methods of cultivation. The main aim of the article is to determine an optimal irrigation regimes of agricultural crops, including proper irrigation scheduling, especially during the period of plant growth through consideration of soil properties and evapotranspiration (ET).

Experimental section

In 2015 the experiment was conducted at Tamarisi village experimental site in the Marneuli Municipality, which is an

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integral part of the administrative borders of Kvemo Kartli Region (44°47'58" East longitude and 41°29'24" North latitude, elevation – 420 m above sea level).

Situated in fertile alluvial plains of Khrami Rivers, and with availability of appropriate irrigation facilities, from agricultural point of view Marneuli Municipality is pretty prosperous area. A cattle breeding is also predominant. This region is said to have been producing half of the total Georgia's production of vegetables, meat and milk products.

Marneuli Municipality is located in the accumulative depression of Kvemo-Kartli Region in Southern Georgia. Topography is predominantly undulating and dotted with low range hills. Topography in the south, towards River Khrami is predominantly plain.

Comparatively, Marneuli city is located on the higher elevation than its surroundings. Town mostly drains into River Alageti.

Marneuli Municipality can be best described as having moderately humid subtropical climate, and is characterized with climate zones, as determined by the relief. In general, the territory has a moderately warm steppe climate, with hot summers. Experimental area (Tamarisi village) is located in the lower part of Marneuli Municipality, where the climate is subtropical and dry. There is almost no snow in winter. Stable snow cover is formed only in the mountains and forests. According to the Marneuli weather station (which is located at 432 m above sea level) the average air temperature in January (the coldest month) is 0-(+0.7 °C and in July (the hottest month) – (+)23.9 °C. Absolute value of minimum air temperature is (-)25 °C and maximum temperature is (+)40 °C. The vegetation period lasts for 7 months.

In Marneuli the annual precipitation is 444 mm, among which 121 mm falls in cold seasons (XI–III months). The long sunny days are typical for this climate.

It should be noted, that municipality is characterized with optimum climate for agricultural production. Due to the suitable climate conditions it is possible to harvest 2–3 times a year (see Figs. 1–6).

Marneuli Municipality is in the Madneuli-Poladauri sub-zone of Bolnisi zone. This sub-zone is characterized by Eocene volcanic and sediment strata; Oligocene and Oligocene Miocene terrigenous, and in small areas Pliocene and Upper Cretaceous carbonate-volcanic formations. According to

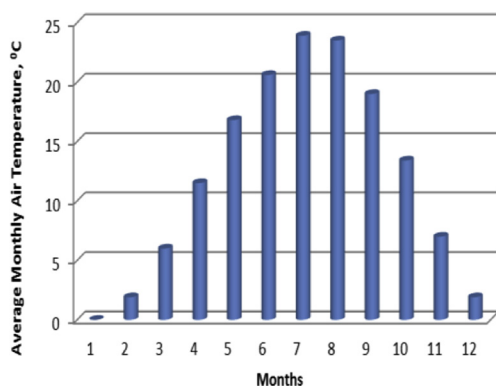


Fig. 1 – Average monthly air temperature, °C.

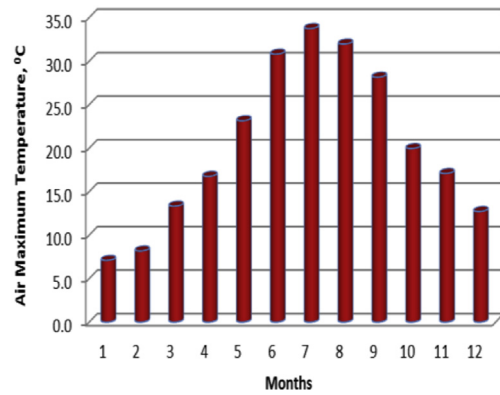


Fig. 2 – Air maximum temperature, °C.

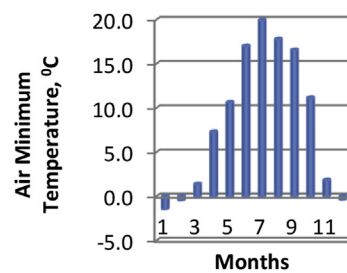


Fig. 3 – Air minimum temperature, °C.

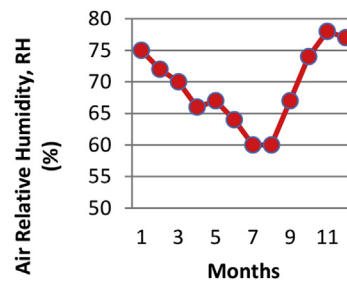


Fig. 4 – Dynamics of the air relative humidity.

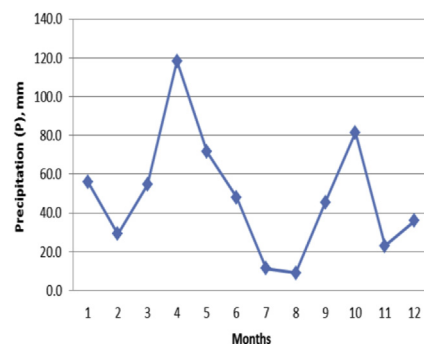


Fig. 5 – Dynamics of atmospheric rainfall.

seismic zoning map, Georgia is classified into Zone 6 to Zone 9 (in increasing order of seismic intensity) and Marneuli falls under Zone 7 (strong seismic intensity zone). However, there is no recent history of earthquakes in Marneuli.

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