DROUGHTY AUTUMN OF 2012 IN THE SOUTH-WEST OF ROMANIA

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ABSTRACT. – Draughty autumn of 2012, in the south-west of Romania. The droughty weather of the agricultural year 2011-2012 continued also in autumn which, in Oltenia, had two distinct parts: a first warmish and droughty part, and a second cold part, characterized by drought. In September, the maximum temperature values which were comprised between 30 and 35°C were registered in the last days. The warmish weather continued also in the first decade of October, followed by a slow accentuated cooling. This was the second excessively droughty autumn of the last 14 autumns in Oltenia. In November the weather was slightly warmer than normal and maximum thermal values between 18 and 22°C were registered. The paper is the continuation of a broad series of analysis of the climatic variations in the south-west of the country and analyzes the characteristics of this autumn in detail and the study is completed by a comparison to the last 14 autumns. The paper is useful to researchers, specialists in climatology, master graduates and Ph.D. candidates.

Key words: droughty autumn, heat waves, Hellmann criterion, warm autumn, record maximum thermal values.

1. INTRODUCTION

The summer of 2012 was excessively droughty and warmish. The excessive drought of the agricultural year 2011-2012 has been also prolonged in the autumn of 2012. Consequently, September was excessively droughty and warmish, and the maximum temperatures were registered in the last three days, an unusual situation for September. The intense drought of summer and of the first part of autumn occurred on extended areas of the European continent causing the decrease of the Danube flow to nearly a half from the multiannual mean in the end of August (on 28 August 2012 the flow was 2200 m^3/sec, lower than the multiannual mean of August with 2050 m^3/sec). This drastic fall in the flow caused serious problems for the navigation on the Danube because in the Romanian sector, downstream of Orşova, areas with sand rapids have appeared. Although on the continent it has been raining since September 1st, and on September 2nd the flow at the entrance in the country was of 2700 m^3/sec, lower than the multiannual average flow of September with 3800 m^3/sec. The navigation problems on the Danube due to the low flow lasted until the end of the second decade of October.

In the autumn of 2011 the water reserve in the soil has fallen at values corresponding to the degree of extreme pedological drought causing serious

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problems to the autumn agricultural campaign and notably to the works of setting up the autumn crops.

We will further analyze this period of excessive drought in the south-west of Romania, its effects and causes.

2. DATA AND METHODS.

We have used for our research on this droughty autumn the data from Oltenia MRC Archive, NAM (National Administration of Meteorology) Bucharest, the maps made by the Agrometeorology Laboratory (NAM), synoptic maps, the data offered by the archive, the satellite and radar images as well as the facilities offered by Office.

3. CLIMATIC CHARACTERISTICS OF SEPTEMBER 2012.

3.1. Pluviometric regime of September 2012.

The monthly quantities of precipitations were comprised between 3.2 l/m^2 in Calafat in the south-west of Oltenia and 16.8 l/m^2 in Voineasa in the submountainous area, and the percentage deviations from the multiannual means were comprised between -91.7% in Dr. Tr. Severin and Calafat and -58.7% in Slatina, thus according to the Hellmann criterion September was a very droughty month (VD) for the entire region.

The monthly precipitation mean for the entire region was 11.9 l/m^2 and its percentage deviation from the multiannual mean was -74.8%, thus confirming the classification of excessively droughty month (ED) for the entire region (table no. 1).

As a consequence of this scanty pluviometric regime and of high air and soil temperature, in the end of September the humidity reserve in the soil accessible to plants, in the soil layer of 0-20 cm (in the wheat crop) fell to values between 40-100 m^3/ha and 100-150 m^3/ha in the southern half of the region where extreme drought (ED) and severe drought (SD) were registered, between 150-200 m^3/ha in the northern part where the drought was moderate (MD) and only on a restricted area in the north-east of Vâlcea county the water reserve was comprised between 200 and 300 m^3/ha, that is almost satisfactory (AS) due to the local conditions, since it is an area of forests which favors the convective rains during afternoons. In the soil layer depth of 0-100 cm (in the corn crop) on the same date the water reserve was comprised between 0 and 300 m^3/ha, therefore extreme drought (ED) was registered in most of the region, excepting the restricted area in the north-east of Vâlcea county where the water reserve was comprised between 300 and 600 m^3/ha- a severe drought (SD).

The precipitation regime is closely related to the air temperature regime and, consequently, it is useful to analyze the air thermal regime too.

Table no. 1, *Quantities of precipitations registered in the autumn of 2012 (Σ), in comparison to the normal values (N for the period 1901-1990), the deviation (%) and the pluviometric time type according to Hellmann criterion (CH).*

Meteorological Station	Hm	September 2012				Octombrie 2012			
		ΣIX	**N**	**Δ%**	**CH**	**ΣX**	**N**	**Δ%**	**CH**
Dr. Tr. Severin	77	4.0	48.4	***-91.7***	**ED**	50.4	66.4	-24.1	**D**
Calafat	66	***3.2***	38.7	***-91.7***	**ED**	25.9	48.9	-47.0	**VD**
Bechet	65	11.2	42.8	-73.8	**ED**	***20.4***	42.6	***-52.1***	**ED**
Băileşti	56	5.0	34.5	-85.5	**ED**	24.6	46.2	-46.8	**VD**
Caracal	112	12.0	35.1	-65.8	**ED**	24.7	39.8	-37.9	**VD**
Craiova	190	10.2	36.1	-71.7	**ED**	41.4	41.3	0.2	**N**
Slatina	165	16.2	38.4	**-57.8**	**ED**	26.6	46.3	-42.5	**VD**
Bâcleş	309	9.9	39.2	-74.7	**ED**	40.9	57.1	-28.4	**D**
Tg. Logreşti	262	10.0	38.4	-74.0	**ED**	55.0	47.5	15.8	**LR**
Drăgăşani	280	16.2	50.3	-67.8	**ED**	36.4	50.3	-27.6	**D**
Apa Neagră	250	9.1	60.5	-85.0	**ED**	75.4	66.7	13.0	**LR**
Tg. Jiu	210	6.8	51.5	-86.8	**ED**	96.0	66.3	44.8	**VR**
Polovragi	546	11.6	61.7	-81.2	**ED**	**108.2**	68.6	**57.7**	**ER**
Rm. Vâlcea	243	15.0	53.2	-71.8	**ED**	74.8	48.6	53.9	**ER**
Voineasa	573	**16.8**	55.1	-69.5	**ED**	53.1	56.1	-5.3	**N**
Parâng	1585	33.2	72.5	-54.2	**ED**	88.6	69.7	27.1	**R**
Media Oltenia	-	11.9	47.3	-74.8	**ED**	52.65	53.9	-2.3	**N**
Meteorological Station	Hm	Noiembrie 2012				Toamna 2012			
		ΣXI	**N**	**Δ%**	**CH**	**ΣD**	**N**	**Δ%**	**CH**
Dr. Tr. Severin	77	56.2	71.5	-21.4	**D**	110.6	186.3	-40.6	**VD**
Calafat	66	58.6	54.2	8.1	**N**	87.7	141.8	-38.2	**VD**
Bechet	65	30.8	49.3	-37.5	**VD**	62.4	134.7	-53.7	**ED**
Băileşti	56	27.8	57.2	***-51.4***	**ED**	***57.4***	137.9	***-58.4***	**ED**
Caracal	112	52.2	48.5	7.6	**N**	88.9	123.4	-28.0	**VD**
Craiova	190	41.7	44.7	-6.7	**N**	93.3	122.1	-23.6	**D**
Slatina	165	***30.6***	47.5	-35.6	**VD**	73.4	132.2	-44.5	**VD**
Bâcleş	309	57.0	47.9	19.0	**LR**	107.8	144.2	-25.2	**D**
Tg. Logreşti	262	61.4	49.8	23.3	**R**	126.4	135.7	-6.9	**N**
Drăgăşani	280	55.0	52.6	4.6	**N**	107.6	153.2	-29.8	**VD**
Apa Neagră	250	**100.8**	87.1	15.7	**LR**	185.3	214.3	-13.5	**LD**
Tg. Jiu	210	90.8	62.3	**45.7**	**VR**	**193.6**	180.1	**7.5**	**N**
Polovragi	546	68.4	78.7	-13.1	**LD**	188.2	209.0	-10.0	**LD**
Rm. Vâlcea	243	67.4	55.0	22.5	**R**	157.2	156.8	0.3	**N**
Voineasa	573	65.6	53.3	23.1	**R**	135.5	164.5	-17.6	**LD**
Parâng	1585	25.4	55.7	-54.4	**ED**	147.2	197.9	-25.6	**D**
Media Oltenia		55.6	57.2	-2.8	**N**	120.15	158.4	-24.1	**D**

(Source: processed data).

3.2 The thermal regime of September 2012.

The monthly temperature means were comprised between 14.5°C in Voineasa and 21.3°C in Dr. Tr. Severin, and their deviations from the monthly multiannual means were comprised between 0.9°C in Apa Neagră and 3.1°C in Rm. Vâlcea designating a warm month (W) according to Hellmann criterion in most part of the region, excepting some restricted areas (Bechet and Tg. Logreşti) where the month was warmish (WS), due to the local conditions which led to more moderate temperature values. (The deviations were calculated in comparison to the multiannual means for the interval 1901-1990.

The general mean deviation for the entire region was 2.5°C, which means a warm month (W) for the entire region. This is also confirmed by the fact that ***24 days registered the maximum thermal values of more than 25°C which means that all the days of September were summer days. Among them, 14 (registered in the intervals 1-5 September, 8-9, 14 and 25-30 September) were tropical days, namely they had daily maxima of over 30°C.***

The climatic record of this month was registered in the interval 27-30 September, in which the daily maximum thermal values exceeded 30°C and reached 35.4°C in Calafat, thus being the highest temperature values in the last 52 years for this interval.

There were registered 9 days with scorching heat in almost entire region excepting the high area.

The monthly maximum thermal value was 35.4°C, registered in Calafat in the warmest area of the region, and the monthly maximum thermal values mean for the entire region was 32.4°C, being a comparable value to that of the summer months. We also mention that in Calafat in the last century, the frequency of the monthly maximum temperatures in September over 35°C, was of 15.7%.

The monthly minimum temperatures were comprised between 2.0°C in Apa Neagră and 9.6°C in Calafat and were registered during the weather cooling events in the intervals 14-17 September and 20-23 September.

4. CLIMATIC CHARACTERISTICS OF OCTOBER 2012.

4.1. Pluviometric regime of October 2012.

The monthly quantities of precipitations registered in October at the meteorological stations in Oltenia were comprised between 20.4 l/m^2 in Bechet and 108.2 l/m^2 in Polovragi, and their percentage deviations from the multiannual means were comprised between -52.4% in Bechet and 57.7% in Polovragi, which, according to the Hellmann criterion leads to pluviometric time type classifications from excessively droughty (ED) in the extreme south of the region in Bechet to excessively rainy (ER) in some areas in Oltenia Subcarpathians (Polovragi, Rm. Vâlcea) (table 1).

The general precipitations mean for the entire region was 52.7 l/m^2, and its percentage deviation from the monthly annual mean was -2.3%, showing that on average October was a normally pluviometric month (N). Nevertheless, the

significant rains for the autumn agricultural works were registered in the interval 27-28 October and only in Subcarpathians, the moderate pedological drought (MD) persisting in almost 70% of the region's territory (situated in the southern part), in the arable layer depth of 0-20 cm. In north and north-west, especially in Gorj Subcarpathians, the water reserve was even exceedingly (E) on 31 October, due to the interaction of the high relief with the atmospheric circulation in the south-east of Europe, which amplified the phenomena of precipitations to atmospheric fronts penetration of the two Mediterranean cyclones that crossed the Balkan Peninsula in the intervals 11-14 October and 27-28 October.

In terms of calendar dates, the optimum period for setting up the autumn crops is until 25 October, and after this date crops setting up is recommended only if the soil temperature mean is comprised between 10-13°C, showing that most part of the optimum period was lost in this autumn.

4.2 The thermal regime of October 2012.

The monthly temperature means were comprised between 9.2°C in Voineasa and 14.3°C in Dr. Tr. Severin and Calafat, and their percentage deviation from the monthly multiannual means were comprised between 1.5°C in Calafat and 2.6°C in Caracal and Drăgăşani, determining according to Hellmann criterion a classification of warm month (W) in most part of the region, confirmed also by the deviation of the general mean for the entire region of 2.3°C, except for the reduced areas in the extreme south (Bechet) and Subcarpathians (Tg. Logreşti and Apa Neagră).

The monthly maximum temperature values were comprised between 29.6°C in Polovragi and 32.6°C, registered in Bechet and Rm. Vâlcea on 1 October**.**

After 1 October the air temperature fall was progressive and fast with down slopes of -0.4321 for the maximum thermal values, -0.3362 for the daily temperature means and -0.2303 for the daily minimum values.

The monthly minimum thermal values were comprised between -5.4°C in Apa Neagră and -0.6°C in Caracal registered on 31 October.

5. CLIMATIC CHARACTERISTICS OF NOVEMBER 2012.

5.1. Pluviometric regime of November 2012.

The quantities of precipitations were comprised between 30.6 l/square meters in Slatina in the south-east of the region and 100.8 l/square meters in Apa Neagră in Subcarpathians. Their percentage deviation from the monthly multiannual means were comprised between -51.4% in Băileşti and 45.7% in Tg. Jiu, determining according to Hellmann criterion classifications of pluviometric time type from excessively droughty (ED) in Băileşti and Parâng and very rainy (VR) in Tg. Jiu (table no. 1), which shows that drought persisted in Oltenia Plain. More significant precipitations for autumn agricultural crops were registered on 1 November, and during this month there were 20 days with light, isolated or local

precipitations in different areas in Oltenia, which cumulated they totalized the monthly values, and this is why the water reserve decreased compared to October in the north-west of the region.

The water soil reserve on 29 November 2012 was comprised between 350 and 960 m^3/ha in the southern half of the region in which the drought with different degrees of intensity from severe (SD in the extreme south-east and Slatina area) to moderate (MD) persisted. In the northern half the water reserve was comprised between 960 and 1650 m^3/ha, being from almost satisfactory (AS) to almost optimum (AO).

5.2 The thermal regime of November 2012.

The monthly temperature means were comprised between 4.6°C in Voineasa and 8.4°C in Dr. Tr. Severin, and their deviation from the multiannual means were comprised between 1.2°C in Bechet and 2.4°C in Voineasa, due to the frequent phenomenon of thermal inversion, which led to higher temperature means in the high area than the multiannual means, and thus confirming the higher climatic warming in the high area.

According to Hellmann criterion the classification of thermal time type in Oltenia in November was comprised between warmish (WS) and warm (W) predominating the warmish weather.

The monthly maximum air temperature values were registered in the first five days of the month (the interval 3-5 November) and were comprised between 15.6°C in Voineasa and 22.0°C in Dr. Tr. Severin and Calafat in the extreme south-west, and monthly maximum temperature values mean was 20°C in Voineasa.

The monthly minimum air temperature values were comprised between -3.8°C in Voineasa and 2.2°C in Dr. Tr. Severin and were registered in different days, most of them in the second half of the month. Three intervals of intense weather cooling were registered: 8-9 November, 16-17 November and 26-27 November when the daily minimum temperature values were negative and frost in the air was registered.

The tendencies of air temperature variation was highly decreasing with more accentuated slopes than in October for the daily average and minimum temperature values, announcing the early winter in the first decade of December.

6. GENERAL CLIMATIC CHARACTERISTICS OF AUTUMN.

6.1. Pluviometric regime of autumn 2012.

The seasonal quantities of precipitations were comprised between 57.4 l/square meters in Băileşti and 193.6 l/square meters in Tg Jiu, and their deviations from the multiannual means were comprised between -58.4% in Băileşti and 7.5% in Tg Jiu, determining according to Hellmann criterion classifications of pluviometric time type from excessively droughty (ED) in the southern half of Oltenia Plain (Băileşti-Bechet) and normal (N) in the hilly area and Subcarpathians (Tg. Logreşti, Tg. Jiu and Rm. Vâlcea).

The general mean for the entire region was 120.5 l/square meters, and its percentage deviation was of -24.1%, determining an overall classification as droughty autumn (D).

6.2. The seasonal thermal regime of 2012

The seasonal air temperature means were comprised between 9.4°C in Voineasa and 14.7°C in Dr. Tr. Severin, and their deviation from the multiannual means were comprised between 1.4°C in Apa Neagră and 2.8°C in Rm. Vâlcea, determining a classification of thermal time type as a warm month (W) in most part of the region, excepting the areas of Rm. Vâlcea and Parâng in which there was a very warm month (VW).

The seasonal general mean for the entire autumn was 12.8°C, and its deviation from the general multiannual mean was 2.3°C, thus confirming the general classification of warm autumn (W).

7. CONCLUSIONS.

Although, usually, in Oltenia as well as in Romania, the secondary maximum of precipitation is registered, the autumn of 2012 was droughty (D) on the whole. ***In 2012 the droughty season during summer prolonged in most part of autumn season, and the secondary pluviometric maximum was much diminished and we could say that it was registered with delay only in December. The precipitations registered in September show that it was the second excessively droughty month after March 2012***.

From a thermal point of view, the autumn of 2012 had two distinct parts: a first warmish part (1 September 2012-30 October 2012), when summer and tropical days were registered and a second cold part when, in some days, negative maximum thermal values were registered.

The atypical evolutions during the entire year of 2012 we have studied (Marinică and al. 2012), prove an increase of the climatic variability not only in Oltenia, but also in the entire Romania.

Taking into account the registered maximum thermal values and that September was a warmish month we can say that in Oltenia the summer of 2012 has lasted for 4 months.

The drought during the summer and autumn of 2012 affected vast European areas, notably the neighboring regions of Mediterranean Sea and most part of western and central parts of the countries, leading to the drastic fall of the Danube flow, and highly damaging the fluvial navigation.

These phenomena are due to the positive phase of the North-Atlantic oscillation and show that while the Atlantic and Iceland Cyclones have trajectories situated above the northern part of the continent, the Mediterranean Cyclones are no longer formed or are poorly developed with trajectories above the south of the Balkan Peninsula, and most part of the continent remains in warmish anticyclonic regime, Atlantic-East-European anticyclonic girdle being located so that the air circulations from the western sector predominate for Romania.

These kinds of circulations have in general a great stability in time sometimes leading to a prolongation of the droughty season to more than 6 months.

The agricultural year 2011-2012 was excessively droughty and only the exceedingly precipitations registered in the intervals: 24 January -10 February 2012, 13-25 April 2012 and 13-27 May 2012, contributed essentially to the production of this agricultural year. It is widely known that the droughty periods are interrupted by short rainy periods, a typical characteristic for this droughty interval. The drought of the summer of 2012 continued also in this autumn.

The excessive drought in the last month of summer and autumn caused serious problems for the autumn agricultural campaign, the soil being dry on big depth the autumn ploughlands could not been performed, the autumn crops were set up quite late, after 15 October 2011, and in Oltenia Plain after 29 October the first insufficient rains were registered and afterwards the drought came back.

The lack of precipitations caused the late rising of crops, even if their setting up was made in the optimum time.

As a consequence of its intensity and duration, the drought of the autumn of 2012 damaged the agricultural year 2012-2013 too.

REFERENCES

1 Ion Marinica, Andreea-Floriana Marinică (2012), *CLIMATIC AND AGROCLIMATIC CONDITIONS IN THE SOUTH-WEST OF ROMANIA DURING THE SUMMER OF 2011*, Conference on water observation and information system for decision support BALWOIS 2012 abstacts 28 may – 2 iunie, Ohrid, Republic of Macedonia, pp. 145, ISBN 978-608-4510-10-9, catalog CIP 556:551.58(062; 626/628(062); 502.51(062), edited by M. Morell, Institut de Recherche pour le Développement, France, http://ocs.balwois.com/index.php?conference=BALWOIS&schedConf=BW2012&page=paper&op=view&path%5B%5D=405&path%5B%5D=52

2 Ion Marinică, Iulica Văduva, Andreea Floriana Marinică (2012), *CONSIDEARTION ON WEATHER WARMING IN THE PERIOD 10-15 JUNE 2010*, RISCURI ŞI CATASTROFE, An XI Vol 10 Nr. 1/2012, pp 135-145, Editor Victor Sorocovschi, Editura Casa Cărţii de Ştiinţă 400129 Cluj Napoca http://www.doaj.org/doaj?func=findJournals&hybrid=&query=riscuri+si+catastrofe

3 Ion Sandu, Elena Mateescu, Ion Marinică, Victor Viorel Vătămanu (2012), *Consideraţii privind clima Olteniei şi tendinţe actuale*, Publicaţiile Societăţii Naţionale Române pentru Ştiinţa Solului, Nr 38, A XX-a Conferinţă Naţională de Ştiinţa Solului. Starea de calitate a resurselor de sol şi protecţia mediului în Oltenia (judeţele Dolj, Gorj, Mehedinţi). General conditions and natural resources, Craiova 26 august-1septembrie 2012, pp 44-80, Editura Sitech.