

Spate irrigation in Morocco

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Agriculture is one of the main sectors of the economy in Morocco and contributes 13 percent of the gross national product. The rural population of the country represents 59 percent of the total population and 40 per cent of the active population is employed in agriculture. In its economic and social development plans, Morocco has given special attention to the development of irrigated agriculture, which is integrated into the national objectives for self-reliance in food production and financial balance in external trade.

The development of irrigation is possible thanks to the existing water resources, which are estimated at 2 100 m³, and to the arable land resources of 7.7 million ha.

The area presently irrigated covers 1.2 million ha of which 815 000 ha profits either from perennial water resources regulated by dams, or from regular water flow. The seasonally irrigated area covers 265 000 ha.

Spate irrigation extends over a total of 165 000 ha of which 65 000 ha are situated in big irrigation schemes (under the authority of the Regional Offices for Agricultural Development), and 100 000 ha are in small and medium-sized irrigation zones (in general, under the authority of the Provincial Directorates of Agriculture).

1. The importance of spate irrigation

In Morocco one can find spate irrigation in all regions south of the Atlas mountains and in the east of the country, characterized by an arid climate and insufficient rainfall (below 150-200 mm/year). In these regions, apart from ground water, flood water is the only available water resource. The exploitation and use of this water largely determines the extent and success of agricultural activities, and thus the welfare of those who work there.

The development of spate irrigation is directed towards the cultivation of wheat and barley, which currently constitutes about five percent of the country's cereal production.

In addition, the spate waters help to recharge the aquifers in the spate zone, and are used in the pre-Saharan zone for drinking water and cattle watering.

2. Flood control systems in Morocco

In Morocco spate irrigation has been practised since ancient times. The spates, which in an average year occur two to five times, depending on wadi characteristics, are diverted by traditional weirs (stones and brushwood) which

feed earthen lateral canals and bring the flood waters to the spreading areas or, in some cases, to the irrigation plots where the normal field channels are used.

The diversion and distribution of water occur according to customary water rights well established among the community.

The irregular pattern of wadi spates and the heavy sediment loads typical for spate waters make the traditional spate systems highly vulnerable. They require intensive maintenance and management.

3. Modern spate improvement works

The government services have, for a number of years, initiated improvement trials to modernize the traditional systems.

However, the first modernization works—simply strengthening traditional structures or duplicating them in masonry or concrete, without taking into account the breaching characteristic of the traditional weir, essential for its functioning—were not always successful. Techniques where additional devices such as discharge control, sediment excluders and flood protection works have been applied have resolved some of the main problems linked with flood diversion.

In Morocco the diversion technique most commonly applied consists of a solid weir body, together with sediment sluices to keep the intake open. The sediment sluice may be different from weir to weir, according to the terrain. The function of the weir is not to store flood water but simply to lift the water height to the level of the intake. To protect the scheme against excessive intake of water with rising floods, the intakes are equipped with regulators to restrict the discharge.

4. Evaluation of spate rehabilitation works

Evaluation of the functioning of a range of structures erected in Morocco according to this model suggest that the approach followed is largely successful. Nevertheless, the removal of sediment remains a major problem.

For most of the observed cases, the efficiency of the desilting devices is not satisfactory and improvements are required. This problem, and its impact on the performance of the spate schemes, receives increasing attention.

Morocco has, since 1979, experienced long periods of drought which, together with silting-up problems, have

put several existing works out of use and reduced the effective diversion capacity of the structures.

The government services have launched an extensive rehabilitation and maintenance programme for spate irrigation in the provinces of South Atlas and the east. The planned activities include the execution of rehabilitation works for spate structures and devices and for the establishment of mobile units complete with earth-moving equipment (hydraulic excavator, loaders, compactors and trucks) to carry out maintenance for spate schemes in each province (a total of ten). The programme also includes a number of measures to organize irrigation communities.

A first part of the programme is already operational in the provinces of Agadir, Toroudant and Guelmim, within the framework of two technical co-operation programmes of FAO. The first results of these projects, which carried out a parallel monitoring and evaluation programme, were very encouraging.

5. Improved criteria in planning, design and operation

The irrigation developments in Morocco have been directed in particular towards the large scale schemes. It is only since 1980 that more attention has been paid to the small and medium scale schemes and, in particular, to the spate irrigation schemes. This new interest is in line with the national development objective to reduce the regional inequities, to improve agricultural production and to stabilize rural population.

Morocco's experience of spate irrigation is therefore relatively recent. However, this experience has allowed a number of criteria for the planning and development of the best possible spate irrigation projects to be developed. They include the following.

□ At the planning stage:

The lack of hydrological data of floods and sediment transport imposes a serious constraint for the project study, while the establishment of a hydrometric network applying the density standards applied in the interior of the country would be very cumbersome and costly. Therefore a simple procedure to monitor floods is presently being tested to improve the execution of diversion works. It monitors the floods with the help of water level gauges installed at the diversion structures. It is foreseen that the flood monitoring systems will ultimately be replaced by a flood warning system.

□ At the design stage:

the planning of the modernization of the spate systems must take into account, as well as the purely technical aspects, the social requirements. The technical solutions chosen in the design should be assessed according to which of them will be the most practical for the users to operate and maintain. The use of locally-available construction materials will allow communities to deal with their own repairs and maintenance work. Serious consideration must also be given to the farmers' usual water rights and

distribution practices.

□ At the operational stage:

The durability of the modernized or new structures will depend on the care taken in maintaining them in good order. It will therefore be important at the beginning of a project to establish an adequate framework for operation and maintenance, and to include in it the participation of the farmers as much as possible. In this respect the irrigation community and their commitment are decisive elements in the success of the project.