The effects of drought on irrigation water resources and the new water-saving trend of irrigated farming. Case of the Korimat irrigated perimeter, Essaouira province, Morocco

El Moujahid A.

in

López-Francos A. (ed.).
Drought management: scientific and technological innovations

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 80

2008
pages 127-132

The effects of drought on irrigation water resources and the new water-saving trend of irrigated farming. Case of the Korimat irrigated perimeter, Essaouira province, Morocco

A. El Moujahid
Provincial Direction of Agriculture, BP 23, Assa, Assa-Zag Province, Morocco

SUMMARY – The increasing scarcity of the water resources for irrigation, combined with the growing demand of water of the other sectors, leads us to re-examine the established system of irrigation and push us to adhere to the new tendencies of the national water-saving strategy. The present study focused on reconversion of the sprinkler irrigation system set up in the irrigated perimeter of Korimat (Essaouira province) to a drip irrigation system. The suggestion was adopted in a context of implementing strategies of water saving developing water resources in the hydraulic basin of Tensift and launching by the Administration of the Agricultural Engineering, the Program of Development of the Drip Irrigation on an area of 450,000 hectares. The study focuses essentially on the evolution in irrigation water resources and its effects on the non-utilization of irrigation equipments and the suggestion of reconversion of the existing system of irrigation as a convergence choice to the national strategy of water saving.

Key words: Scarcity of water, strategy of saving water, hydraulic basin of Tensift, perimeter of Korimat, drip irrigation.

RESUME – *"Les effets de la sécheresse sur les ressources en eau pour l'irrigation et la nouvelle tendance à l'économie d'eau en agriculture irriguée. Le cas du périmètre irrigué de Korimat, province d'Essaouira, Maroc". La rareté croissante des ressources en eau d'irrigation, conjuguée aux conflits d'usage avec les autres secteurs, nous amène à revoir le système d'irrigation instauré et à adhérer aux nouvelles tendances de la stratégie nationale d'économie d'eau. La présente étude a été menée à sa fin avec orientation de reconversion du système d'irrigation aspersif mis en place dans le périmètre irrigué de Korimat (province d'Essaouira) en un système d'irrigation localisée. Suggestion adoptée dans un contexte de mise en œuvre des stratégies relatives à la préservation et au développement des ressources en eau dans le bassin hydraulique du Tensift, et lancement, par l'Administration du Génie Rural, du Programme de Développement de l'Irrigation localisée sur une superficie de 450 000 hectares. L'étude s'articule essentiellement sur l'évolution des ressources en eau d'irrigation et leur implication dans l'inexploitation effective des équipements d'irrigation et la proposition de reconversion du système d'irrigation existant comme choix de convergence avec la stratégie nationale d'économie d'eau.*

Mots-clés : *Rareté de l'eau, stratégie d'économie d'eau, bassin hydraulique du Tensift, périmètre de Korimat, irrigation localisée.*

Introduction

Irrigated farming is considered as one of the big realizations of modern Morocco. The area laid out by the authorities surpasses currently 1,016,700 hectares of which 682,600 hectares in large scale hydraulic and 334,100 hectares in medium and small scale hydraulic, leading to the development of important agro-industries and the increase of farmers incomes and life conditions.

Nevertheless, succession of drought episodes during the eighties and nineties of the last century combined with the progressive request of water in touristic, industrial and urban centers has generated a strong reduction of water reserved for the irrigation and consequently impose inevitably a revision of the adopted methods of irrigation.

By the way, the Moroccan Department of Agriculture has organised several events devoted essentially to the irrigation water saving considered fundamental for the country. Among those events we can mention:

(i) The Information Day on the national debate on water, organized by the Administration of Agricultural Engineering on December 19, 2006.

(iI) The financial aid granted to the agricultural investments (60% of the cost of installing the drip irrigation system).

(iii) The development of the drip irrigation program, that foresees fitting in long term an area of 450 000 hectares.

In this context, the case of Korimat zone irrigated by sprinkling constitutes an example of reorganization regarding the adoption of saving water irrigation methods with the reconversion of the existing system to a drip irrigation system (see Fig. 1).

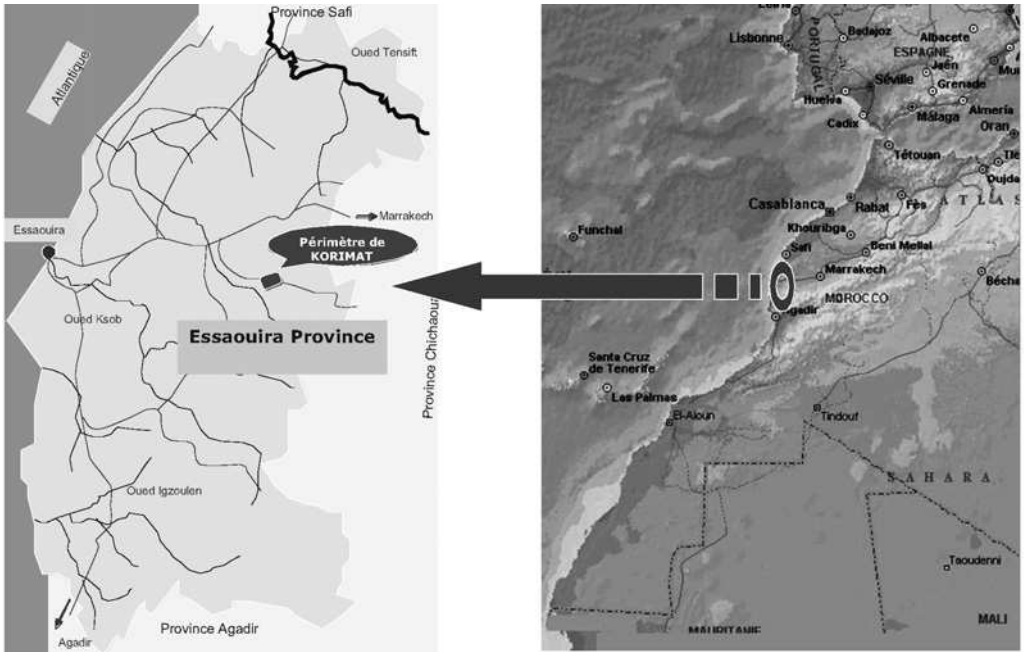

Fig. 1. Geographic situation of Korimat zone.

Generalities

The irrigation zone of Korimat covers 945 ha, including 600 ha as irrigable area. The first evaluation of the balance resources-needs has helped to establish 450 ha to the net area of irrigation. The supply of irrigation water is made by pumping the local groundwater. It is in the *turoniens* limestone aquifers which are at varying depths between 20 and 40 metres. The annual pumping volume was estimated initially at 3.37 million cubic meters.

The zone behaves three areas: the first area (I) occupy 50 ha, the second (II) 330 ha, the third (III) 70 ha. The irrigation system for the first one is gravity system but it's sprinkling system for the second and the third ones (see Fig. 2). The areas (I) and (II) are irrigated with three wells: no. 1, no. 6 and no. 12, while the area (III) is irrigated by the well No. 4. Immersed electropumps are used to pump the irrigation water from wells, and the horizontal axis electropumps bring water to area (I) and (II) (see Fig. 2).

The goal of the project is to introduce besides existing crops (olive trees, vegetables, cereals...) new crops like (oat, bersim, potatoes...).

However, the weak flow of the wells had deeply impeded the normal functioning of the project. The new situation leads us to rethink the irrigation system.

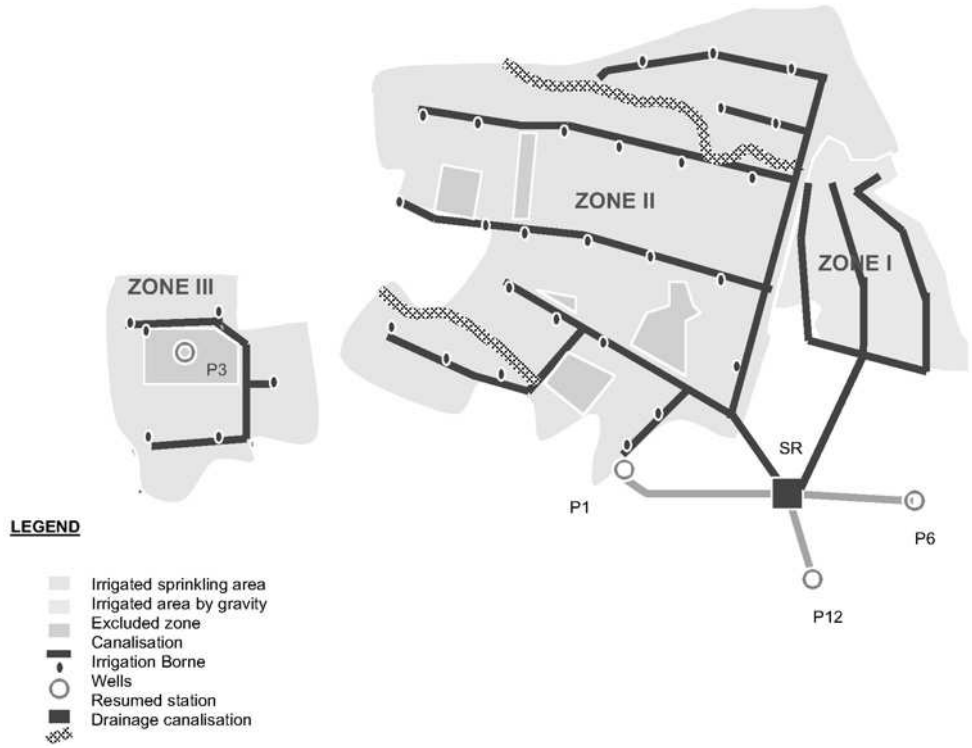

Fig. 2. Irrigation perimeter of Korimat.

Water resources

The underground local water table is the exclusive origin of irrigation water. The water is captured by four wells with an average depth of between 31 and 39 meters. The first characteristics of the wells obtained in 1980 trials pumping are summarized in Table 1:

Table 1. Characteristics of the wells obtained in 1980

Wells	P1	P3	P4	P6	P9	P12
Depth/curbstone level (m)	18.50	36.00	40.00	20.40	28.00	36.00
Piezometric level (m)	14.38	19.60	32.60	18.40	18.50	21.96
Casing of a well (m)	14.00	35.00	36.00	18.00	26.00	32.00
Water level (m)	0.90	18.70	8.20	8.30	12.50	14.86
Use flow (l/s)	42	28	8	85	8	70

In April 27, 1993, the characteristics of the wells in question had changed. The new characteristics are summarized in Table 2:

Table 2. Characteristics of the wells obtained in 1993

Wells	P1	P3	P4	P6	P9	P12
Depth/Curbstone level (m)	17.60	33.70	38.35	18.10	25.60	33.70
Piezometric level (m)	13.90	18.80	32.35	17.80	18.50	21.15
Casing of a well (m)	14.00	35.00	36.00	18.00	26.00	32.00
Water level (m)	3.70	14.90	6.00	0.30	7.10	12.55

From the data on characteristics of wells and hydrogeological context of the region, the Provincial Administration of Agriculture had proceeded for deepening 6 wells and to long term pumping tests. Considering the results of pumping tests conducted during the months of October, November and December of 1994, and hydrogeological conditions of the Korimat area, it was proposed to exploit a flow of global operations of 240 l/s. The new features of the wells are presented in Table 3.

Table 3. Characteristics of the wells obtained in 1994

Wells	P1	P3	P4	P6	P9	P12
Depth/curbstone level (m)	38.50	36.00	51.00	31.60	31.50	36.80
Piezometric level (m)	14.60	20.00	33.00	18.80	19.20	22.30
Casing of a well (m)	23.90	16.00	18.00	12.80	12.30	14.50
Water level (m)	33.50	36.00	48.00	28.80	30.00	33.00
Use flow (l/s)	60	40	20	60	20	40
Total manometric level (m)	30.00	28.00	44.00	25.00	28.00	28.00

Effectively, the project was designed on a mobilisable flow estimated at 188 l/s, quantity that any more produced by the wells. We have noticed a gradual decline of their flow to reach approximately 128 l/s. In fact, the examination of the measures of water, depths and flow extracted from wells, indicate that since 1980 the level of the water table had fluctuated from one to another wells (see Tables 4 and 5 and Figs 3 and 4).

Table 4. Depths water evolution of wells (m)

Year	P3	P6	P12
1980	18.7	8.3	14.8
1994	16	12.8	14.5
2006	13	13	8

Table 5. Flows evolution (l/s)

Year	P3	P6	P12
1980	28	85	70
1994	28	64	48
2006	24	59	45

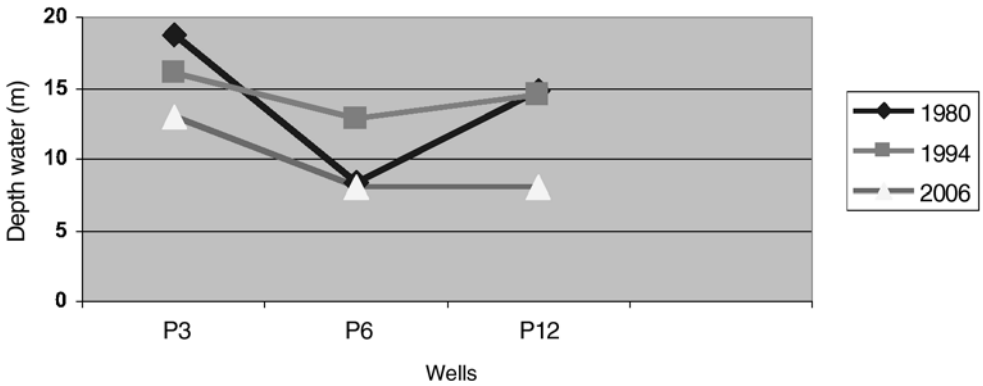

Fig. 3. Water depths evolution.

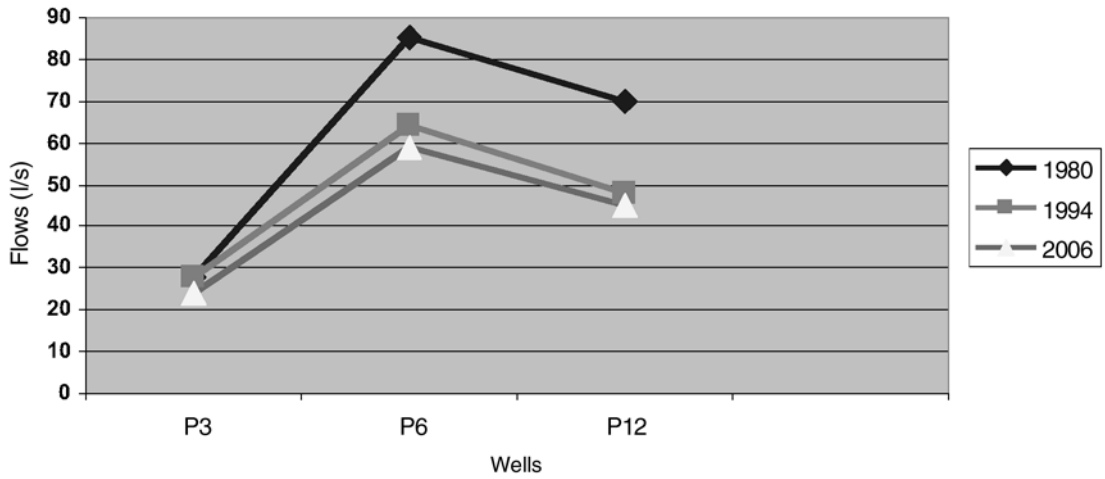

Fig. 4. Water flows evolution.

Indeed, the wells no. 1, having a use flow of 48 l/s, is not producing the expected volume of water (about 25 l/s at present) and the motopump stop completely after a few minutes pumping with a lowering in the piezometric level.

Supplying the recapture station is assured only by the wells no. 6 and no. 12, with a respective flow of 59 l/s and 45 l/s. Similarly, the zone (III) is supplied by the well no. 3 with a flow of 24 l/s (flow inferior to the initial operating flow of 28 l/s).

Considering the aforementioned observations, the pattern of exploitation of water of the water table had currently changed at the level of the total removed flow. It includes the following flows:

P1: No longer working
P6: 59 l/s
P12: 45 l/s
P3: 24 l/s

Either a total of 128 l/s with a deficit of 60 l/s compared to the total flows defined previously and that correspond to 188 l/s for the whole area Zone (I + II), and 28 l/s for Zone III.

Reconversion of sprinkling system into drip irrigation system

Given the new operating data of the project, and considering the steps taken by the Administration of Agricultural Engineering in the field of water conservation and sustainability of agriculture, the perimeter of Korimat must overcome constraints water resources, by establishing a network of water-saving irrigation.

The reorganization scheme of hydro-agricultural perimeter is based on three main activities:

(i) Total and progressive reconversion of the sprinkler and gravity irrigation systems of a global area of 414 ha. In this perspective, the network of underground driving and the irrigation boundaries will be preserved, on the other hand the antennas, the ramps and sprinklers will be substituted by the equipment of drip irrigation.

(ii) While completing the drip irrigation system study and setting up the network, the improvement in irrigation water can be done by the following actions:

– Flushing the well no. 1 and reconstruction of the collapsed bottom of the well.
– Increasing the well no. 1 depth to 40 meters.
– Increasing the well no. 3 depth to 40 meters.
– Increasing the well no. 9 depth to 40 meters.
– Construction and outfitting of the pumping station of the well no. 9.

(iii) Constructing a bowl of accumulation of the water runoff to reinforce the supplying of the water table underground by infiltration. This supplying can be done by the streaming waters of Mohamed Azrouala trough and channeling these waters towards the accumulation bowl. The diversion dam may have a length of 200 m and a height of 2.5 m.

Conclusion

The actions of reorganisation proposed in this paper can contribute to increase the availability of water in recapture station and consequently will provide the need of irrigation water.

In addition, the proposed conversion of the sprinkler and gravity irrigation system to drip irrigation system, may encourage farmers in the region to adopt more localized irrigation system. It's certainly the most efficient method of providing economic and distribution of water to the plants, and most convenient for supplying nutrients.

The economic study of the project shows that the cost of the reorganization is high. Indeed, the total reconversion of the sprinkling system will cost nearly 859,470 Euros. In this case, it must be considered the subsidy rate of 60% granted by the government to farmers, to be included in the project in question. So, we may be limited to 40% of the schedule for the conversion project. Thus we can limit the project cost at 511,710 Euros.

At the end, it is advisable to indicate that for the beginning of the project, it's better to adopt a partial reconversion on the irrigation system on area (III). After the evaluation of the success of this partial reconversion we can generalize the reconversion to the area (I) and (II).

Bibliography

Study of hydro-agricultural equipment project of the Korimat perimeter, Hydro technica, Casablanca, 2000.

Study of hydro-agricultural reorganization project of the Korimat perimeter, Ahmed El Moujahid, DPA/Essaouira, 2006.