RESEARCH REGARDING THE NECESITY TO RECALCULATE THE ELEMENTS OF IRRIGATION REGIME, IN MAIN CROPS FROM MOSTISTEA PLAIN, HAVING IN VIEW THE SCENARIOS OF CLIMATIC CHANGE MODIFICATIONS

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Abstract: *The aim of the studies and researches - By the performed researches, the need to recalculate the elements of irrigation regime depending on the possible climatic changes, which could affect Romania, in the future, as well as the possibility of low limited water supply, in the context of the climate modifications. Stage of the research - The global warming is a phenomenon unanimely accepted by the international scientific community, being already emphasized by the observation data analysis, during long periods. The simulations achieved by global climatic models underlined the fact that the main factors which determine this phenomenon are both natural (variations of sun light and vulcano activity) and anthropogeneous ones (changes in atmosphere compositiopn due to human activities). Materials and methods - To achieve the proposed objectives, the paper presents three possible climatic scenarios, such as: 1.Tn – current average temperatures; 2.Tn+2°C – increasing, with 2°C, of the current average temperatures, 3.Tn+5°C – increasing, with 5°C, of the current average temperatures. The need to apply irrigation for a certain area was established depending on the moisture deficit calculated as difference between water consumption and supply sources for both soil and crops. The ETRO value was highly precisely estimated, using Thornthwaite method, and to follow all the modifications of the elements of irrigation regime, the water soil balances for all crops under study were achieved. Novelty degree - The paper tries to underline the negative impact of global warming, as well as to find practical solutions for farmers to counteract the drought effects. Stage of achievements - Following the researches on world plane, measures to limit the alert rhythm of climate change were taken. The measures were discussed in international summits, as those of Kyoto and Copenhagen. Limits of the research - To achieve the researches, indirect methods to determine the water consumption were used due to lack of modern equipments. Practical implications of the research - The proposals are very important for irrigated farming, because it is important to produce a lots and cheap, for food security. Paper originality - The paper presents high level of originality, no similar papers were performed till present, in Romania. Importance of the paper - The modification of elements in irrigation regime could lead to devastating economical effects for Romania's agriculture. Following increasing of average temperatures, there could be catastrophic effects, even as danger for human beings, under the current economical context*

Key words : limited water supplying; watering rate; irrigation norm; water consumption,drought

INTRODUCTION

The global warming is a phenomenon unanimously accepted by the international scientific community, being already emphasized by the data analysis during long time. The simulations performed based on global climatic models emphasized that the main factors which determine this phenomenon are both natural (variability in light, volcano activity) and anthropogenic ones (changes in atmosphere composition due to human activity). Only the cumulated effect of both factors could explain the changes registered in global average temperature, during last 150 years. The increasing of greenhouse gas emission into atmosphere, especially of carbon dioxide, was the main cause of pronounced warming from the last 50

years of XX century, 0.13^0C, two times of last 100 years value. The air global average temperature increased with 0.74ºC, during last 100 years (1906 -2005) as compared with 0.6ºC, during 1901-2000. Eleven out of last 12 years were the warmest ones, registered after 1850.

The Europe's climate registered a warming with about 1^0C, during last century, higher than global average. The rainfall increased considerably in the North of Europe. Compared to increasing of global annual average temperature, of $0,6^0$C, during 1901-2000, in Romania, the annual average registered an increasing of only $0,3^0$ C. During 1901-2006, the increasing was of $0,5^0$C vs. $0,74^0$C, at world plane (1906-2005).

There were regionally diferences: a pronouncedwarming in the South and East of the country (till $0,8^o$C at meteorological stations Bucharest-Filaret, Constanta and Roman) and un-significant in intra-Carpathians regions, excepting baia Mare station, where the effect of anthropogenic activity lead to a warming of $0,7^o$C, droughts becoming more frequent).

MATERIALS AND METHODS

Depending on the values of normal average temperatures, the values of monthly average ones were achieved,in the case of increasing with 2^oC and 5^oC, respectively.

Thus, to assess the objectives of the present paper, three possible climatic scenarios were performed, namely:

1   Tn   - current average temperatures
2   Tn+2^oC - increasing of current average temperatures with 2^oC
3   Tn+5^oC - increasing of current average temperatures with 5^oC

After that, the values of annual thermic index for the three climatic scenarios were calculated, for the area under study, Mostiştea Plain.

Based on these values, the ETRO for all the four crops (sunflower, maize, sugar beet and soybean) was estimated, depending on the climatic scenarios. The ETRO value was estimated by Thornthwaite method.

The necessity of irrigation was established depending on the moisture deficit, as difference between soil and crop water consumption and supply sources. To calculate the soil water balance, the values of initial reserve, minimum level and watering rate specific for each area were established.

So that, for all scenarios, the same values of annual and monthly rainfall were maintained, the irrigation regime depending on only moisture deficit, as follow of water consumption increasing.

The rainfall values utilized in soil water balance calculation were average values, on 20 years at least, for areas under study, with 80 % calculation ensuring.

RESULTS AND DISCUSSION

The results are synthetically represented in tables 1 and 2 and figure1. In Mostistea Plain, the number of waterings will increase with 1, in the case of increasing of current average temperatures with 2^oC and with 2-3 in the case of increasing of current average temperatures with 5^oC (table1).

In sunflower, the irrigation rate will increase from 3500 m^3/ha, in the case of normal average temperature to 4200 m^3/ha in the case of its increasing with 2^oC, respectively 4900 m^3/ha, in the case of its increasing with 5^oC.

In maize, the irrigation rate will increase from 4200 m^3/ha, in the case of normal average temperature to 4900 m^3/ha, in the case of its increasing with 2^oC, respectively 5600 m^3/ha, in the case of its increasing with 5^oC.

In sugar beet, the irrigation rate will increase from 4900 m^3/ha, in the case of normal average temperature to 5600 m^3/ha, in the case of its increasing with 2^oC, respectively 7000

m^3/ha, in the case of its increasing with 5°C.

Elements of irrigation regime depending on climatic changes, vs. current one (Fundulea meteorological station)

Area under station	Crop	Temperature ^{0}C	m (m³)/ha	No of waterings	Σm (m³)/ha	Watering scheme
FUNDULEA	Sunflower	T_{normal}	700	5	3500	0-0-2-2-1-0
		$T_{normal} + 2\ ^0C$		6	4200	0-0-3-2-1-0
		$T_{normal} + 5\ ^0C$		7	4900	0-1-2-3-1-0
	Maize	T_{normal}	700	6	4200	0-0-1-3-2-0
		$T_{normal} + 2\ ^0C$		7	4900	0-0-2-2-2-1
		$T_{normal} + 5\ ^0C$		8	5600	0-0-2-3-3-0
	Sugar beet	T_{normal}	700	7	4900	0-0-2-2-2-1
		$T_{normal} + 2\ ^0C$		8	5600	0-0-2-3-2-1
		$T_{normal} + 5\ ^0C$		10	7000	0-0-3-3-3-1
	Soybean	T_{normal}	700	6	4200	0-0-2-2-2-0
		$T_{normal} + 2\ ^0C$		7	4900	0-0-2-2-2-1
		$T_{normal} + 5\ ^0C$		8	5600	0-0-3-2-3-0

In soybean, the irrigation rate will increase from 4200 m^3/ha, in the case of normal average temperature to 4900 m^3/ha in the case of its increasing with 2°C, respectively 5600 m^3/ha, in the case of its increasing with 5°C.

Elements of irrigation regime, by low limited water supply depending on climatic changes, vs. current one (Fundulea meteorological station)

Area under station	Crop	Temperature ^{0}C	m (m³)/ha	No of waterings	Σm (m³)/ha
FUNDULEA	Sunflower	T_{normal}	700	5	3500
		$T_{normal} + 2\ ^0C$	525	6	3150
		$T_{normal} + 5\ ^0C$		7	3675
	Maize	T_{normal}	700	6	4200
		$T_{normal} + 2\ ^0C$	525	7	3675
		$T_{normal} + 5\ ^0C$		8	4200
	Sugar beet	T_{normal}	700	7	4900
		$T_{normal} + 2\ ^0C$	525	8	4200
		$T_{normal} + 5\ ^0C$		10	5250
	Soybean	T_{normal}	700	6	4200
		$T_{normal} + 2\ ^0C$	525	7	3675
		$T_{normal} + 5\ ^0C$		8	4200
	Average	T_{normal}	700	6	4200
		$T_{normal} + 2\ ^0C$	525	7	3675
		$T_{normal} + 5\ ^0C$		8.25	4331

By the low limited water supply in Mostistea Plain (table and figure2) of the four crops (sunflower, maize, sugar beet and soybean), the water necessary could be achieved by the application of the same number of waterings and same watering schemes, but by the diminution of pedological rate from 700 m^3/ha to 525 m^3/ha. Thus, the irrigation rate will modify, as follows:

In sunflower, the irrigation rate will decrease from 3500 m^3/ha, in the case of normal average temperature to 3150 m^3/ha, in the case of increasing with 2°C, and will increase to 3675 m^3/ha, in the case of increasing with 5°C.

In maize, the irrigation rate will decrease from 4200 m^3/ha, in the case of normal average temperature to 3675 m^3/ha in the case of increasing with 2°C and will be equal with 4200 m^3/ha in the case of increasing with 5°C.

In sugar beet, the irrigation rate will decrease from la 4900 m^3/ha in the case of normal average temperature to 4200 m^3/ha in the case of increasing with 2°C and will increase to 5250 m^3/ha in the case of increasing with 5°C.

In soybean, the irrigation rate will decrease from 4250 m^3/ha in the case of normal average temperature to 3675 m^3/ha in the case of increasing with 2°C and will be equal with 4250 m^3/ha in the case of increasing with 5°C.
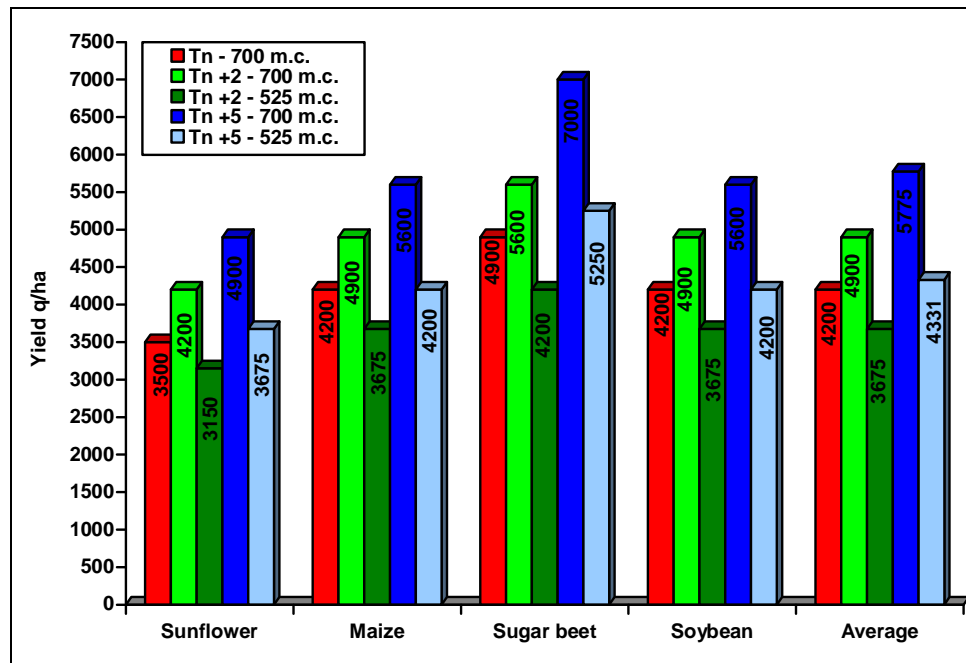

Figure 2. Recalculation of irrigation rate, by low limited water supply, in Mostistea Plain

CONCLUSIONS AND RECOMMENDATIONS

Having in view the current climatic conditions, the results emphasized that:

- Under edaphic conditions similar to those of the Mostistea Plain, the diminution of irrigation rate in maize and soybean is possible with 20-40%;

- The number of waterings will increase with 1, in the case of increasing with 2°C and with 2 waterings in the case of increasing with 5°C;

- The irrigation rates will be lower in the case of low limited water supply vs. values registered in the case of an optimum irrigation regime, for increasing with 2°C and will be equal with those registered under an optimum regime, in the case of increasing with 5°C;

- Under semi-arid area of Romania, which will be extended together with aridization process, the low limited water supply is a method which diminish the irrigation water need under desertification conditions and financial restrictions, as energy and water.

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