

Development of the Saver Irrigation in the Northwest of the Algeria: the Case of the Tlemcen Department

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ABSTRACT

Algeria has a limited water resource, irregular and very unevenly distributed. With the exception of fossil water of the Sahara, natural water resources are mainly located in the North of the country. The share taken by the drinking water supply has increased significantly in volume and proportion and therefore the share of the water used for irrigation has dropped. Despite this reduction, the agricultural sector remains the largest consumer of the water. During the last five years -and in order to promote agriculture and sustainable development as well as managing better the water of the irrigation- the focus was on the use of saver irrigation systems. The objective of this study is to investigate the development of this type of irrigation at the level of Tlemcen. The working methodology is based on classical statistical calculations and a Multiple Correspondence Analysis (MCA) rates of irrigated farmland by the two types of irrigation (traditional and saver). The results show a very encouraging development of these modern systems in this state, about 44% of the physical total useful agricultural area irrigated.

Keywords: natural water resources, water-saving irrigation systems, Tlemcen, MCA.

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I. INTRODUCTION

Algeria has limited natural resources, erratic and unevenly distributed. With the exception of fossil water Sahara, natural water resources are mainly located in the North. 90% of the total surface flows (estimated at 12.4 billion m³ / year) are on the coastal area (7% of the land area) the remaining 10% were split between the Highlands and the Saharan basins. These water resources are becoming more limited due to the successive years of drought are more frequent and more cyclical than in the past. The overall water demand in Algeria has increased rapidly and significantly. Multiplied by four over the last forty years, it now exceeds more than half the volume of potentially available resources. At this rate, the maximum limit of the hydraulic potential will be reached before 2050 [1]. In another context, strong competition is developing between the major sectors of use, which is added to the imbalances in availability of resources between regions, and making it more and more difficult the distribution of trade-offs. Therefore, it is becoming increasingly urgent to implement strategies for rational and efficient management of its resources to cope with this significant growth in water demands and conflicts of use (drinking water, industrial water, agricultural water). According to Mayor (1997) [2], this scarce resource, essential for life, should be considered a natural treasure that is part of the common heritage of humankind. This is a public good and an essential resource for life and indispensable to be managed sustainably. The part that takes the water supply has increased significantly in volume and proportion. 16% of overall consumption in 1975, it increased to 35% currently. This increase has meant that the share of water for irrigation fell by 80% to 60% during the same period [1]. Despite this reduction, the agricultural sector remains the largest consumer of water. For small and medium irrigation, the total irrigated area in Algeria reached 980,000 ha mainly from underground resources, whereas it was only 350 000 ha in 2000 [3]. The gravity irrigation system by irrigation channel is the mode of irrigation dominant over much of the irrigated area and can be seen on the perimeters of crops during the dry season. According to the usual practice in Algeria, water is distributed by lines. This method of irrigation alone accounts for 80-90% of irrigation systems worldwide. This is a technique, which continues to be widespread particularly in developing countries. Although the cost of building a gravity system is 3 to 4 times lower than that of a network under pressure and there is little or no energy consumption, the efficiency of these systems is low, 30% usually less than that easily reaches 80 to 90% on pressurized

systems. In addition, they are consuming water and require a large workforce [4]. During the last five years and in order to promote agriculture and sustainable development and to better manage water for irrigation, the focus was on the use of surface and ground water using saver irrigation systems (sprinkler pivots centre, drips) to increase the irrigated areas in arid to semi-arid.

The use of saver irrigation systems aims to improve the efficiency of irrigation and thus increase the surfaces or to practice several crops a year using the same amount of water and thus minimize consumption water. In this context, the Ministry of Agriculture has initiated a water conservation policy by subsidizing the purchase of equipment by the irrigators to use the "drip". This operation was a great success at the national level and resulted in a share of more and more of "localized" among other irrigation modes [1]. Indeed, this type of irrigation has increased from 5,000 ha in 2000 to 20,000 hectares in 2001 and 47,000 hectares in 2002 to nearly 212,000 ha in 2012 [5]; [6]. Nevertheless, the questions that arise, is that this operation themselves as successful at all states of Algeria? The objective of this work is to study the development of gout and gout systems to spray at the state of Tlemcen.

II. METHODOLOGY OF WORK

The methodology is simple enough. It consists of a simple static treatment and a Multiple Correspondence Analysis (MCA) individual data at the Agricultural Services Directorate (ASD). The data collected are as follows: Total UAA, irrigated UAA applied different irrigation systems (traditional and modern) and end, irrigated UAA by each system.

III. OVRVIEW OFTHE STUDY AREA

The state of Tlemcen occupies a specific position in the Oran region northwest of Algeria (Figure 1). His Montes, belonging to the Maghreb-Mediterranean area are found in the sub-sector O3: Tell Atlas, the Oran area (Figure 2). This state, both coastal and border is geographically limited to the north by the Mediterranean Sea to the north - east by the state of Ain Temouchent, to the east by the state of Sidi Bel - Abbes, west by Morocco and south by the state of Naama. It is characterized by a semi-humid to arid climate very variable in time and space. It has 979,715 inhabitants (in 2005) and covers an area of 9 017.69 km², with a density of 108 inhabitants per square kilometer. Although she has a wide and diversified industrial base, the state of Tlemcen has a very strong agricultural aspect.

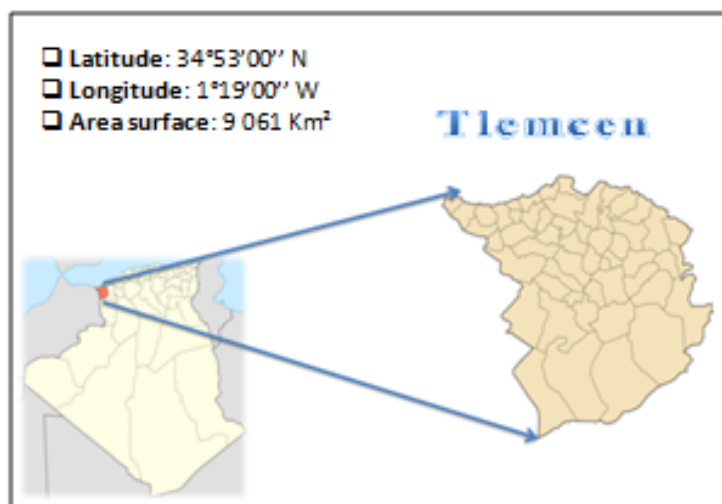


Figure 1: Geographic Situation of the State of Tlemcen.

The mountains of Tlemcen represent the wettest areas of the West Algerian with average rainfall exceeding 600 mm / year [7]. These mountains are the main mountainous terrain in western Algeria, it is a good proportion of the territory of Tlemcen area with 386 819 ha, more than 42% of the total area and culminate to 1843 m Jebel Tenouchfi. The mountains of Tlemcen figure with the mountains of Beni Chougrane Daya and the water towers of Oran. The population is estimated at 200,997 inhabitants with a rurality index of around 230.48 (2007 census) [8]. This chain is formed of Jurassic carbonate and dolomitic land and has a long karstification allowing the infiltration of rainwater. This karst water resurfaced through a high number of sources that account this massive. Its vegetation is important, especially the south-western forests that significantly diminish the erosive effects [7].

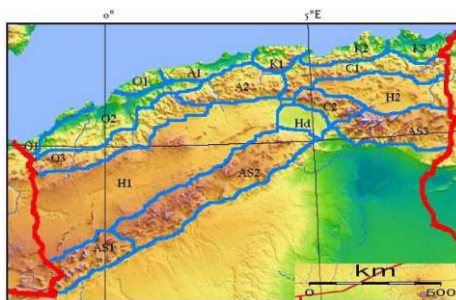


Figure 2: cartographic sketch of phyto-chorologic districts of northern Algeria [9]

On the catchments, watershed Tafna (Figure 3), in the North West of the Algerian territory stretches over much of the province of Tlemcen on an area of 7245 km² [10]. The remaining third overlaps a part of Moroccan territory. Under the new structure of Hydrological units in Algeria, Watershed Tafna is number 16 and belongs to all of Oran-Chott Cherguie.

The state of Tlemcen undergoes enormous pressure on water resources, surface and groundwater. This trend was exacerbated in recent years with the rainfall deficit, which led to a prolonged and severe drought, and the priority given to the ASP for the exploitation of water resources. The province has five dams: Dam Blessed Bahdel, Mafrouch dam, dam Sikkak dam Sidi Abbedelli and finally dam Boughrara. All these dams were assigned to urban water supply of Tlemcen, Oran but also including those originally dedicated to the supply of irrigation (Blessed Bahdel and Sikkak). At present, the dam Sikkak no longer intended for drinking water supply.

This water crisis has led local authorities to launch groundwater surveys through the mountains of Tlemcen are the wettest regions of western Algeria. These are the natural water tower in a range of cities belonging to the province of Tlemcen, Ain-Temouchent and Oran [11]. In addition to the exploitation of groundwater naturally by the spring catchment, small hydraulic works also exploit these waters: boreholes and wells. Table 1 shows the progress of the drilling of execution of works through the mountains of Tlemcen before 1970 to 2004.

Table 1: Boreholes Achievements State through the mountains of Tlemcen [11]; [12].

Realization period	Number of boreholes	drilled linear (m)	Prospected area
Before 1970	20	1644,6	Meffrouch
1970-1980	12	1811	Terny, El gor, El Aricha
1980-1990	53	12 642,75	Tlemcen, Sebdou
1990-2000	51	11 620	Tlemcen, Sebdou
2000-2004	22	7715	border area

IV. RESULTS AND DISCUSSION

The state of Tlemcen is divided into four agricultural regions either: (1) Monte of Traras / Coastal, (2) the Mountains de Tlemcen / Beni Snous highly Tafna, (3) Medium and Low Tafna / Plain Tlemcen Maghnia and end (4) of Steppic Zone Ras El Ma. The total agricultural area of the state (UAA) is 370 176 ha, while the irrigated UAA of 20 012 ha only, representing only 5.4% of the total UAA. The Tlemcen ranks second only to Mascara to Oran, and the 13th rank at national level. The vegetable growing occupies more than 50% of the irrigated UAA. Grain farming occupies a third of the total UAA and its production site Tlemcen in 7th place nationally. 55.30% of the total irrigated UAA of the province is irrigated by groundwater or 11 067.45 hectares and 45.70% left is irrigated by surface water or 8 944.5 ha (Figure 4).

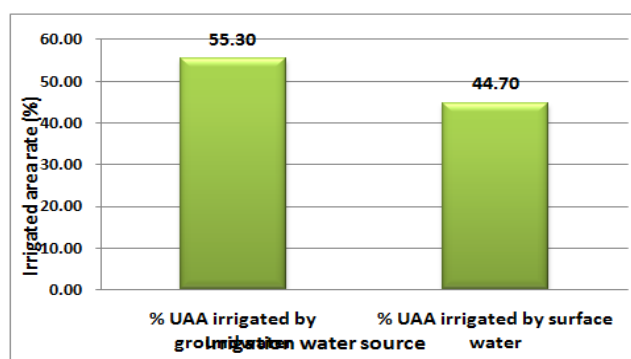


Figure 4: irrigated area rate (%) by irrigation water source.

The flow irrigation «irrigation channel» occupies 11198.5 ha, or nearly 56% of the total irrigated physical SAU of the state. Regarding modern irrigation systems since the advent of the NADP (National Agricultural Development Plan), the state of Tlemcen saw developing drip and sprinkler systems to drop, respectively, 27% (5416, 45 ha) and 17% (3397 ha) of the total irrigated UAA physical (Figure 5), or 44% in total.

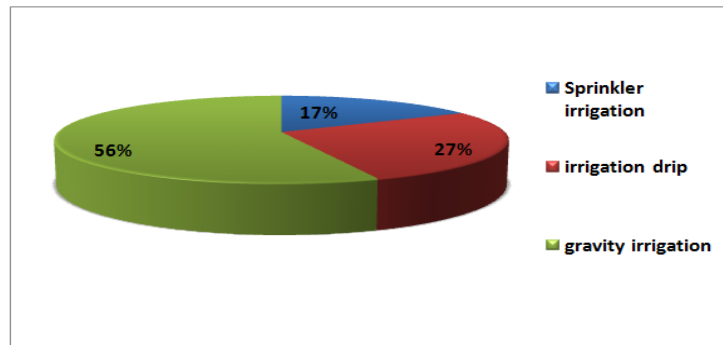


Figure 5: irrigated area rate by each system on the total UAA of Tlemcen.

The Principal Component Analysis (PCA) allowed us to visualize the similarities and differences between the municipalities according to the concept of distance between individuals (common in our case) (Figure 6 and Figure 7). The factorial axis in red (with 69.2% of the variance), which has a gradient of irrigated areas by modern systems, shows that the municipality where the rate of surface irrigation is more important is the town of Maghnia with an irrigated area of 3670 ha. As against the second axis (with 29.2% of the variance) where the irrigation rates by these systems contributes greatly to its building shows that the municipality where the rate of gravity irrigation is the largest compared to modern systems is the Town of Hennaya where the area irrigated by the gravity system is 875 ha. An against, the area irrigated by sprinkling is 193 ha. and 72 ha by drip. Comes in the second place the town of Beni Snous with 775 ha, then the town of Maghnia with 580 ha

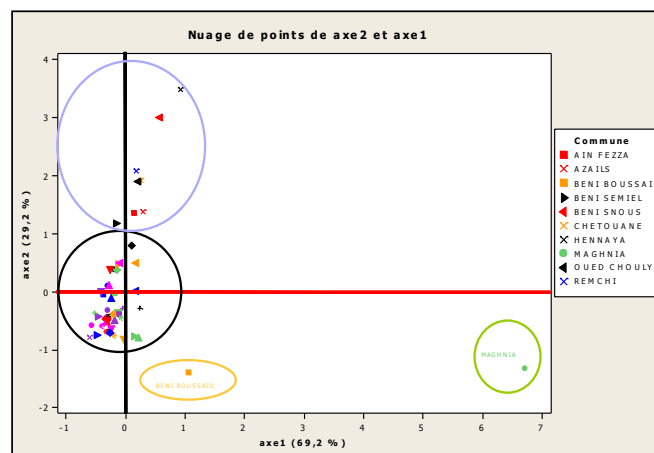


Figure 6: Dispersal of individuals (towns) according to the first two factorial axes.

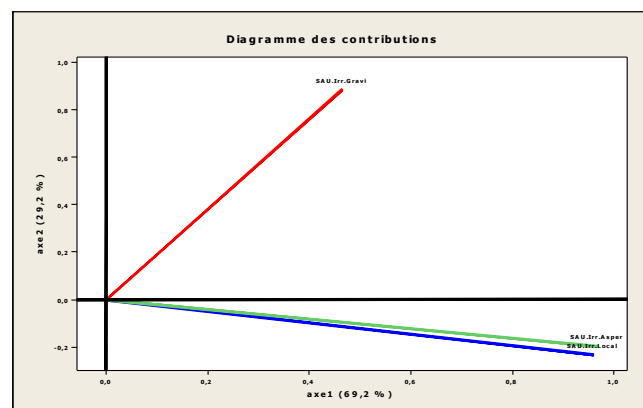


Figure 7: correlations of variables according to the first two factorial axes.

These results show a very encouraging development of modern systems in the agricultural region (3) (which alone accounts for 53.39% of the total UAA irrigated state) especially in the city of Maghnia that focuses on she only 3670 ha of drip and sprinkler, or 86% of the irrigation systems introduced in its total irrigated farmland. By cons in regions known by their collective gravity irrigation systems and very ancient, if the agricultural region of Tlemcen Hills / Blessed Snous- High Plains, only 1371 ha are irrigated with "drip", 6 85% of the total UAA irrigated the province, according to the inventory of the TDC (Perimeters Medium Hydraulics) in 2009. This system affects only 7 ha of irrigated UAA of the common "OUED CHOULY" owned this region, nearly 2.8% only. Sprinkler irrigation is only 597 hectares of irrigated UAA of the aforementioned agricultural region in 2009 with 2.98% of the total UAA irrigated the province of Tlemcen (Figure 8).

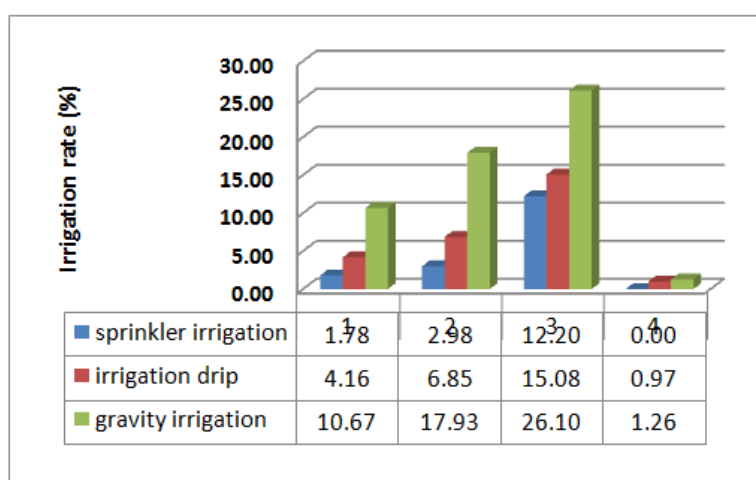


Figure 8: irrigation rate by each irrigation system at the agricultural areas of the province of Tlemcen.

V. CONCLUSION

The results demonstrate a very encouraging development of modern systems and therefore the considerable effort was made by the State in order to expand irrigated areas in the agricultural area (3) Medium and Low Tafna / Plain Tlemcen-Maghnia, which alone accounts for 53.39% of the total UAA irrigated the province, especially in the city of Maghnia. On the other hand, in other agricultural regions, the use of modern systems are less developed. It should be emphasized that a great effort remains to be done in the field of mastering these saver irrigation techniques (modern) to make more efficient the water saving in terms of water policy. It takes more than awareness of farmers still using the conventional system so that they opt for saver systems and especially the drip-drip that has proven itself nationally and at the level of the state of Tlemcen.

VI. APPENDIX

Appendices, if needed, appear before the acknowledgment.

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