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ASPECTS REGARDING REQUIREMENTS OF THE RAPESEED CULTURE TOWARDS THE CLIMATIC CONDITIONS. CASE STUDY: THE IALOMIȚA COUNTY, ROMANIA

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Abstract

Being a plant specific to the temperate climate with mild winters, cool and humid summers, the rapeseed is currently one of the world's most important oil plant species, being cultivated for its oil rich seeds. The main purpose of this study is to analyze the relationship between climatic conditions and the rapeseed culture for the time interval 1990 – 2013, in the context of the climate changes. The analysis was based on the climate data collected from the meteorological stations from Urziceni, Griviţa and Slobozia, on the data regarding the rape cultivated area and production in the territory of the Ialomiţa County. The research was carried out in the Southern Romania, in the second favorability degree area for the rapeseed culture. With the help of the analyzed data, the variability in time and space of the rapeseed culture in relation with the climatic conditions has been highlighted.

Key words**:** *climatic conditions, productions, rapeseed, Ialomiţa*

INTRODUCTION

Rape is one of the most important plants grown in Europe, with an average area of 6.6 million hectares cultivated and an average production of 21.6 million tonnes [8]. This is due to increased demand for vegetable oil and agronomic advances that make production more efficient and more profitable. It is a plant that prefers a temperate ocean climate with mild winters and an average annual temperature of 7–10°C [10]. Big rapeseed or autumn rapeseed is currently one of the most important oil species in the world due to the oil content of 42–48% [12]. Rapeseed has a multiple use in the textile, leather, plastic industries or as a feed or melliferous plant. In autumn, the rapeseed culture has two important stages, namely: first, from sowing to starting of winter and the second one at the winter outing, when the cycle of vegetation is resumed to maturity and harvest. In achieving the maximum production, it is necessary that soil, plant, soil or hybrid, lack of pests and pathogens, but especially climatic conditions to be optimal. The autumn rapeseed may have low productions due to drought at sowing, weaker winter resistance, especially when there is no snow cover and higher susceptibility to brumishes during blooming so that knowing the climatic factors plays a major role in the agricultural management of the culture [4].

In Romania, the rapeseed has been cultivated since the 19th century, disappearing from culture in the middle of the last century, but in the early 2000s, it was reintroduced and expanded into culture. The degree of favorability of the rapeseed is higher in the Eastern, Centre and Western Romania, because the conditions for springing and wintering without loss of culture are ensured comparing to the Southern Romania with lower rainfall, where cultivation with irrigations is recommended. Due to the high demand on the Romanian agricultural market, the use of rapeseed hybrids has become a neccessity due the higher productions than those of the rapeseed varieties. The main purpose of this study is to analyze the requirements of autumn rapeseed crops towards the climatic conditions in the Ialomiţa

County area in the context of the global climate changes. At both global and national levels, there has been observed, over the last decades, a progressive warming of the atmosphere, an increase in the frequency of extreme weather events and a rapid alternation between high drought and abundant floods [3; 10]. All of these have direct implications in agriculture, and implicitly in the supply of water to the soil. The Ialomița County is located in the South-Eastern Romania, occupying 1.9% of the country's surface. In 2014, the county's agricultural area was 374,495 ha [11], representing 84.1% of its area. The Ialomița County overlaps most of its part over the Central Bărăgan Plain, a plain of fluvial-lake origin and with altitudes falling from West to East, from 150 m to 20 m [7] (Fig. 1).

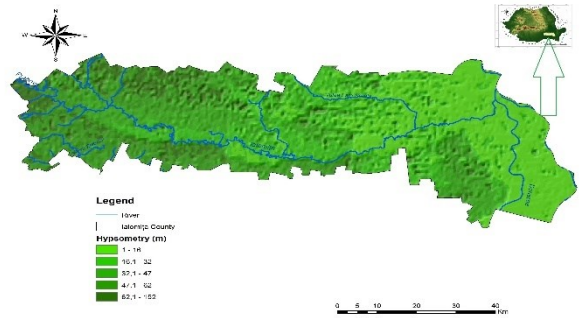

Fig. 1. The hypsometric map of the Ialomița County
Source: own processing from open source GIS

MATERIALS AND METHODS

For this study, there were used the climatic data from the meteorological stations: Urziceni, Grivița and Slobozia, which belong administratively to the Ialomița County (Fig. 2). The three stations are considered to be representative for the study area [6]. In order to highlight the climatic requirements of the autumn rapeseed, there have been used the areas and productions data from the National Institute of Statistics (NIS). Besides the analysis of the climatic data, the surfaces and productions, the Angot report (mm) was also calculated as the ratio between the sum of the warm semester precipitation (April–September) and the sum of the cold semester precipitation (November–March).
The methods used in the data analysis are the classic statistical ones, but also the modern ones in the GIS environment and the graphic representations are based on the Microsoft Office Excel software.

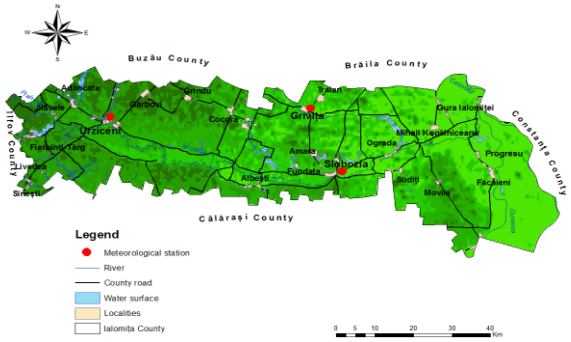

Fig. 2. The geographic localization of the meteorological stations: Urziceni, Grivița and Slobozia in the study area
Source: own processing from open source GIS

RESULTS AND DISCUSSIONS

The autumn rapeseed is a plant with moderate demands on the soil and air temperature, being sensitive to the temperature oscillations. The amount of temperatures required during autumn vegetation is about 800ºC ($\sum t > 0$ºC) [12]. The recommended sowing period for rapeseed is from August 15th to September 15th. In terms of humidity, it is a crop with high water requirements and with a low drought resistance, especially after the emergence and formation of the leaf rosette. This aspect is the result of the small sowing depth of 2–3 cm, so the root system grows poorly during this period. The rapeseed is a light-loving plant, especially towards the end of the growing season. It is also a plant that economically capitalizes the deep, permeable, rich in humus and calcium soils, with neutral Ph, of the chernozem type, present in the Ialomița County. The climate data analysis provides information on the main climatic factors with optimal or restrictive character on the rapeseed culture. In the analysis of the air temperature, the surface temperature and atmospheric precipitation, there have been used the monthly, annual and seasonal data for the time interval 1990–2013, highlighting four years: 2007 and 2012 as drought years and 2005 and 2013 as rainy years. These years indicate the rapid change between the dry

years and the rainy years as a consequence of the global climate changes.

The air temperature has a major role in the cycle of vegetation of the autumn rapeseed [9]. Each phase of vegetation has upper and lower temperature limits, besides which the culture is the subject of heat stress. For the studied area, from 1990 to 2013, one can see from Figure 3, a thermic regime with values close for all the three stations, which varies between -1.4ºC for January at Grivița and Urziceni stations and 23.7ºC at Slobozia in July. The multiannual average for the time interval 1990–2013, at the level of the Ialomița County is of 11.4°C, being 0.4°C higher than the normal climatic values, 1961–2000 [1]. There are remarkable for this period, the years 2007 and 2012, with annual average temperatures higher or close to 12ºC. The year 2007 holds the thermic record, oscillating between 12.7ºC at Grivița station and 12.8ºC at Slobozia and Urziceni stations. The thermic deviation from the multiannual average is +1.4ºC.

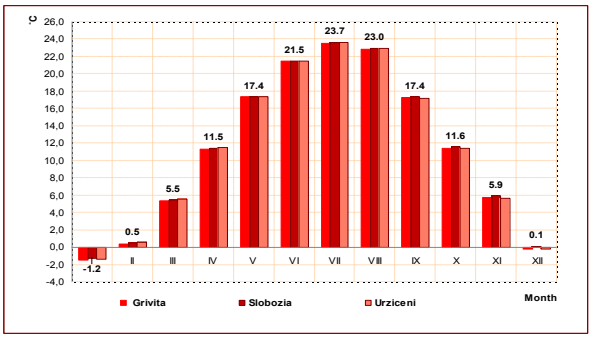

Fig. 3. The annual air temperature regime (°C) in the Ialomița County, 1990–2013
Source: processed data after NMA

The surface soil temperature influences all the plant physiological processes. Their intensity increases with temperature, up to a limit threshold considered critical to plants. From the analysis of the monthly and annual average of the soil surface temperature, one can notice that: at the Grivița station, the temperature registers values between -1.5ºC in January and 29.5ºC in July, with a multiannual average of 13.6ºC; at the Slobozia station, the values are between -1.4 ºC for January and 29.5ºC in July, with a multiannual average of 13.7ºC and at the Urziceni meteorological station, the value difference is between -1.6ºC and 28.9ºC and with a multiannual average of 13.7ºC (Fig. 4). At all the meteorological stations in the Ialomița County, the climatological normal was exceeded, from 1961 to 2000, with 0.6–0.7ºC [1].

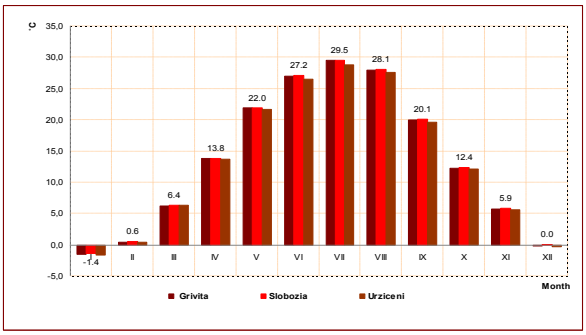

Fig. 4. The annual soil temperature regime (°C) in the Ialomița County, 1990–2013
Source: processed data after NMA

The thermic factor, both the air and surface temperature, plays a very important role for the autumn rapeseed in properly preparing the plants for the wintering and restarting in vegetation.

The atmospheric precipitation is the main source of the soil water, and the crop requirements are different during the vegetative cycle. The critical periods for water are in August and September, when the rosette leaves (6–8 leaves) and the phases of flowering and fructification are rising and forming. There are good productions in the areas where the annual rainfall value is 450–650 mm. In the Ialomița County, for the time interval 1990–2013, there were recorded multiannual quantities of rainfall of 469.3 mm at Grivița, 475.9 mm at Slobozia and 526.0 mm at Urziceni. These values are within the specified range, but closer to the lower limit of the water demand throughout the growing cycle, that being the reason the irrigation is required. At the level of the county, the multiannual average precipitation value is 490.4 mm, 50.4 mm more than the lower limit of 450 mm of the optimal rainfall requirement. There is a decrease in the amount of precipitation from West to East, as shown in Figure 5.

During the study period, the years 2005 and 2013 are recorded as rainy years, the record being in 2005, 900.9 mm at Urziceni, 713.7 mm at Grivița and 734.1 mm at Slobozia.

These amounts of excess rainfall have caused depreciation and production losses.

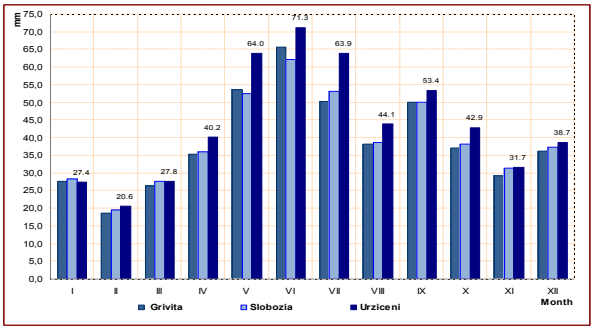

Fig. 5. The annual precipitation regime (mm) in the Ialomița County, 1990–2013
Source: processed data after NMA

For the study period, the *Angot ratio (mm)*, has been calculated, indicating the degree of climatic continentalism [5]. The values of this index varies from 1.8 mm at Urziceni to 1.6 mm at Slobozia, while for Grivița, the Angot ratio value is 1.5 mm. The values over 1 of the index indicate a decrease in precipitation in the warm semester (April–September), due to the continentalisation of the ocean air masses reaching the area. The years 2007 and 2012 with severe droughts, and the years 2005 and 2013 with abundant periods of rainfall, confirm the intensification of the climatic variability after 2000 [2]. The average productions of rapeseed fluctuate within fairly high limits, from 364 kg/ha, in 2007, on a cultivated area of 71,116 ha to 2732 kg/ha, in 2013, on an area of 38,950 ha [11] as a consequence of the great variability in time and space of each meteorological element in relation to the cultivated soil or hybrid, the soil conditions and the applied crop technology. The average production for the Ialomița County, for the time interval 1990–2013, is 1,408.1 kg/ha.

CONCLUSIONS

The autumn rapeseed is an agricultural crop for which the cultivated area is growing, this being the result not only of the high oil content, but also of the good trading price. The rapeseed is a culture plant with moderate temperature requirements, but demanding for moisture. For the Ialomița County, in the time interval 1990–2013, there was an increase in the average productions of the rapeseed and cultivated areas. In the context of the global climate changes, the agricultural production will be affected by the climate variability, especially in the areas with a high-risk drought, such as the Ialomița County. As a result, knowing the climatic factors is absolutely necessary in a decision-making system for a sustainable agricultural management.

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