THE NEED FOR INTEGRATION OF IRRIGATION AND DRAINAGE MANAGEMENT; SOME EXAMPLES AND PROPOSALS

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In irrigated lands lacking or with insufficient natural drainage, artificial drainage systems are needed to capture irrigation water losses. The conveyance losses can be intercepted either by a subsurface drainage system of parallel drains or by interceptor drains. The operational losses are discharged into the main drainage system and the application losses at the field level are captured by the surface and subsurface drainage systems.

In many rehabilitation projects of areas currently under irrigation, waterlogging and salinization problems must be solved. To do that, a choice has to be made among possible options:

(i) Modernization of the irrigation system.
(ii) Improvement of the water management at the project level.
(iii) Improvement of the water management at the field level without changing the irrigation method.
(iv) Improvement of the water management at the field level by changing the irrigation method.
(v) Intensification of the drainage system.

The following goals can be achieved by investing in modernization of the irrigation network and by improving the irrigation water management:

(i) Water savings.
(ii) Diminishing the drainage recharge.
(iii) Diminishing the drainage requirements.
(iv) Reducing the volume of the drainage water to be disposed.

However, sometimes the costs of modernization of the irrigation systems are so high that a compromise must be reached between investments in irrigation and drainage.

In this paper two examples are described showing the need for integration of irrigation and drainage. The first example comes from the Lower Tunuyan Irrigation Scheme, Mendoza, Argentina. There, alluvial soils situated in a large alluvial fan are irrigated by means of unlined canals on a rotational basis. In the upper and middle parts of the fan vineyards are irrigated with surface water. The overall irrigation efficiency is low and water losses recharge the aquifer. Groundwater flows towards the lower part of the fan, where farmers pump groundwater to irrigate because surface water is insufficient. Soil salinization occurs locally because of the salt content of the groundwater. In the adjacent fan formed by the river Mendoza, the low-lying lands need subsurface drainage to avoid waterlogging. Therefore, the best solution from a technical, economic and environmental point of view calls for integration of irrigation and drainage management.

Similar cases are common in the irrigation districts of northwestern Mexico, such as the Carrizo district in Sinaloa. There, seepage from unlined irrigation canals and application losses due to surface irrigation recharge the water table, which is close to the soil surface in the low-lying areas. In developing a solution to these problem, a comparison must be made of the benefits and costs of modernization of the irrigation network, improvement of the irrigation water management at the field level, and drainage intensification.

A case study on the integration of irrigation and drainage management is the Bajo Guadalquivir irrigation project. It is situated in southern Spain, where heavy clay and saline soils were reclaimed by means of irrigation and drainage. At the very start of the project, irrigation water was poorly applied. To solve the waterlogging and salinization problems, farmers asked for intensification of the subsurface drainage system by installing a new drain between two consecutive laterals. From monitoring the drainage system and the water management, it was concluded that by improving the irrigation management without changing the irrigation model no new investments in drainage works were needed.

To achieve the integration of irrigation and drainage management some research needs are proposed:
(i) Development of simulation models.
(ii) Introduction of environmental effects in the cost-benefit analysis.
(iii) Evaluation of areas with integrated irrigation and drainage management.

The improvement of the productivity of the areas already under irrigation per unit of water used is an element of a strategy defined in the context of FAO's Special Programme on Food Production in Support of Food Security. To achieve this goal, there is a need for integration of irrigation and drainage in the currently irrigated lands.

In the Waterlogging and Salinity Control activity of the FAO-AGLW Regular Programme for 1997, a proposal has been submitted which include two objectives:
(i) Review the existing simulation model for integration of irrigation and drainage management.
(ii) Review recent experiences in drainage design factors for a revised edition of FAO Irrigation and Drainage Paper no. 38[1].

To achieve these objectives international cooperation is necessary.

Discussion

On the issue of more efficient water use, a question was raised on how to determine the amount of water which is just adequate. Fixing the right amounts of ET and leaching is indeed difficult, but experience will help. Another question addressed the integration of saturated regional models with unsaturated one-dimensional models as one of the difficulties in the development of appropriate simulation models. A final remark was made on the absence of water pricing in the Argentina case. It appeared that the Water Users Association is now being involved in making farmers aware of the cost of irrigation water.

[1] Drainage design factors, 1980.