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WEATHER FACTORS, WATER RESOURCES AND THE NEED OF IRRIGATION. CASE STUDY – BRĂILA COUNTY

ABSTRACT

Climate modification by the progressive warming of the atmosphere resulting from the concerted action of several factors, both natural and anthropic (emission of increasingly large amounts of greenhouse gases), favours the diminution of precipitations at soil level, corroborated with the increase of temperatures.

The climate became a constraining factor in the growth and development of crops, its influence being pregnant both in the allocation and use of water resources in agriculture.

The present study refers to the influence of weather factors and the need of irrigation in the county Brăila.

Key words: weather factors, soil, water resources, irrigations.

JEL Classification: Q54, Q24, Q 25, Q15.

1. INTRODUCTION

Irrigation is one of the important agro-technical measures that contribute to crop production prosperity, to higher yields and maximum profits.

The performant, competitive agriculture cannot be practiced in the absence of this production factor.

Among the factors that influence the need of crop irrigation an essential role is played by the weather factors (temperature, rainfall, solar radiation, wind intensity) and soil.

2. CURRENT STATE OF KNOWLEDGE

The following water sources for crops are found in nature: rainfall, which is the most important source, snow, dew, mist, air humidity and water reserve in soil (Grumeza et al., 2000; Maxim, 2008).

Irrigation corrects the weather conditions, as the only viable production factor (Botzan, 1972; Luca et al., 2008).

In the period 1950–1990, more than 3 million hectares of land were equipped with irrigation facilities, which made Romania be among the first countries in Europe with the largest irrigated areas (Spain with 3.39 million ha and Italy with 3.14 million ha) and on the 5th place in the world as regards the area equipped with irrigation facilities per capita (Lup A., 1997).

After 1990, the equipment of land with irrigation facilities stagnated, and following the privatization process in agriculture, many existing irrigation systems were no longer used due to the low investments and funds allocated to agriculture (Suciu, S., 2010).

3. MATERIAL AND METHOD

The study was based on methods specific to selective research: identification of problem under research, delimitation of research framework, information collection, data processing, analysis and interpretation and drawing up the conclusions.

The information sources that have been used are the official data and the data obtained from field surveys conducted under a research project. [1]

4. RESULTS AND DISCUSSIONS

4.1. Geographical and climate data

The county Brăila is located in the plain, in the south-eastern part of Romania, occupying a part of the lower Siret river plain, a part of the Bărăganului Plain and small parts from the plain Sălcioara and Buzăului Plain.

The county Brăila has a continental temperate climate, at contact with the specific climate of the Danube River plain. Summers are hot and dry, and winters are cold with little snow. The rainfall features high variability in time and space, reflecting the continental climate type.

Moisture deficit mainly depends on air temperature, solar radiation and wind intensity.

The county Brăila has average temperatures higher by 1.5ºC compared to the rest of the Romanian Plain; the absolute maximum temperature, i.e. 44.5ºC was in the year 1951, while the absolute minimum temperature, –30ºC, was in 1942.

The average annual air temperature in the period 2006–2010 had values over the annual average of the period 1975–2000, the highest values being found in the year 2007.

[1] FP-7 Project – Sustainable Irrigation Water Management and River – Basin Governance: Implementing User-Driven Services, (SIRIUS), 2010–2013.

Table 1
Average annual air temperature (ºC) in the period 2006–2010
and average multi-annual temperature (ºC) in the period 1975–2000

County	1975–2000 average	2006	2007	2008	2009	2010
Brăila	10.7	11.2	12.5	12.1	12.0	11.6

Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

The maximum annual air temperature (41.1ºC) was in the year 2007 in the month of August.

Table 2
Maximum annual air temperature (ºC) in the period 2006–2010,
absolute maximum temperature (ºC) and their dates

County	Absolute maximum	2006	2007	2008	2009	2010
Brăila	41.1 (23.VII.2007)	36.6 (20.VIII)	41.1 (23.VII)	38.5 (16.VIII)	38.0 (24.VII)	37.2 (15.VIII)

Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

In the year 2010, the minimum air temperature was in January, its value (–22.6ºC) being the closest to the absolute minimum (–25.5ºC) in the year 1985.

Table 3
Minimum annual air temperature (ºC) in the period 2006–2010,
minimum absolute temperature (ºC) and their dates

County	Absolute minimum	2006	2007	2008	2009	2010
Brăila	–25.5 (13.I.1985)	–20.3 (23.I)	–12.0 (24.II)	–15.1 (5.I)	–16.9 (22.XII)	–22.6 (26.I)

Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

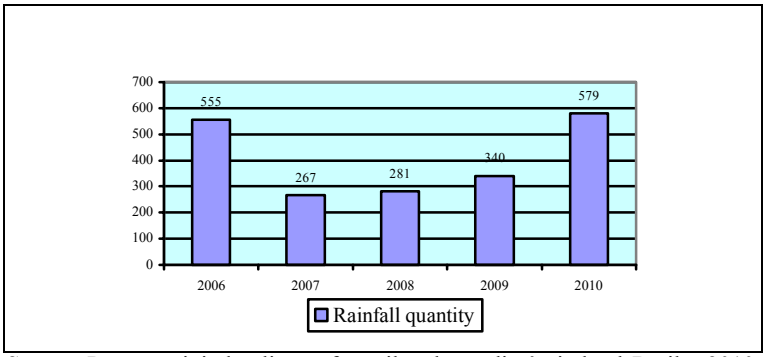
The solar radiation at the weather station Brăila has high values, averaging 125 kcal/cm^2/year.

The wind blows in the period autumn – spring from the direction north and north-east, its intensity being 1.5–3.1 m/s.

The average annual rainfall is low, with torrential rain in summer time. In summer time there are long periods of drought (60–90 days).

The data on the rainfall level reveal that in the year 2010, rainfall was higher in quantity compared to previous years.

In the year 2010, July was the richest month in rainfall (624 l/m²), while August was the driest month of the year (18 l/m²), the normal rainfall being 441.8 l/m²



Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

Figure 1. Rainfall – average annual quantities, l/ m².

The annual rainfall amount does not cover the needs for obtaining high yields, and the water deficit must be covered by irrigations.

The annual relative humidity of air can reach over 72%, it exceeds 80% in winter, while in summer it reaches only 65%.

The moisture deficit in soil, in the period April – September, calculated as difference between evapotranspiration and rainfall is 300–350 mm/season. This deficit reveals the need of complementary irrigation of crops.

4.2. Land use

The soil is the main support to all the socio-economic activities and represents the environmental factor that is the most exposed to pollution.

Soil quality is determined by natural factors such as relief, climate, vegetation, time, as well as by anthropic factors. Thus, the agricultural practices that are not adapted to the environmental conditions, the treatments and fertilizer applications that did not respect the agro-pedological and agro-technical norms, the discharges of hazardous chemical substances, the storage of waste of all categories, represent anthropic factors that significantly and fast modify the quality of soils.

The soil and weather conditions from the county Brăila determined the emergence and evolution of a various soil cover, where the chernozem soils prevail.

Table 4
Soil types characteristic to the county Brăila, in the year 2010

Soil types	Area (ha)	Percentage (%)
Protisols	131991	34.1
Cernisols	203552	52.5
Hydrisols	36077	9.3
Salsodisols	15743	4.1
Total	**387363**	**100.00**

Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

In the county Brăila, the agricultural land areas have the largest share in total land area, accounting for 81.43% in the year 2006 and 81.28% in the year 2010 of the total area of the county.

Table 5
Distribution by land use categories in the period 2005–2010

Land use category	Area (ha)				
	2006	**2007**	**2008**	**2009**	**2010**
Arable	349401	349830	353087	349089	350447
Pastures	33144	33274	28905	33171	31743
Vineyards	4825	4686	4840	4492	4519
Orchards	730	636	640	640	654
Agricultural total	388100	388428	387470	387392	387363
County total	476576				

Source: DARD Brăila, 2010.

In total agricultural land, arable land had the highest share (over 90%) throughout the investigated period.

4.3. Water resources

The county Braila has a significant surface water network and ground water reserves.

The surface water resources are the following:

– The Danube river, with 222.5 km length on the territory of Brăila county and an average transited water flow of 6200 m^3/s, supplies water for irrigations, fisheries, industry and drinking water for the population;

– The Buzău river, with 207.0 km length on the territory of Brăila county and average transited water flow of 26.32 m^3/s, supplies water for irrigations and industry;

– The Călmățui river transits Brăila county only between the localities Jugureanu and Gura Călmățui, with a length of 84 km, with an average transited water flow of 0.872 m^3/s and supplies water only for irrigation purposes;

– The Siret river, with 55 km length and an average transited water flow of 220 m^3/s supplies water for irrigations and fisheries;

– The Strachina river, an affluent of the Ialomița River, has a low number of local water uses.

The ground waters in Brăila county are phreatic waters located in the large river plains of the Danube, Siret, Buzău and Călmățui rivers, at a depth ranging from 0 m in the low river plains to 20 m in the fields covered with sands and depth waters located either in gravel or in sandy deposits, their depth ranging from 50 to 200 m.

In the year 2010, the usable water resource from the surface resources accounted for 62.9% of the theoretical water resource from the surface resource, and the usable ground water resource accounted for 29.4% of the theoretical ground water resource.

Table 6
Water resources in Brăila county in the year 2010

- thousand m^3 -

	Surface resources		Ground resources	
	Theoretical	**Usable**	**Theoretical**	**Usable**
County Brăila	2,387,000	1,502,000	687,000	202,000

Source: Administratia nationala apele romane, Administratia Bazinala de apa Buzau-Ialomita, SGA Braila.

4.4. Situation of land equipped with irrigation facilities

The land reclamation infrastructure (irrigations and drainage) of the investigated area consists of the following types of works: hydrotechnical constructions for irrigations and drainage, irrigation and drainage channels, water pumping stations for irrigations and drainage, hydro-mechanical installations (pumping aggregates, electric equipment, feeding and discharge pipelines) for irrigation and drainage.

The total length of channels in the county Brăila is 5,870.65 km, out of which 1,203.55 km are for irrigations and 4,667.1 km for drainage, with 598 pumping stations (461 for irrigations and 137 for drainage), with a total installed power of 387MW, i.e. 359.4MW for irrigations and 27.7MW for drainage. The total pumping capacity is 2068 m^3/s for the whole system.

Irrigation is absolutely necessary in the conditions of the dry weather specific to the county Brăila. Dryness was also favoured by the increase of the demographic pressure and the climate changes.

The deviations from the optimum irrigation regime may have negative effects upon soil. Significant modifications may be produced due to the irrigation water quality, with the possible emergence of salinization and alkalization phenomena (in the situation of water containing salts), or texture modification (in case water contains alluvia).

Table 7
Irrigated area and volume of water consumed in the county Brăila, in the period 2006–2010

Item	**Year**				
	2006	**2007**	**2008**	**2009**	**2010**
Irrigated area (ha)	78761	111776	90307	166342	113795
Volume of water consumed (thousand cubic meters)	72959	341396	188833	227281	159143

Source: Raport privind calitatea factorilor de mediu în județul Brăila, 2010, Agenția pentru Protecția Mediului Brăila.

The irrigated area in the year 2010 was larger than the irrigated area in previous years, except for the year 2009.

The volume of water used for irrigations had the highest values in the period 2007–2009, when the rainfall was much under the average, the high water deficit in soil being covered by irrigations.

5. CONCLUSIONS

From the data on the climate in the investigated area, it results a significant moisture deficit in the vegetation period of crops, which needs to be compensated by irrigations. Irrigations in the county Brăila became absolutely necessary in the conditions of the arid and dry weather.

The dry weather was also aggravated by the increase of the demographic pressure and of climate changes. The deviations from the optimum irrigation regime may have negative effects upon soil. Significant modifications may appear due to irrigation water quality, the emergence of salinization and alkalization phenomena being possible (in the situation of waters that contain salts), as well as texture modification (when the water contains alluvia in suspension).

At present, the irrigation facilities are far from being used at their full capacity. The diminution of effectively irrigated areas is the result of cumulated factors, among which the most important are the following: decreased interest in irrigations from the part of small farmers lacking financial means; the land reform that led to extremely fragmented agricultural land areas and numerous parcels; high costs of crop irrigation; frequent institutional reorganizations.

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