INFLUENCE OF CLIMATIC CONDITIONS FOR DIFFERENT CROP PLANTS GROWN UNDER THE BANAT PLAIN

Andreea Bianca LUPU, Florin Catalin IONESCU, Iacob BORZA

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Calea Aradului no. 119, RO-300645, Romania
Corresponding author: andreea.lupu@uex-usamvbt.org

Abstract: *The purpose of paper is to establish the extent to which climatic conditions have influenced both humidity water soil and yield obtained during a period of 3 years (2008/2010). The experimental work was made in the experimental fields of USAMVB Timisoara Didactical Station which belongs to the great physical and geographical unit of the Banat Plain, the main form of relief in the region. Soil characterization was made based on a soil profile opened at the experimental place unde the field represents on a flat, slightly wavy, with groundwater at a depth of 1.5-2.0 m. Processing the climate data supplied by C.M.R. Banat – Cri□ana, it could be observed that the highest amount of rainfall was resgistered in agricultural year 2009/2010, when the deviation was higher than multiannual average with +268,2 mm and the lowest amount of rainfall was resgistered in agricultural year 2008/2009, when the deviation was situated under the multiannual average with -150,6 mm. In the final the production of cultivated plants is the result of the interaction of all the factors involved in one way or another to the final harvest. Among the environmental factors, climatic regime, was found to have a strong influence on the regime of ground water and ultimately on the level of agricultural output. The results of yields presented in this paper were achieved processing field data from maize, sorghum and oat cultivated in the experimental field of the Ecology and Environmental Protection department. The highest yield achieved from all cultivated plants was in the agricultural year 2009/2010 when rainfall regime was favorable and there were not semnalated any periods of drought, while the lowest yield achieved from all cultivated plants was in the agricultural year 2008/2009 on a lowest humidity deficit.*

Key words: *climatic conditions, soil, yield*

INTRODUCTION

Plant response to environment has been a paradigm for millennia.

Basically,a large percentage of the interactions that have been reported have been studied in agricultural systems.

Since agriculture is only applied ecology,the relationships between mineral nutrition, plant growth and development, plant–waterrelations, photoperiod, lightintensity, temperature, pesticides, and plant biochemistry are closely interwoven, (WILKINSON, R.E.,2000).

Agriculture is strongly influenced by the availability of water: rainfall, evaporation, runoff, and soil moisture storage. Changes in total seasonal precipitation or in its pattern of variability are both important and water is one of the factors of vegetation of the utmost importance for plants life, being the most variable factor during a calendar year or season.

In natural conditions, water and nutrient availability in the soil is often heterogeneous (WILKINSON, R.E., 2000).

The environment represented by: water, air, soil, vegetation, fauna is a complex of space and space groups which work as cybernetical systems generating permanent changes of substance, energy and information, both between the phytocenotic and zoocenotic elements and also between those elements and the environment (BORZA, I. et. al., 2007).

Among the limiting factors of crop, drought is one of the most devastating stresses limiting plant growth and crop productivity (BOYER, J.S., 1982).

Production capacity shows the way of manifestation of all vegetation factors, which act independently for the plants and determine the satisfaction level of physiological needs of those, in certain place and certain time.

MATERIAL AND METHODS

All three main experiments were conducted at the same experimental field of the USAMVB Timisoara Didactical Station.

The experiment was designed in a randomized complete block with three repetitions, and each plot repetition had 30 m^2 area.

Shortly before sowing, the field was ploughed with a disc harrow to refine the seed bed and the experiments were sown between 23^{th} March – 15^{th} May in each year.

Fertilization was both types: organic - with manure and chemical - with $NaNO_3$, NPK, K_2O.

Based on the soil samples taken from an opened profile field, were made physical, chemical (pH, humus, total nitrogen, phosphorus and potassium), and mineralogical, biological, and microbiological tests.

To emphasize the influence of climatic conditions on the crop production, were analyzed climate data such as, atmospheric temperature, amount of rainfall and multiannual average during the three years period from 2008 till 2010, obtained from the weather station of Timisoara.

RESULTS AND DISCUSSIONS

Under geomorphologic aspect, the mentioned area belongs to the great physical and geographical unit of the Banat Plain, the main form of relief in the region. Pedological profile was placed on a flat, slightly wavy, with groundwater at a depth of 1.5-2.0 m.

Following determinations made in the field and laboratory, the soil profile analyzed is a cambic, batigleic, mezocalcic chernozem soil that has a large expansion in the plain of Banat. Physical and chemical characteristics of the typical chernozem are found in Table 1.

Interpretation of soil analysis results the following:

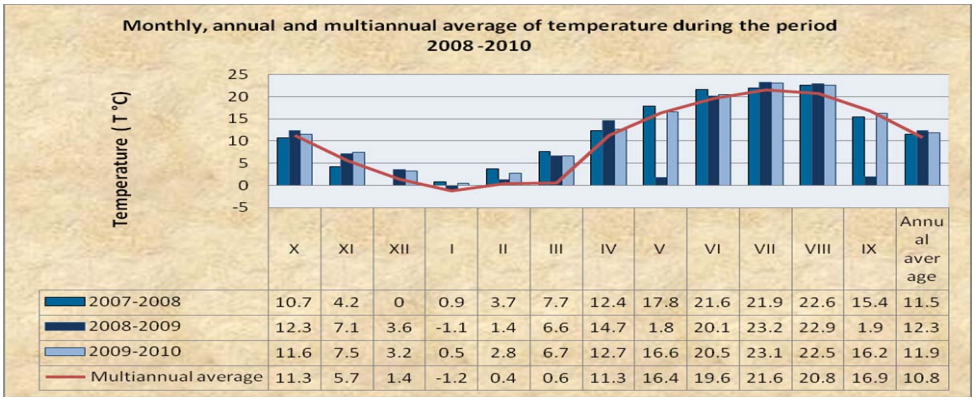
- Texture is clay-loamy average (TT) from 0-200cm;
- Total porosity have very high values between 0-13cm, low between13-28 cm, medium values between and 28-87;
- Field capacity (CC), have medium values between 0-87cm;
- The fading coefficient (CO) have high values between 0-87cm
- Apparent density (DA) have very low values between 0-13cm, high 13-28cm, medium between 28-87cm;
- The content of calcium carbonate CaCO3 is absent from 0-74cm, medium between 74-100cm high and between 100-148cm;
- Humus reserve in the top 50 cm have high values;
- Nitrogen index in Ap present high levels;
- Content of assailable P in Ap have a state of supply means;
- Content in assailable K in Ap (or 20 cm) have a good supply status;
- The soil reaction is weak acid between 0-48 cm, neutral between 48 - 57 cm, and slightly to moderate alkaline between 57-200 cm.

Table 1

Characteristics of Soil profile

HORIZONS	UM	Ap	Atp	Am	A\B	Bv	B\C	C\B	C	Cca	Cca2
Depth	cm	13	28	48	57	74	87	100	125	148	200
Coarse sand %	%	0,5	0,4	0,2	0,3	0,3	0,3	0,3	0,3	0,7	0,4
Fine sand%	%	31,4	32,6	30,8	32,8	32,8	31,5	38,3	38,3	32,1	34,9
Dust %	%	33,1	26,8	28,1	28,1	26,3	28,5	28,5	29,7	23,8	22,4
Colloidal clay	%	36,0	40,2	40,9	40,6	39,7	39,7	31,7	31,7	43,4	42,3
TEXTURE		TT	TT	TT	TT	TT	TT	TT	TT	TT	TT
specific density	g/cm^3	2,69	2,73	275	2,75	2,75					
apparent density	g/cm^3	1,02	1,58	1,35	1,43	1,39	1,34				
Total porosity	%	62,08	43,22	50,90	48,00	4,21	51,27				
Degree of compaction	%	-0,22	9,06	1,49	7,01	0,39	0,38				
Hygroscopicity coefficient	%	10,43	9,41	9,58	9,51	9,43	9,30				
Fading coefficient	%	12,65	14,12	14,37	14,26	14,08	13,95				
Field capacity	%	23,45	23,72	23,76	23,74	23,71	23,68				
Total capacity	%	60,86	26,66	37,70	33,57	38,24	38,26				
Usable water capacity	%	10,80	9,60	9,42	9,48	9,62	9,73				
pH		6,65	6,76	6,72	6,99	7,51	7,53	7,78	8,10	8,28	6,30
$CaCO_3$	%	0	0	0	0	0	4,60	5,30	13,10	16,70	8,10
Humus	%	3,40	3,23	2,30	1,70						
Nitrogen index		2,25	1,96	1,95							
Humus reserve	to/ha	32,8	80,29	49,68	162,77						
P mobile	ppm	32,6	30,1	27,5	30,1	35,5	36,8	29,6	28,1	28,1	28,1
K mobile	ppm	215	240	215	225	218	238	221	203	203	203
Base exchange	me/100 g sol	25,19	26,66	23,90							
Replaceable H	me/100 g sol	15,10	14,30	15,80							
Degr. of sat. in base	%	83,96	84,82	85,14							

Regarding climate data recorded at the weather station of Timisoara, it can be observed that the annual average with the highest value was recorded in the agricultural year 2008/2009, (12.3ºC) while the lowest annual average (11,5 °C) was recorded in the agricultural year 2007/2008. (fig. 1.).

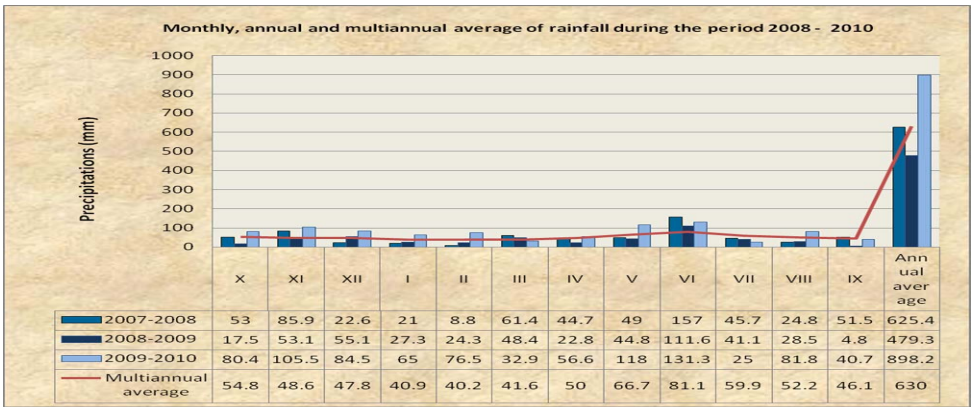


	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	Annual average
2007-2008	10.7	4.2	0	0.9	3.7	7.7	12.4	17.8	21.6	21.9	22.6	15.4	11.5
2008-2009	12.3	7.1	3.6	-1.1	1.4	6.6	14.7	1.8	20.1	23.2	22.9	1.9	12.3
2009-2010	11.6	7.5	3.2	0.5	2.8	6.7	12.7	16.6	20.5	23.1	22.5	16.2	11.9
Multiannual average	11.3	5.7	1.4	-1.2	0.4	0.6	11.3	16.4	19.6	21.6	20.8	16.9	10.8

Figure 1.Evolution of monthly, annual and multiannual average of temperature during the period 2008-2010

Following climate data recorded for the period taken in study (2008– 2010), analysis highlights the variability of rainfall regime recorded compared with multiannual average.

Climatically, the highest annual precipitation (898,2 mm) was recorded during the agricultural year 2009/2010, while the lowest (479,3 mm) was recorded during the agricultural year 2008/2009, (fig. 2).



	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	Annual average
2007-2008	53	85.9	22.6	21	8.8	61.4	44.7	49	157	45.7	24.8	51.5	625.4
2008-2009	17.5	53.1	55.1	27.3	24.3	48.4	22.8	44.8	111.6	41.1	28.5	4.8	479.3
2009-2010	80.4	105.5	84.5	65	76.5	32.9	56.6	118	131.3	25	81.8	40.7	898.2
Multiannual average	54.8	48.6	47.8	40.9	40.2	41.6	50	66.7	81.1	59.9	52.2	46.1	630

Figure 2. Evolution of monthly, annual and multiannual average of rainfall during the period 2008-2010

To highlight the significance of the rainfall quantities fallen on the cultivated plants, were analized the yield results obtained from the USAMVB Timisoara Didactical Station.

Among the analized data the following aspects were observed:

❖ between 2007-2010 the highest quantity of rainfall was registered in the agricultural year 2009 - 2010, when the deviation from multi-media was with +268,2 mm higher than the multiannual average and the lowest quantity of rainfall was registered in the agricultural year 2008 – 2009, when the deviation from multi-media was with -150,6 mm lowest than the multiannual average.

❖ in agricultural year 2007-2008, between november-march the quantity of rainfall registered was 252,7 mm and we may consider it is an optimal quantity. An optimum-satisfied level of rainfall is reached in april (44.7 mm), then during the period of summer (may-july) rainfall quantity reached the optimum level 251,7 mm.

❖ agricultural year 2008-2009, reached a satisfied level of rainfall in winter (225,7 mm) and summer (197,5 mm), but in the spring (april) the quantity of rainfall registered was only of 22,8 mm, which determinates to frame this period as a droughty one.

❖ the rainfall during the winter (XI – III) is important because generally it determinates the moisture of the soil in the spring, which determinates the storage source of water in soil and also the rainfall in the spring it has a very big importance, because values situated under the average emphasizes the fenomen of drought for the upcoming months.

❖ an excedentar level of rainfall (444,8 mm) was reached in the winter season of the agricultural year 2009-2010, but in the spring the level was an optimal one (56,6 mm) and has maintained the same too during the summer (274,3 mm).

Regarding yield results achieved in maize, sorghum and oats, recorded in the experimental fields of USAMVB Timisoara Didactical Station during 2008-2010, can be noticed the following:

❖ the medium yield of maize obtained was between 4634 – 6779 kg/ha, the highest level of 6779 kg/ha had been reached in year 2010 (fig. 3), when annual average temperature was situated slightly above multiannual average and annual rainfall exceeded multiannual average with + 268,2 mm.

❖ the lowest maize production, of 4634 kg/ha, had been registered in year 2009 when annual average temperature exceeded multiannual average with + 1, 31 ºC and annual rainfall was situated under the multiannual average with -150,6 mm.

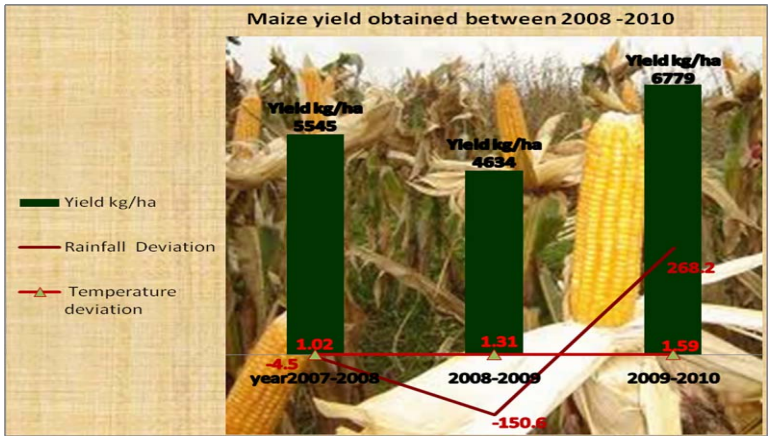


Figure 3. Evolution of maize yield during 2008-2010

❖ the medium yield of sorghum obtained was between 4829 – 5882 kg/ha, the highest yield, 5882 kg/ha, had been reached in year 2010 (fig. 4), when annual average temperature exceeded multiannual average with + 1,59 ºC and annual rainfall exceeded multiannual average with + 268,2 mm.

❖ the lowest yield, 4829 kg/ha, had been registered in year 2009 when annual average temperature exceeded multiannual average with + 1,31ºC and annual rainfall was situated under the multiannual average with -150,6 mm

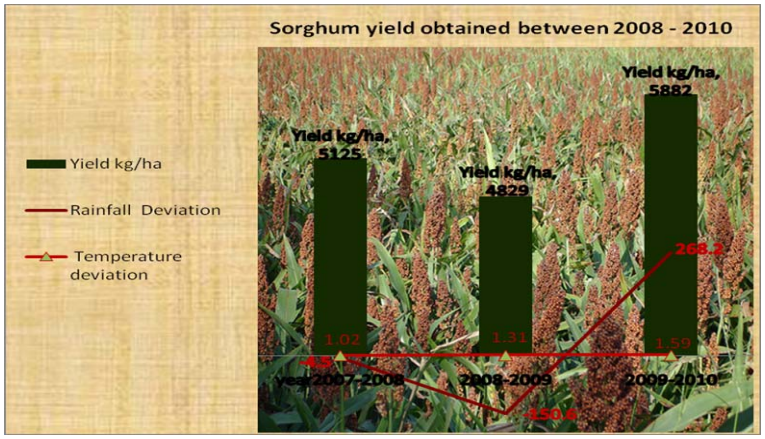


Figure 4. Evolution of sorghum yield between 2008-2010

❖ the medium yield of oat obtained was between 3499 – 4112 kg/ha, the highest yield, 4112 kg/ha, had been reached in year 2010 (fig. 5), when annual average temperature exceeded multiannual average with + 1,59 ºC and annual rainfall exceeded multiannual average with + 268,2 mm.

❖ the lowest oat yield, 3499 kg/ha, had been registered in year 2009 when annual average temperature exceeded multiannual average with + 1,31ºC and annual rainfall was situated under the multiannual average with -150,6 mm.

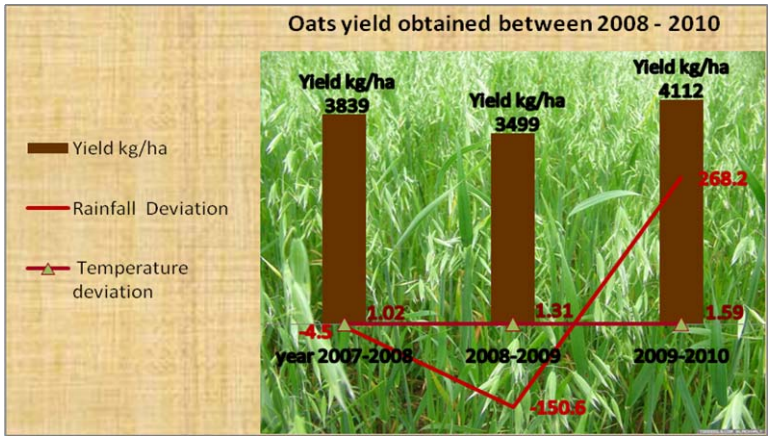


Figure 5. Evolution of oat yield between 2008-2010

CONCLUSIONS

According to yield evolution, the highest levels of production of all the plants cultivated had been registered in year 2010, while the lowest productions had been registered in year 2009.

Regarding climate data recorded at the weather station of Timisoara, it can be observed that the annual average with the highest value (12.3ºC) was recorded in the agricultural year 2008/2009, when annual average temperature exceeded multiannual average with +1,31 while, in the same year, was registered the lowest annual average (479,3 mm) when annual average rainfall was situated below multiannual average with – 150,6, which determinates to frame this year as a droughty one.

Climatically, the highest annual precipitation (898,2 mm) was recorded during the agricultural year 2009/2010, when the deviation from multi-media was with +268,2 mm higher than the multiannual average, and when were registered the highest levels of production from all crop plants.

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