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Climatic moisture deficit in the period 1998-2011 in climatic conditions of the Banat Plain

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Abstract: Analyzing the moisture deficit in the Plan of Banat during the agricultural years 1998-2011, interpreting the results after the classification proposed by Donciu [2] have found that:

- **The agricultural years 1998, 1999, 2000, 2001, 2002, 2003, 2004 was characterized by an "arid" climate. During the vegetation period, the moisture was characterized as being "arid".**
- **The agricultural years 2005 was characterized by a "moderate dray" climate. During the vegetation period, the moisture was "semiaride".**
- **The agricultural years 2006, 2007, 2008, 2009, 2011 were characterized by an "arid" climate. During the vegetation period, the moisture was "arid".**
- **The agricultural years 2010 was characterized by a "semiaride dry" climate. During the vegetation period, the moisture was "arid".**
- **• The greatest moisture deficit was recorded in 2009 (800.7 mm) and lowest in 2005 (192.5 mm)**

Keywords: "moderate dry" climate, climatic moisture deficit, potential evapotranspiration

1. INTRODUCTION

Human intervention in the environment through the work they perform must be substantiated by controlled flow of water in the continuous system soil-plant-atmosphere in order not to endanger the ecological balance of this system.

Plants grow using environmental resources and respond to environmental conditions.

Moisture deficit is determined by several factors that are influenced each other by soil water reserve , which is accessible to plants, by rainfall, air humidity, air temperature, wind speed, plant, soil type, agro-technical use, etc.

Determination of aridity in all its complexity, it is very difficult, so research was generally done on elements which characterize it.

First results of the THORNTHWATTE method for determining ETP were published in Romania in 1958 [2].

ETP has been researched, evaluated and applied in general as "regional climatic factor" and only in special cases as "reference climatologically factor" in evaluating the effectiveness of rainfall [2].

Characterization by THORNTHWATTE is based on the differences between precipitation and evapotranspiration.

Compare the monthly intake of water from precipitation (P) with losses by evapotranspiration from the soil surface, or with stretches of water evaporation.

THORNTHWATTE [5] intuited that a large field covered with diverse vegetation, vigorous, and well supplied with water, real evapotranspiration (ETR) increases and tends towards a maximum which can be considered independent of plant species covering the soil, as and the nature of the soil, thus depending only on energy and dynamic characteristics of the atmospheric environment, in contact layer with the soil and vegetation that covers it (ETP).

2. MATERIAL AND METHODS

Climatic moisture deficit has been made on agricultural years because the period from October to September plants grow and reach their maturity.

The data used were taken from Timisoara Weather Station and potential evapotranspiration (ETP) was calculated with the relationship THORNTHWATTE (Table 1).

Climatic moisture deficit was determined by the relation P-ETP and to determine the effectiveness of annual rainfall relationship was used (100 * P / ETP)

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ETP (mm/month) Table1

Month Agricultural year	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
1998	31,93	19,57	4,81	2,65	9,40	8,27	81,43	136,5	232,7	241,3	224,5	115,6
1999	65,07	7,98	0	0	0,26	27,60	77,15	142,4	221,6	250,8	217,5	149,7
2000	58,02	8,697	1,01	0	4,91	189,8	104,3	180,0	140,7	245,1	266,5	125,7
2001	72,44	43,88	6,57	3,10	6,5	44,52	60,01	165,5	189,4	248,9	246,0	105,9
2002	74,34	6,64	0	0	16,0	36,02	68,86	191,7	246,1	278,3	214,1	119,4
2003	57,17	30,12	0,09	0	0	13,67	55,31	203,6	265,6	292,4	268,4	119,4
2004	38,21	24,38	1,16	0	1,51	20,72	76,09	126,5	212,5	254,7	215,8	113,2
2005	68,72	16,6	3,29	0	0	7,87	65,86	151,5	207,1	247,1	200,4	133,5
2006	54,63	10,58	1,65	0	0	15,19	77,15	141	203,5	276,3	197	136,2
2007	66,88	18,57	2,62	9,37	15,52	38,26	80,36	173,5	257,7	288,4	247,9	102,4
2008	51,31	9,06	0	0,63	7,9	31,7	77,15	165,5	242,2	243,3	240,6	109,5
2009	65,07	22,16	6,57	0	1,51	24,37	103,1	168,7	214,3	268,4	240,8	156,7
2010	58,88	24,34	5,38	0	4,91	25,01	72,96	146,9	221,6	266,4	238,8	119,4
2011	39,67	35,11	0,40	0	0	18,42	73,99	143,9	230,9	249	238,8	175,3

TEMPERATURE (°C) Table 2

Month Agricultural year	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
1998	8,1	6,6	3	2,1	4,1	3,5	13	16	21	21,8	21,7	16
1999	12,3	3,9	-4	0	0,5	7,1	12	16	21	22,3	21,3	19
2000	11,5	4,1	1,2	-2,8	2,8	5,7	15	19	16	22	24	17
2001	13,1	10,6	3,6	2,3	3,3	9,4	11	18	19	22,2	22,9	15
2002	13,3	3,5	-3	-0,8	5,6	8,3	12	19	22	23,7	21,1	16
2003	11,4	8,5	0,3	-2,5	-4,7	4,7	10	20	23	24,4	24,1	16
2004	9	7,5	1,3	-2,2	1,4	6	12	15	20	22,5	21,2	16
2005	12,7	6	2,4	0	-3,3	3,4	11	17	20	22,1	20,3	17
2006	11,1	4,6	1,6	-1,7	0	5	12	16	20	23,6	20,1	18
2007	12,5	6,4	2,1	4,4	5,5	8,6	13	18	22	24,2	23	15
2008	10,7	4,2	0	0,9	3,7	7,7	12	18	22	21,9	22,6	15
2009	12,3	7,1	3,6	-1,1	1,4	6,6	15	18	20	23,2	22,9	19
2010	11,6	7,5	3,2	-0,3	2,8	6,7	12	17	21	23,1	22,5	16
2011	9,2	9,3	0,7	-1	-1,3	5,6	12	16	21	22,2	22,5	20

Table 3. Annual rainfall efficiency (by Donciu 1986

Agricultural year	P(mm)	ETP(mm)	P-ETP(mm)	(P/ETP)*100(%)
1998	584,7	1110	-525,3 Arid	52 Semiaride
1999	723	1160	-437 Arid	62,3 Semiaride
2000	436,8	1150	-713,2 Arid	38 Arid
2001	616,5	1190	-573.5 Arid	51,8 Semiaride
2002	492,4	1250	-757,6 Arid	39,4 Arid
2003	539,1	1310	-770,9 Arid	41,1 Arid
2004	623,1	1080	-456,9 Arid	57,7 Semiaride
2005	907,5	1100	-192,5 Moderate dray	82,5 Moderate dray
2006	645,3	1110	-464,7 Arid	58,1 Semiaride
2007	557,7	1300	-742,3 Arid	42,9 Arid
2008	625,4	1180	-554,6 Arid	53 Semiaride
2009	479,3	1280	-800,7 Arid	37,4 Arid
2010	898,5	1180	-281,5 Semiaride	76,1 Moderate dray
2011	502,7	1210	-707,3 Arid	41,5 Arid

Table 4. Precipitation efficiency (Warm period) (by Donciu 1986)

Agricultural year	P(mm)	ETP(mm)	P-ETP(mm)	100*P/ETP(%)
1998	364,7	1030	-665,3 Arid	35,4 Arid
1999	427,9	1060	-632,1 Arid	40,3 Arid
2000	164,3	1060	-895,7 Arid	15,5 Arid
2001	446,7	1020	-573,3 Arid	43,8 Arid
2002	384	1120	-736 Arid	34,3 Arid
2003	304,7	1200	-895,3 Arid	25,4 Arid
2004	337,8	999	-661,2 Arid	33,8 Arid
2005	511,5	1010	-489,5 Arid	50,6 Semiaride
2006	389,8	1030	-640,2 Arid	37,8 Arid
2007	312,5	1150	-767,5 Arid	27,1 Arid
2008	372,7	1080	-707,3 Arid	34,5 Arid
2009	253,6	1160	-906,4 Arid	21,8 Arid
2010	453,2	1070	-616,8 Arid	42,3 Arid
2011	260,5	1110	-849,5 Arid	23,4 Arid

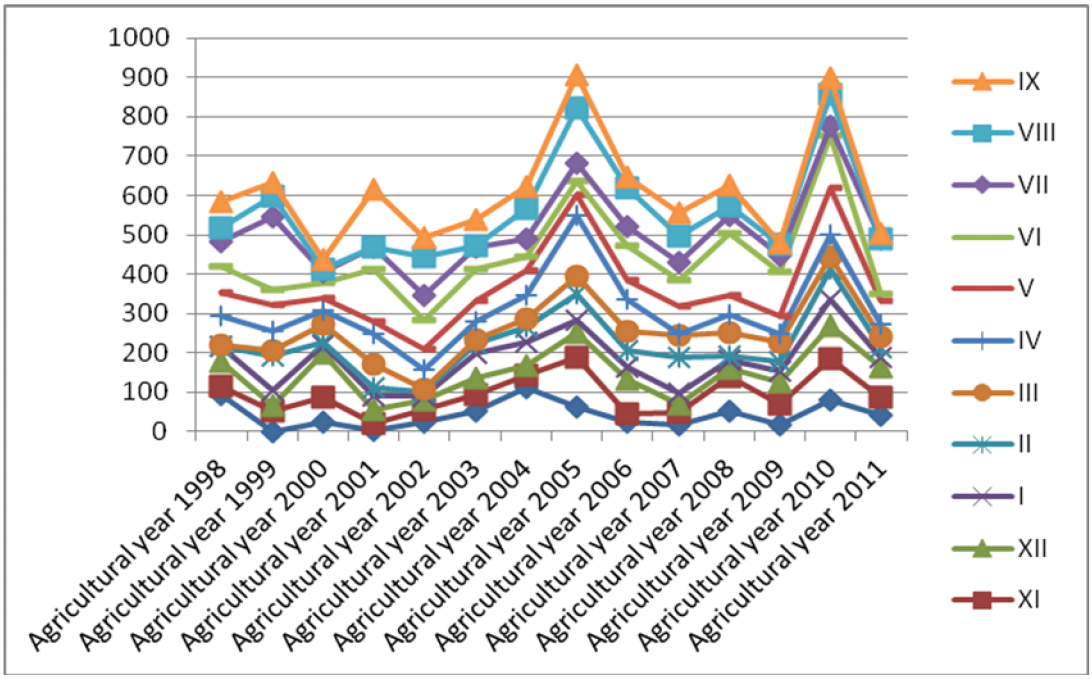

Figure 1. Change in rainfall (mm) in the period studied

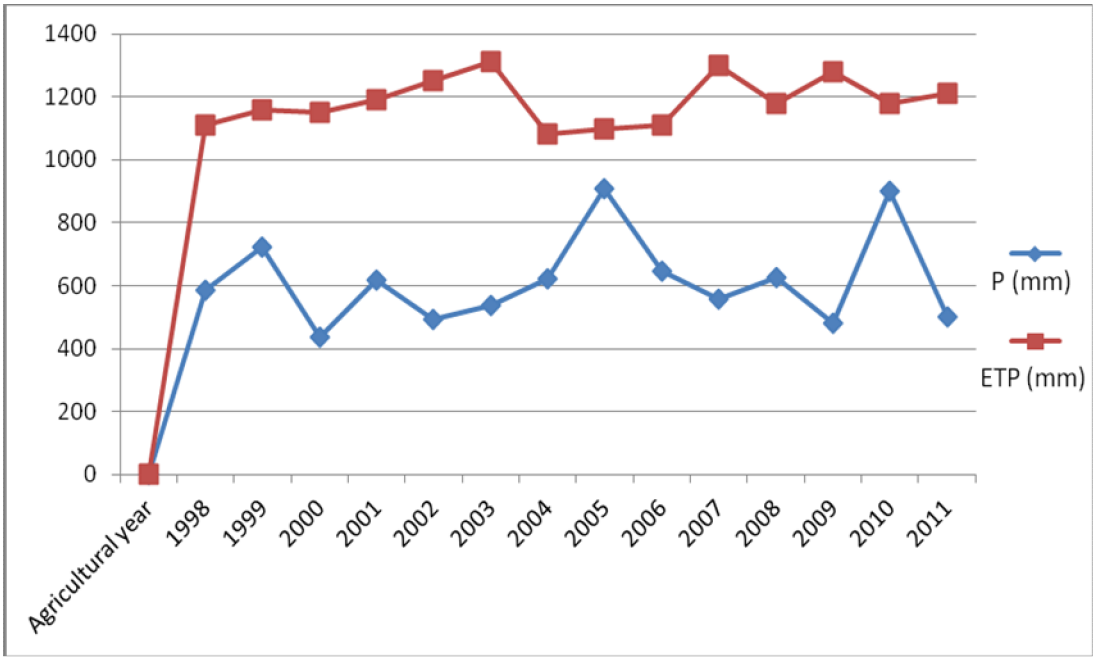

Figure 2. Change in rainfall and potential evapotranspiration during the period 1998-2011

3. CONCLUSIONS

The study deals moisture deficit between 1998-2011, regardless of the subject on which work (soil, culture, etc.) and may be the introduction to the complex study of drought in which is made contact with soil drought and stress plants.

Annual moisture deficit for 9 years of the study have values greater than 500 mm.

The highest values of ETP in the warm period occurred in the years: 2003-1200 mm, 2007-1150 mm, 2008-1080mm, 2009-1160 mm, 2010-1070 mm , 2011-1110 mm.

Monthly average values of temperatures in these years were in June, July and August between 20°C and 24°C.

In agriculture the only technical solution for complete moisture deficit is the land reclamation works - irrigations.

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