DYNAMIC OF SOIL MOISTURE CONDITIONS OF NON-IRRIGATION TO S.C.D.P. BANEASA (2008-2013)

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Abstract

This work is a short presentation to put in evidence the evolution of soil moisture for 2008-2013 period, according to the changes of rainfall regime due to the globall warming and other conditions and extreme climate changes. The study was done on the soil SCDP Baneasa plantation in conditions of non-irrigation. It was concluded that in the years of 2008, 2011, 2013, the rainfall amount was much lower than in the years of 2009, 2010, 2012, namely between 265 mm and 290 mm, respectively between 304-524 mm. However, it should be noted, that from the point of view of the rainfall, both years groups, were placed below normaly multiannually average by 596,2 mm). Being dependent of rainfall amount, the soil moisture (U%) fell below the lower limit of the optimum moisture period in the (2008, 2011, 2013), years, but was maintained in optimum moisture period in the (2009, 2010, 2012) years. From the quarterly average results, the amount of rainfall that fell during the six years investigated, represent only 44% to 88% from the multianually normaly average value. Although the drought was felt partly in the reducing soil moisture, this is a consequence of the normal soil ability (capacity) to maintain of the (moisture) absorbed water.

Keywords: soil moisture, drought, atmospheric precipitations.

In the present period is observed an accumulation of negative factors that powerful affects and almost constant the climate evolution both global and regional level, as well as the zonal level of meteorological changes. The globally negative factors is due to human activity such as massive and of long standing deforestation, industrial technologies, that produce major changes, consisting in pollution (soil-air-water), the destruction of the ozone layers, evaporation or rapid condensations of large quantities of water (glaciers). This explains the fact that climatic changes are planetary extensive and therefore are practically intractable from the local point of view. Such aspects have been studied by other researchers (Jităreanu G., 2007). As a result, in such circumstances, both atmospheric precipitations and the evolution of atmospheric temperature, can not be influenced or corrected. It is easly observed both the correction of a part of them and the modification of soil moisture. Therefore, should be given attention to soil quality in orchards (fruit-trees-growing or farming in general) as soil quality serves to partially compensate atmospheric precipitations climate disruption and air temperatures. So for example, some famous researchers have studied the depth role of the soil layer, of the edaphic volume correlated with the root system of (orchards) fruit-trees-growing (Blaga Ghe., 1996; Voiculescu N., 1999). They have shown the importance of the absorption capacity and of the water retention in soil that depends on maintaining and improving of the soil nutrient capacity (Voiculescu N., 1999) and the soil fertility regarding both relationship between the content of the humus and water supply in the soil, and the importance of soil suction force and water requirements of plants, etc., (Jităreanu G., 1996; Unguraşu A, Stănescu Fl., 2013). The soil water reserve expressed by "active humidity" has been studied by some famous researchers, from the point of view of "wilting coefficient" as well as the differentiation process and fruit bud formation in fruit trees (Cociu V,1993), through which the water supply is dynamic regarded from one season to another, from a period of active growth at the vegetative rest, and from one year to another (Chiriţă C-tin,1967).

In SCDP fruit tree Baneasa plantation are fruit trees species that have different degrees of sensitivity to water deficit as apple, cherry with moderate sensitivity and apricot, peach with reduced susceptibility. In the present study, for the interpretation of the results of soil moisture

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samples (U%), we take into consideration the soil characteristics that allow the accumulation and maintenance of water reserves. **The objective** of this work is the evaluation of the soil moisture on specific methods such as the effect of rainfall regime on the water accumulation in soil correlated with the evolution of atmospheric temperature.

MATERIAL AND METHOD

To estimate the state of soil moisture relative to the amount of rainfall, were performed decade and sometimes twice a month throughout the years (2008-2013), soil sampling and laboratory gravimetric determinations 3 depths (0-20, 20-40, 40-60 cm). The soil samples were extracted randomly with specific sounding from different areas of SCDP Baneasa plantation, so that the samples are representative for the entire experimental surface. To determine the soil moisture, it was applied the classical gravimetric method (according to the studied methodology of ICPA laboratory) through which the extracted fresh soil samples, were, each weighed, in special vials with cover in order to dry them in an oven at 105 ° C, 5 hours, followed by subsequent weighing after drying. The difference resulted between the two weighings (of the fresh soil and the dry soil in oven) was expressed as a percentage (%). The results obtained of the soil (U%) were decadal and then, interpreted by the monthly, average quarterly and annual average and their interpretation served to assess soil water deficit for the studied period (2008-2013).

RESULTS AND DISCUSSIONS

The soil in our fruit trees plantation SCDP Baneasa, is assigned in the soil type „sloppy-argiloiluvial molic on a forest reddish brown background”. The characteristic porosity (46-49%) and clay argillaceous texture, provides a good water absorption and accumulation (Cociu V, 1993; Blaga Ghe.,1996, Ghenea N., 2004). Also, the parent rock is more than 1,5 m deep and contribute to the completion of favorable conditions both for water storage and rooting. The humus content (2,7 to 3%) and slightly acidic pH to neutral (6.7-7) are also contributing factors to the limitation of the drought effects. Thus, the „mull” humus type (trough the humic acid with the partial saturation of the base) is a main component of the soil fertility and also favors water preservation.

The results obtained (*table 1*) and (*figure1, figure 2, figure 3*) reveals the average annual humidity (U%) of the soil and annual amount of rainfall during the period 2008-2013. All annual values of the rainfall (2008-2013) were placed /classified far below average normaly multiannualy value by 596,2 mm. Soil moisture was either “minimum” soil moisture (for 2008, 2013, 2011), or in the "optimal" range for soil moisture (for the years 2012, 2009, 2010). Also the amount of rainfall was lower in 2008, 2011, 2013 than in the years 2009, 2012, 2010

For 2008, the annual humidity average of the soil (U%) was 16,7% and represents the lowest value of the studied period 2008-2013. It is a lower value of the "optimum" moisture period, but it is included within the "low" (minimum) period without affecting , in any way the trees survival. It is because the type of rooting, fruit trees are in generally resistant to fluctuations in annual precipitation. During the (trimesters II and III), the average moisture content of the soil (U%) was only 15.6%. Annual amount of rainfall was 262,7 mm and is characterized as the driest year of the period of six years investigations, in which the volume of rainfall is only 44 % of the normaly multiannualy average value (596.2 mm). The average air temperature from April-September period was 18,45ºC, so higher than normaly multiannualy average value (18,05ºC) during this period.

For 2009, the humidity of the soil (U%) was 18,8% and is placed in an "optimum" period of humidity, and in the (April-September), the average (U%) soil was greatly reduced, reaching "minimum" 15,9% moisture. The annual rainfall amount was 304 mm and 51% of normaly multiannualy average value. The average of air temperature was moderate, so the second and third trimesters were together 18.4ºC, compared to the normaly multiannualy value (18,05ºC), of the same period. Thus, the evapotranspiration process of soil was also moderately maintaining the water proportion of the soil at a minimum interval

For 2010, humidity (U%) soil was 21.5%, in on "optimal" soil moisture. For the second and third trimesters period, the soil (U%) average was not greatly reduced, succeded in remaining in the “optimum” interval 20,8%. The annual amount of rainfall was 524.1 mm, the best value in the period studied (2008-2013) and represents 87.9% of the normaly multiannualy average value (596,2 mm). From the point of view of atmospheric temperature, the month (T°C) average from April to September was 18,2°C, relatively about normaly multiannualy average value (18.05°C) for the two quarters (II and III); so the soil U% was also moderately protected.

For 2011, the annual average of the soil humidity (U%) was 17.7%, being included so at the upper limit of "minimum" humidity interval. The average of the soil moisture for April-September was for 17, 5%. The annual amount of rainfall was 264,8 mm and represents 44,4% of the normaly multiannualy average value. In the second and third quarters, the average of air temperature was 18,3°C and thus was moderate evapoperspiration maintaining soil water reserves. However, it should be noted that in the first part of the fourth quarter 2011 (at the exit of vegetation) there was a dry period, making U% soil to fall well below the minimum of the limit of 13,3%.

For 2012, the annual average of the soil humidity (U%) soil was 18,3% and was at the lower limit of "optimum" moisture, and during the months of April to September soil moisture average (%) decreased to 17,05%. The amount of the rainfall was 419,7 mm and represents 70,4% of the normaly multiannualy average value. In the months from April to September the atmospheric temperature (20,15°C) far in excess of the normaly multiannualy average value (18,05ºC). This thermic excess favored evapoperspiration that has reduced soil moisture in the upper limit of "minimum” interval, though the amount of rainfall was very high.

For 2013, the annual average of soil humidity (U%) was 17,56% and is therefore included in the upper limit of the "minimum" humidity and during the second and third trimesters, the humidity average was reduced to 15,7%. The annual amount of rainfalls was 290,6 mm and represents 48,7% of the normaly multiannualy value (596,2 mm). From the point of view of atmospheric temperature in the period April to September, the average (TºC) was 19°C almost 1ºC confronted bay the multiannual average (18,05ºC) of the same period.

Table 1

The correlation of obtained values with the normaly multiannual values

	Period (*/**/***)	2008	2009	2010	2011	2012	2013
(*) Soil humidity (U%)	Annual Average (%)	16,7	18,8	21,5	17,7	18,3	17,56
	II and III trimesters (%)	15,6	15,9	20,8	17,7	17,05	15,07
(**) Atmospheric precipitations (mm)	Average Annual (mm)	262,7	304	524	264,8	419,7	290,6
	Percentage(%) compared to the multiannualy average	44	51	87,9	44,4	70,4	48,7
(***) Atmospheric Temperature (TºC)	Average (ºC) second and third trimesters	18,45	18,4	18,2	18,3	20,15	19,0
(*) Range of soil moisture (U%): optimum 18-22%; minimum 18 to 14%; 22-26% maxim							
(**)Atmospheric Precipitation (multiannual average): 596.2 mm (for 40 years from 1969 to 2009, values provided by LRBS-NMA and Spel pdf. Forecast Pcs.							
(***)Air temperature (multiannual average) of trimesters.II and III: 18,05ºC							

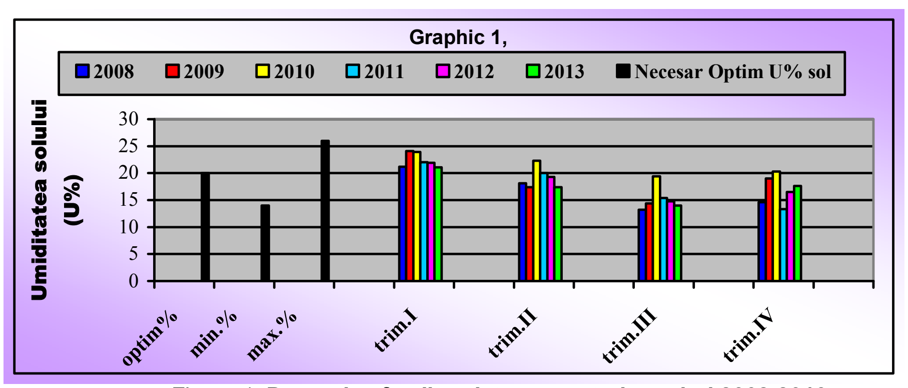

Figure 1 **Dynamic of soil moisture quarterly period 2008-2013 in terms of irrigation at SCDP Baneasa, compared to the optimal, maximum and minimum values(%)**

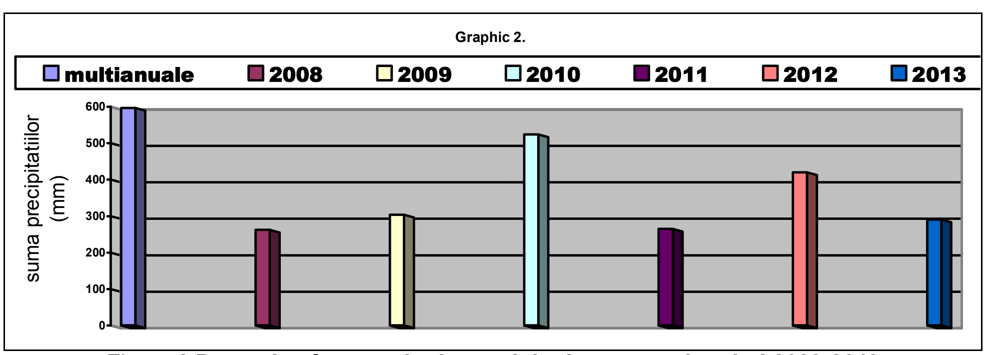

Figure 2 **Dynamic of atmospheric precipitations annual period 2008-2013 in terms of irrigation at SCDP Baneasa, compared to the multiannual value**

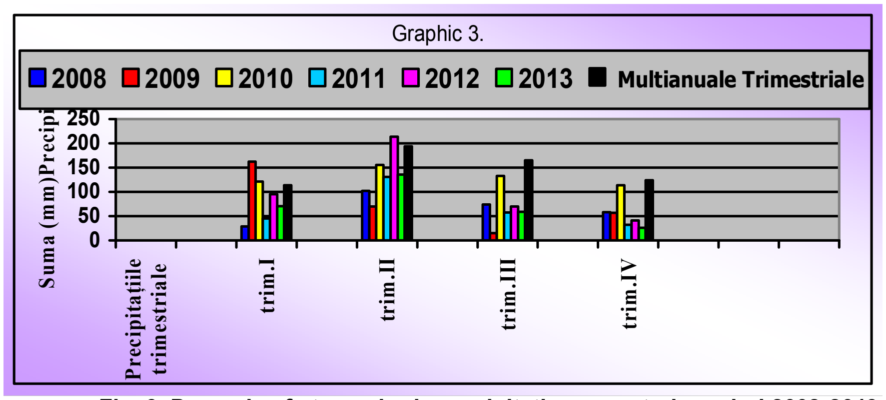

Fig. 3. Dynamic of atmospheric precipitations quarterly period 2008-2013 in terms of irrigation at SCDP Baneasa, compared to the multiannual value

Therefore evapoperspiration losses were high. *(table 1)* it is an interdependence between the values of U% soil (annual average) and rainfall (annual amount mm) and over them we observe the atmospheric temperature. The comparable data of the soil moisture shown that in 2009 the annual humidity (average) 18,8% and in 2012 , annual humidity is with 18,3%; but the amount of rainfall reported the annual value for 2009 is 51% and for 2012 is 70,4%. The difference of atmospheric precipitation is not found in soil moisture, because the average of atmospheric temperature in (II and III trimesters) 2009 was only slightly higher (0,35°C) compared to multiannual temperature (18,05ºC average for the April-September) interval; and in 2012 the atmospheric temperature average was marked with a difference by 2,1ºC namely 20,15ºC, compared to multiannualy average value.

In the years 2011 and 2013 it is shown the same correlations, namely that in 2011 U% annual soil was slightly increased on average by approx. 17,7% compared to 17,56% for 2013, although the amount of atmospheric precipitation was higher in 2013 namely 48,7% compared to 44,4% for 2011. The role of temperature in the April-September through evaporperspiration is also present: in 2011 the average atmospheric temperature is only 0,25ºC higher while in 2013 this average is higher approximately 1ºC compared to 18,05ºC the normaly multiannualy average value for trimesters II and III).

The yers 2010 had the greatest amount of atmospheric precipitation and as a result had the highest value of soil moisture, an average of approx. 21,5%.

It is evident that both the volume of rainfall throughout the year (524,1 mm) and the average temperature of the second and third trimesters of only 18,2°C, make 2010 a comparable and representative year with normaly multiannualy values and may be considered to be a favorable year 2008-2013 period.

CONCLUSIONS

Regarding soil characteristics from SCDP Baneasa plantation, it should be noted that in period 2008-2013, the atmospheric precipitation decreased quantitatively and the atmospheric temperature increased compared to multiannualy value average, resulting the doubling of negative effects to enssure the necessary of soil water. However, the soil succeded in maintaining optimal reserves (factory) of water. The soil at SCDP Baneasa, due to its characteristics, being as "sloppy-argiloiluvial molic on a forest reddish brown background", with texture, porosity and satisfactory content of humus and acid-base equilibrium and due to the agrotehnique permanent and maintenance works, allow the water storage and maintaining the humidity moisture at satisfactory to optimal level.

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