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# Soil and water management in the dry regions of tunisia: prospects of building on traditions
# Sol et gestion de l'eau dans les régions sèches de Tunisie : recherches en vue de l'adaptation des systèmes traditionnels

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## ABSTRACT

The description and various roles of the main indigenous water harvesting techniques (WHT) encountered in Tunisia have been addressed. Their perfect adaptation with the social and environmental conditions has been highlighted. It was concluded that the future viability of these techniques is dependent on the improvement of their performances via a scientific engineering design and the adaptation of their management systems to the new social and economical realities.

## INTRODUCTION & HISTORY

Localised at the north of Africa, the climate of Tunisia is influenced both by the variability of the Mediterranean and the caprices of the Sahara. The arid, semi-arid and desert bioclimates cover more than 2/3rd of its area (Floret & Pontanier, 1982). The rainfall regime is known by its scarcity, variability and torrentiallity (Kassab, 1979).
These natural difficulties weren't a hurdle to the numerous populations who lived in this country. On the opposite, they built flourishing civilisations and their remnants and many other structures still in function are good indicators of their perfect adaptation with the natural environment (El Amami, 1984; Pérennès, 1993). In fact, a wide variety of small to medium sized hydraulic techniques were developed during many centuries to make the land productive irrespective of its geographical location.
By the independence of the country and the orientation of the Government to the installation of large hydraulic infrastructure (dams, ....) dictated by the development plans, these small and traditional techniques were neglected (Ennabli, 1993). In parallel, the emigration and rural exodus accelerated this process. Fortunately, a regained interest at many levels (decision making, research, farmers, NGO, international agencies and donors, ....) has resulted since the mid 80s in reconsidering of the role and the place of

these indigenous techniques in the regional and national agricultural development programmes.

## DESCRIPTION & ROLES OF THE WHT

Four main WHT will be described namely, *meskat, mgoud, jessour* and cisterns.

### The *meskat*

It is a very ancient technique practised in the Sahel (north-east) region of the country (Fig.1.). In fact, the impluvium (watering surface) is called *meskat* and the run-on area *mankaa* or *zankaa* where the olive trees are planted. The latter can be formed of one or many compartments arranged in cascade structure boundered by an earth embankment (*tabia*). They communicate with each other by a spillway (*seguia*). It is estimated that this system is actually covering 300,000 ha and supports more than 10 million of olive trees (Ennabli, 1993). El Amami (1984) estimates that this technique could be extended to more than 200,000 ha with similar conditions in the central regions of the country (Sidi Bouzid, Kairouan, ....).

It plays the following roles:

- supplementing the olive trees with additional water,
- soil erosion and floods control,
- water table recharge.

### The *jessour*

Here again, this technique is very ancient. It is widely practised in the highlands of the arid region of the country. It is a typical small hydraulic system of the Matmata mountains. El Amami (1984) estimated that 400,000 ha are treated in *jessour* and that 200,000 ha could be realised in the central regions (Sidi Bouzid, Gafsa, ...).

The *jessour* occupy the central area of a thalweg. In fact, the *jessour* is the plural of a *jesr* which is a hydraulic unit made of three components: the impluvium, the terrace and the dike (Fig.1.).

The impluvium is the area destined for collecting and channelling of the meteoric water. It is bounded by the natural water dividing line.

The terrace is the area where the agricultural activities are carried out. It is formed progressively by the decantation of the carried sediments. Generally, the fruit trees (olive, fig, almond, date palm, ...) and the legumes (pea, chickpea, lentil, broad bean, ...) are planted in the neighbourhood of the dike while the remaining areas are cultivated with cereals (barley, wheat).

The dike *(tabia, sed, katra)* is a barrier destined to block the sediments and run-off Its body is made of earth equipped with a central *(masraf)* and/or lateral *(manfes)* spillway assuring the evacuation of the excess water.

Though this technique was developed first for the production of various agricultural commodities (oil, barely, fruits, ...), it is now playing three additional roles namely:

- the water table recharge via the infiltration of run-off water in the terrasse,
- protection of the infrastructures and the towns installed downstream,
- wind and water erosion control.

**The *mgoud***

It is a flood water harvesting technique widely practised in the central regions of the country (Sidi Bouzid, Kairouan, Gafsa, Tozeur, Ennfidha, ...). It is based on the principle of diverting the total or a portion of the flood water and its spreading on the neighbouring cultivated fields in the form of natural irrigation.

It is made of diversion dike (in earth or gabion), a distribution network (similar to an open irrigation channels network) and the fields where fruit trees (almond, olive, ..) and/or cereals (wheat, barely) are cultivated (Fig.1.).

Here again, this technique is playing various roles and contributes to:

- natural irrigation and amendment of the soils,
- water table recharge
- flood control

**The cisterns**

These techniques, locally known by *fesquia* or *majel*, are built for the collection of rainfall and its storage for different purposes: animal drinking, domestic uses and irrigation.

Big to small (70,000 to 5 $m^3$) cisterns can be found in the whole areas south of the 400 mm isohyet.

A cistern is a whole dug in the soil with a gypsic or cement coating to avoid vertical and lateral infiltration. Generally, each unit is made of three main components, the impluvium, the decantation basin, and the storage and pumping reservoir (Fig.1.).

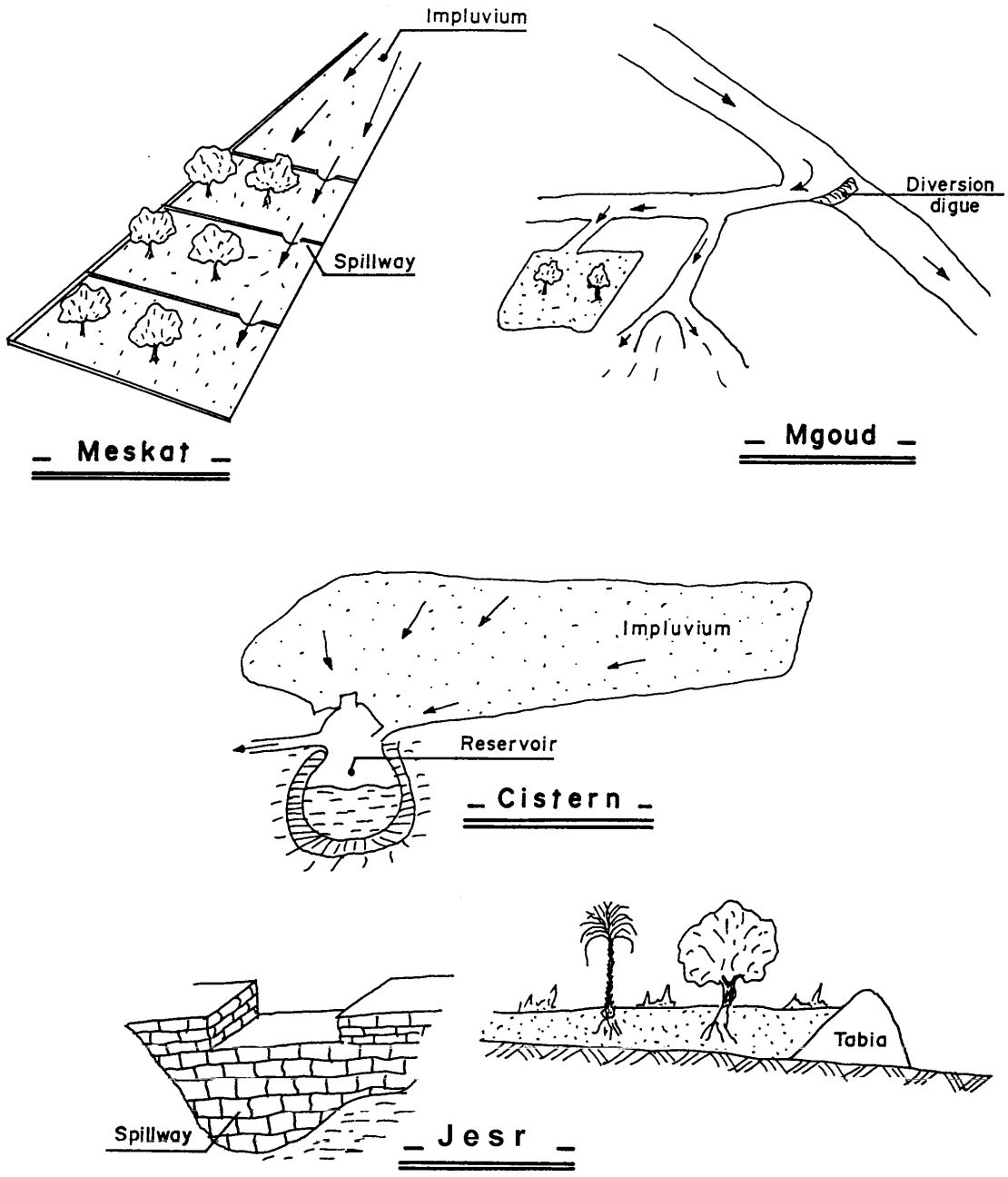


**Fig. 1.** The main water harvesting techniques in Tunisia (adapted from El Amami 1984, Snane *et al.* 1991)

## CONCLUSIONS & RECOMMENDATIONS

The indigenous WHT are well adapted to their physical and social environment They are playing various roles (water supplementing, flood control, water table recharge, water and wind erosion control). Threatened by the emigration and the top-down approach of the 60s, 70s and mid 80s, these indigenous techniques are regaining interest at many levels (decision making, research, education, ...) because of their perfect adaptation with the physical and social environment. This renewed interest should be encouraged to maintain the ecological equilibrium especially in these fragile areas facing continuously the problem of desertification. Based on the principle that the development process should go through the conservation and the amelioration of the local techniques and know-how, the issues of scientific design and the adaptation of these systems to the new socio-economic context have to be addressed intensively. Then, the WHT can be considered as a corner stone in the sustainable agricultural development of the arid regions.

## REFERENCES

- El Amami, Sl., (1984). Les aménagements hydrauliques traditionnels en Tunisie. C.R.G.R., Tunis.
- Ennabli, N. (1993). Les aménagements hydrauliques et hydro-agricoles traditionnels en Tunisie. Imp. Officelle Rep. Tun., Tunis.
- Floret, C. & Pontanier, R. (1982). L'aridité en Tunisie présaharienne: Climat, sol, végétation et aménagement. ORSTOM, Paris.
- Kassab, F. 1979. Les fortes pluies en Tunisie. Publication de l'Université de Tunis, série: Géographie, 234 pp.
- Pérennès, J.J. (1993). L'eau et les hommes au Maghreb: Contribution à une politique de l'eau en Méditerranée. Editions Karthala, Paris.
- Snane M.H., Toumi, M & Chaabouni, Z. (1991). Un modèle d'optimisation des pluies pour les oliveraies. *Sécheresse* **2,** 12-16.

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