As climate change has a major impact on farmers 'work schedules, planting and digging deadlines are adjusted. The study found that soil temperature correlates with exponential dependence on precipitation (fig. 2). The correlation coefficient r = 0.69, and when assessing the relationship between soil temperature and ambient temperature, a linear dependence and coefficient of determination R = 0.5649 were found, and the correlation between these two environmental phenomena is very strong at r =0.751.

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CALIBRATION PROCESS OF SOIL MOISTURE MEASUREMENTS

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Продуктивность роста растений зависит от местных свойств почвы и климатических условий, уровня углекислого газа в атмосфере. Интеграция в европейскую систему мониторинга окружающей среды путем применения стандартизированного индекса осадков для определения не только метеорологических засух, но и сельскохозяйственных засух очень важна для Литовского региона. Целью работы является сравнение значений продуктивной влажности почвы, полученных термостатическим методом с использованием измерений с автоматических агрометеорологических станций (типа Watermark).

Plant growth productivity depends on local soil properties and climate conditions, carbon dioxide level in atmosphere, genetic properties of plant species, growth phase, pests, diseases, etc.

Annual precipitation deviation from the mean value (in long-term period) is up to 40 % and monthly deviations achieve 60 %. Such high irregularity has very adverse effect on agriculture [1]. Droughts in Lithuania occur periodically and became more frequent during the last decades; droughts of different intensity and duration occur almost every year [2]. Within the period 1961-1995, disastrous droughts of local significance recurred approximately every 9 years [3].

Integration in European environment monitoring system by applying the Standardized Precipitation Index to identify not only meteorological droughts, but also agricultural droughts is very important for Lithuanian region. The World Meteorological Organization (WMO) recommends applying SPI to identify a meteorological drought; therefore, alignment of long-term monitoring data and rating scale adjustment is necessary in order to adapt it to our region and use it for identification of agrometeorological droughts in Lithuania [4].

The aim of the work is to compare the values of soil productive moisture obtained by a thermostatic method using measurements from automatic agrometeorological stations (Watermark type) and determine drought period values for soils of different granulometric compositionюThe following major criteria were applied to select the research object location: the established regions of Lithuanian climate, prevailing soils, network of Agrometeorological, and meteorological stations.

Soil moisture in meteorological stations is monitored using a porous gypsum block meter, where voltage drop (resistance) is measured between electrodes contained in porous material (gypsum block), having a direct contact with a soil.

Watermark moisture sensors are installed in Lithuanian agrometeorological stations. These sensors are intended to estimate agrometeorological conditions; therefore, they are installed at depths of 20, 50, and 100 cm. Interpretation of moisture meter values are: 0-10 cbar-saturated soil, 11-29 cbar-soil is relatively humid (excluding coarse sandy soils), 30-60 cbar-normal period for irrigation, 60-100 cbar-time to irrigate heavy clayey soils,100-200 cbar-soil becomes more and more dry.

Instrument calibration was carried out using mathematical-statistical methods: monitoring data was recorded in the stations, and soil moisture was analysed using direct thermostatic-weight method[5]. The soil was analysed at the three layers: in depths of 20, 50, and 100 cm. Sampling during research was arranged so as to ensure reliability of statistical array, considering humidity conditions of a certain period.Moisture content in a soil layer V_n (mm) was determined using the following formula :

$$V_n = \frac{W_n \cdot \gamma \cdot h}{10}, \qquad (1)$$

Where: W_n – moisture level in each soil layer %; γ – soil density, g/cm^3; h – soil layer thickness, cm.

In Dotnuva experimental plot soil is clay, where taken 150 soil samples, in Mol4tai We have – havy clays and was explored 61 soil sampl.

Graphical comparative analysis of moisture values determined by different methods (Watermark and experimental) (Fig. 2) shows that moisture dynamic variation is similar, values have the same graphical trends, and graph peaks approximately correspond to the soil moisture results obtained by the both methods.

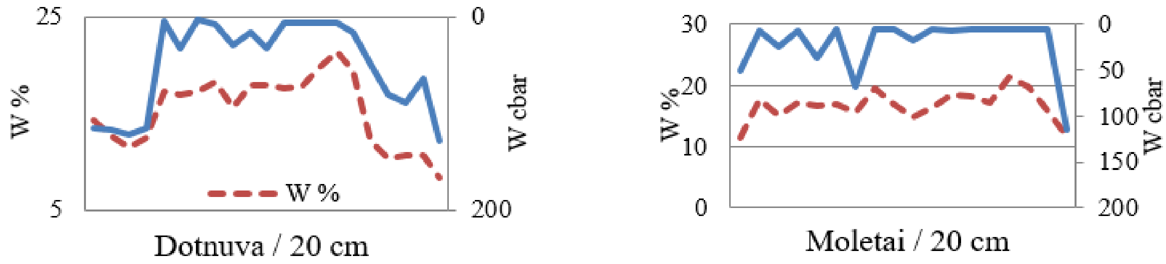

Fig. 2 Graphical comparison of daily average soil moisture values measured in meteorological stations using moisture meter and thermostatic method, cbar and percent (----- W, %; W cbar.)

The used moisture measurement instruments *Watermerk* have no relation with a volumetric soil moisture expression; therefore, moisture values are measured only in cbar. In order to estimate the actual moisture reserve, instruments have to be calibrated, i.e., cbar has to be linked to moisture contents by % or volume (mm).

In Dotnuva, soil is calcareous; soils between 40 and 60 (50) cm from ground surface are gley at the range of 50 cm below ground surface or up to the depth of 50 cm from the bottom of humus horizon arable layer. There is a strong relationship direction and inverse relationship between the numeric values of daily average soil moisture W_0 cbar and moisture determined by the direct-volumetric method W (Fig. 3). Actual data covering drought period constitutes ~19 percent of the total number of samples.

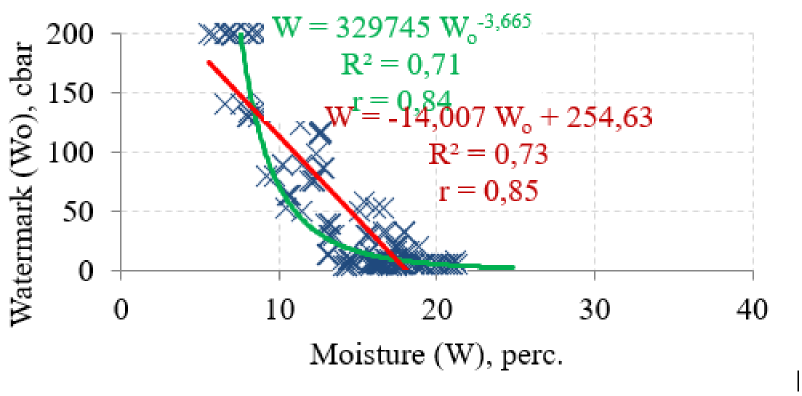

Fig. 3. Calibration diagram of numeric values of daily average soil moisture W_0 cbar measured by the Dotnuva moisture meter and moisture determined by the direct-volumetric method W

Plant fading moisture level in clayey soils is reached when moisture reserve in a soil drops down to 5.6-6.2 percent. Data consistency analysis shows that this value corresponds to Watermark instrument values of ≥160 cbar in a clayey soil.

In Molėtai correlative relationship of the numeric values of daily average soil moisture W_0 cbar measured by a moisture meter and moisture determined by the direct-volumetric method Wis inverse and strong, theoretically described by a power function. The major part of measuring results (~60 percent of total samples) is between 15 and 20 percent. Plant fading moisture level in heavy clayey soils is reached when moisture reserve in a soil drops down to 9.1-10.2 percent. Data consistency analysis shows that this value corresponds to Watermark instrument values of ≥100 cbar in a heavy clayey soil. Based on the completed analysis of the entire period values and the summarized results, it was determined that estimation of plant growth conditions period by HTK and actual soil moisture reserve (W, cbar) differ approx. 2-fold (according to HTK – 31 % wet and according to Watermark – 15 % wet).

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ANALYSIS OF AGRICULTURAL DEVELOPMENT OPPORTUNITIES USING GIS TECHNOLOGIES

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Цель данной работы – продемонстрировать возможности применения ГИС-технологий для определения территорий выбранного района, где в соответствии с действующими в Литве правовыми нормами возможно органическое земледелие. Программное обеспечение ArcGIS и функции пространственного анализа были использованы для достижения цели работы. Сначала были установлены 5 критериев в соответствии с действующей в Литве правовой базой, в которой развитие экономической деятельности ограничено или невозможно, а затем была произведена оценка продуктивности земель.

Since ancient times, Lithuania has been an agrarian country where agriculture occupies an important part of the economy. In order to improve traditional farming,