The drought impact on agricultural crop production in Tunisia

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Abstract. Tunisia is known for its large interannual variability of climate. It knows the heavy rain, rain storm, as well as droughts. Meteorological drought, resulting in low rainfall, is characterized by a duration and relatively high intensity. It can last a year or it can persist for several consecutive years. It has a direct impact on the hydrological drought. The Tunisian climate is marked by alternating wet and dry years. Situated in the Mediterranean watershed, Tunisia is under the influence of Mediterranean climate. Rainfall is usually very poorly distributed over the year. The rainy period occurs in autumn-winter (September-March). This concentration of rain over half of the year has a great effect on the hydrological balance and on agricultural crop potential. Particularly, grain yield of cereals declines when rainfall is lacking during March and April.

Keywords. Drought – Rain – Agriculture – Tunisia.

Impact de la sécheresse sur la production des cultures en Tunisie

Résumé. *La Tunisie est connue pour la grande variabilité interannuelle de son climat. Elle connaît autant de pluies importantes, pluies orageuses, que de grandes sécheresses. La sécheresse météorologique, traduite par des déficits pluviométriques, est caractérisée par une durée et une intensité relativement importantes. Elle peut durer une année comme elle peut persister plusieurs années consécutives. Elle a des conséquences directes sur la sécheresse hydrologique. Le climat tunisien est marqué par l'alternance d'années sèches et humides. Se trouvant dans le bassin méditerranéen, la Tunisie est soumise à l'influence du climat méditerranéen. Les pluies sont généralement très mal réparties sur l'année. La saison des pluies va du mois de septembre jusqu'au mois de mars. Cette concentration de pluie sur la moitié de l'année a beaucoup d'effet sur le régime hydrologique et la production agricole en général et céréalière en particulier. Les mois de mars et d'avril sans pluie peuvent faire chuter considérablement les rendements en céréales.*

Mots-clés. *Sécheresse – Précipitations – Agriculture – Tunisie.*

I – Introduction

Meteorological drought is defined by annual rainfall deficit. Hydrological drought is due to the reduction of surface runoff and therefore a lower level of water. The lack of rainfall greatly affects the runoff and has a direct impact on agriculture. Agricultural drought occurs when low level moisture in soil, coupled with the scarcity of water around plant roots stops growth and reduces crop yields. This study was developed in Siliana, a region located in the middle of Tunisia. The study area is characterized by a semi arid climate. Rainfall is erratic and variable.

II – Data and methods

To perform this study we used rainfall data observed at the Agricultural Station of Siliana during a period of 40 years. Similarly, we investigated cereals productions data (durum wheat, bread wheat and barley) collected over 11 years, 1993-2005. Our approach is based on regression analysis obtained from agricultural production versus time (water year) on one hand and deficit

periods determination on the other hand compared to normal rainfall across annual and seasonal level.

III – Data analysis

Annually rainfall evolution was plotted against time, expressed yearly from 1967 to 2006 and based on long term rainfall. Figure 1 shows a very large variability.

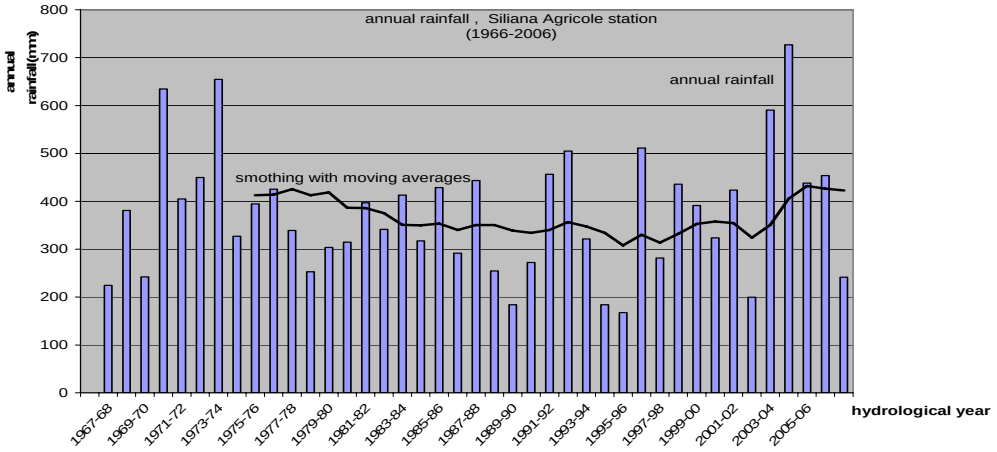

Fig. 1. Annual precipitation. Siliana Agricultural Station, 1967-2006.

Figure 2 shows the calculated differences of annual precipitation in comparison with normal situation and indicates clearly an annually alternation between wet and dry situation.

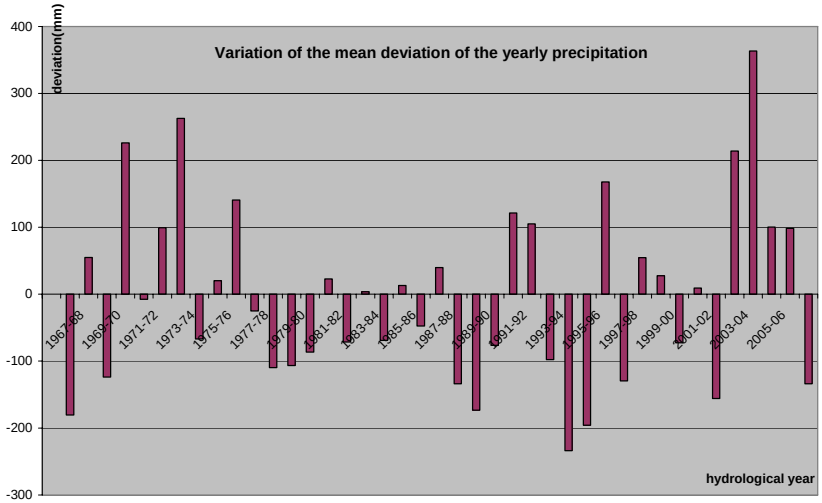

Fig. 2. Variation of the mean deviation of the yearly precipitation.

Due to the lack of data on agricultural production over a long period, we merely analyze this relationship over 11 years. From the graph of Fig. 3, an interannual variability of agricultural production is expected. The correlation between variables is very low. However, we note that agricultural crop production is strictly rain dependant (Table 1).

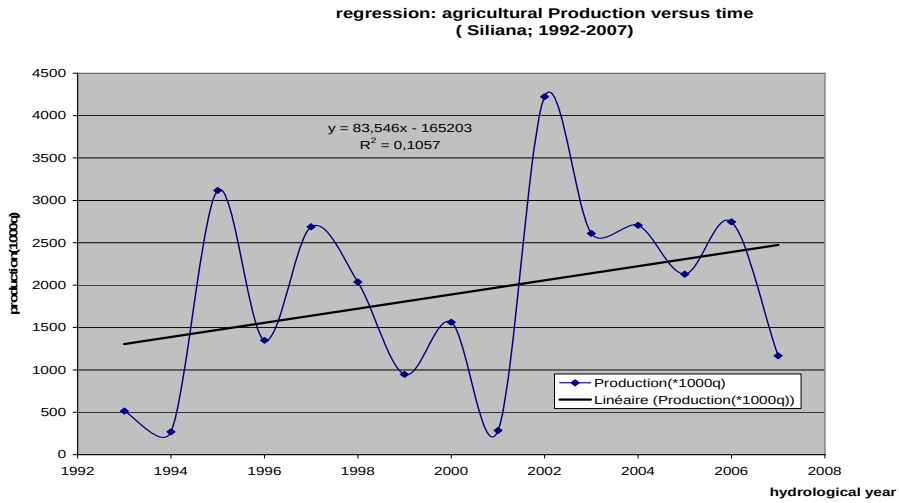

Fig. 3. Regression agricultural production versus time.

Table 1. Agricultural production, annual rainfall, area and seasonal rainfall. Siliana region (Tunisia)

Year	Crop production (×1000 q)	Annual rainfall (mm)	Area (×1000 ha)	Seasonal rainfall (mm)
1993-94	514.746	223.3	113	25.5
1994-95	269.865	317.1	126.5	34.5
1995-96	3116.314	641.7	157	131
1996-97	1349	332.6	135.5	67.7
1997-98	2688	536.5	150	117.2
1998-99	2037	422.1	158	128.2
1999-00	946	382.9	113	99
2000-01	1561	418.9	110.5	139.1
2001-02	285	449	31.5	135
2002-03	4224	622.7	174	165.5
2003-04	2611	672.8	148.5	265.6
2004-05	2707	562.3	150	76.6
2005-06	2129	517.6	160	60.5
2006-07	2746	285.5	150	138
2007-08	1166		124	

Rainfall in March, April and May have a major impact on agricultural crop production. Indeed, for the same cultivated acreage, crop production would be important if the rain during these three months is high even if the annual rainfall is lower or equal to normal level. For the same annual rainfall (around 520 mm) and for the same acreage, a decrease in spring rain of about 48.5%

can cause a fall in total crop production estimated of about 20.8% in Siliana region. This suggests that the monthly or seasonal drought can affect many productions and should be taken into account in agricultural activities and management of water resources in conditions of scarcity. Results would be validated when based on longer series of observation or on other region using data obtained in the same climatic context. In 2006-2007 year, March, April and May months were wet. The 2006-2007 year was dry; however agricultural production was higher than normal. In this case, it would be possible to determine drought levels and intensities which can be calculated based on crop production regression versus time (Barakat and Handoufe, 1997).

IV – Conclusion

The study of rainfall in the region Siliana showed alternation between wet and dry periods. This rainfall irregularity and variability has a spatial and temporal influences on agricultural production. The drought intensity varies from year to another. It varies within the same year (Mellouli *et al.*, 2005). The rainfall deficit in March, April and May can reduce agricultural crop more than 20%.

References

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