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Large Dew water collectors in a village of S-Morocco (Idouasskssou)

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Abstract

The coastal region of south Morocco presents a chronically shortage of drinkable and fresh water. Measurements in the village of Mirleft have shown that collecting dew water could provide 40 % of the rain fall. In order to show to the local population the interest of recovering dew water in addition to rain water, three pilot condensers of terrace, roof and ground type with 136 m^2 total surface area was erected in a small nearby village (Idouasskssou, 8 km SE of Mirleft). A good integration of the project by the village inhabitants was ensured by the cooperation of the local organization IMRJANE. The water production from 15-12-2008 to 31-07-2009 (6 months, 137 dew events for 47 % of days) was more than 3800 L (0.2 mm/dew day). While the devices are specifically designed to condense dew water, they also harvest rain and fog as well.

1. Introduction

Nowadays, the development of the water resources of the arid areas is centered on projects of great irrigation. These projects, however, offer few direct advantages for the small farmers or the nomads who must survive in the constraints of their environment without benefiting from new technologies that are not adapted to their needs. Fortunately, the collection of water is one of the methods of improvement of the conditions of existence of these populations. After the measurements of rain, dew and fog yield in Mirleft, south Morocco (43 m asl, 29° 35' N, 10° 02' W), it was found that the dew contribution, amounting to about 40% of rain precipitation, could not be ignored any more [1].

In a small nearby village (Idouasskssou, 8 km SE of Mirleft, about 300 m asl) some data of dew, fog and rain was collected by OPUR-type 2 m^2 dew collectors and a fog net collector on the roof of a small school by the teacher with the help of a local Organization for local development IMIRJANE. They showed indeed that a significant amount of dew water could be collected. When one of us (O.C.) obtained a 10,000 € award from the Corsica Ferries company for a project of high environmental value and promotion of sustainable development, he gave the amount to the OPUR organization that decided to implement, with the help of the above organization IMIRJANE and the local population a demonstration site at Idouasskssou. the goal was to show to the local population the interest of recovering dew (and fog) water in addition to rain water. The implication of the local population and organization was essential. Three dew condensers (135,7 m^2 total surface area), easily accessible from the ground have been constructed in a month: a roof terrace (40,6 m^2), a slope roof (21,2 m^2), a ground condenser (73,8 m^2), together with a fog collector (30 m^2)

3. Collection devices

3.1 Site

A site favorable to the installation with two water storage tanks on a slope of approximately 17° with the horizontal (Fig.1). The cistern (1) exhibits a planar surface area of 10.6 x 5.3 m^2 on its top and is used as emergency tank when the water distribution is down. The second, 4.7 x 3.0 x 1.60 m^3, not covered, was abandoned. The site is downwards the village on a slope that is not used by the inhabitants. The

installation of condensers will thus not disturb the practices of the inhabitants.
A terrace condenser (40.64 m²) was installed on the covered cistern in (1). The second cistern (2) was rehabilitated to collect water from all the condensers. It was also used to set up a two slopes roof condenser (21.2 m²). In (3), above (2), on the slope, a ground condenser was installed (see Figs. 1, 2).

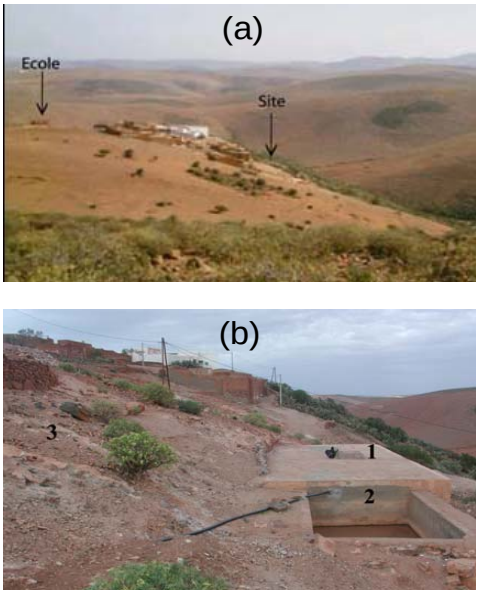

Figure 1: Site in its initial state. (a) General view. (b): (1) condenser on terrace; (2) double-slope roof condenser; (3) full condenser on ground.

3.2 Terrace condenser

The top of the cistern was firstly surmounted by a parapet in order to find a configuration of traditional terrace. The characteristic of this standard " roof " being it is easily accessible. The condensing materials is made with of 0.75 mm galvanized iron sheets painted with a special painting (OPUR) that enhances infrared cooling in the atmospheric window and keeps hydrophilic thanks to continuous photocatalytic reaction with the sun UV. Thermal insulation below the sheets are insured by 2 cm thickness Styrofoam plates.

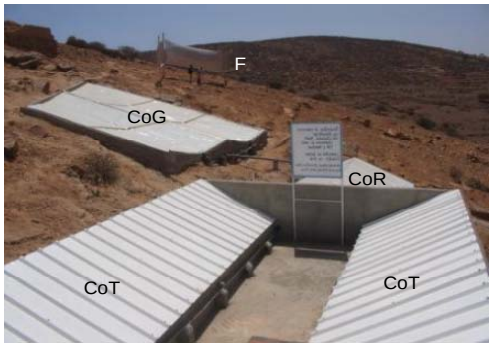

Figure 2: General view. CoT: condenser on terrace, 40.64 m²; CoR: condenser on roof, 21.2 m²; CoG: condenser on ground, 73.8 m²; F: 40 m^2 fog collector.

3.3 Double-roof condenser

The open cistern (2) was firstly raised by three lines of cement blocks then of a gable intended to receive the ridgepole. The condenser is then installed with the same elements as the terrace condenser.

Figure 3: Two slopes roof condenser (CoR) and condenser on terrace (CoT).

3.3 Condenser on ground

The condenser on ground required a preparation (chaining and stabilization of the ground). The design was selected to profit from the slope of the ground (17°) to collect dew water. The principal surfaces of condensation are tilted by 30° in order to increase the dew yield [2]. The surface is made with a UV treated white polyethylene foil that is commercially

available in Morocco and presents a high resistance to mechanical stress.

Figure 4: Condenser on ground CoG.

3.4 Fog collector

A 40 m^2 fog collector (F) made with two layers of polyethylene shading net (50 % transmission, ribbon width 1.7 mm), similar to that by Schemenauer et al. [3] has been installed nearby the condensers, near a crest (Figs.2, 5). No data have been collected so far.

Figure 5: Fog collector.

3. Measurements

The data were collected during 229 days, between 15/12/2008 and 31/07/2009. 137 events of dew were counted, that is, 46.9% of the period of collection with a cumulated volume of 3791.5 L. It corresponds to an output of 16.6 L / day over the complete period and 27.7 L / dew event. Unfortunately, the method to measure volume (graduated bucket) saturates at 22 L. On Fig. 6, it is clear that many dew events should have given more water.

According to the figures above, the CoT plus double slope CoR (total: 61. 8 m^2) collect almost the same quantity of water than the CoG (73,8 m²). This can be explained by the difference of materials of collection used (foil and paint) and the method of construction for each system. Indeed, it has been shown [4] that a suspended condenser of 30 m² condenses approximately 14% more than the identical condenser built on the ground.

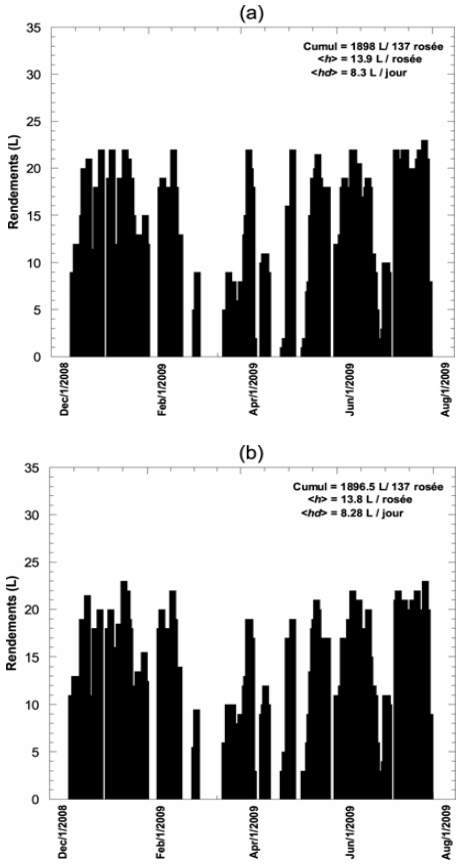

Figure 6 : Dew yield (L) for 229 measurement days. (a) CoT (40.6 m²) plus CoR (21.2 m²). (b) CoG (73.8 m²).

3. Conclusion

The construction of these demonstration condensers, of three main types; CoG on ground, CoR, on roofs and CoT on terraces led to a great satisfaction in the village community. In particular, people were amazed to see the level of water rising although there was no rain.

A year after the construction, the President of the IMRJANE organization left the village. The CoR and CoT were still working a year and a half after their construction. However, due to a severe storm, the CoG was damaged. It is still partially functioning but the foil has not (yet?) been fixed by the inhabitants. They also did not connect the fog net to the tank.

In order to be sustainable and useful on the long term to the population, this kind of project would need a clear involvement of the local authorities to go beyond the good will of small private organizations.

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