Water use efficiency: a contribution to sustainable development of agriculture

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Abstract

In most of the irrigated agricultural areas the volume of water used is higher than actually necessary for the satisfactory production of food. The efficiency in water use can help in solving the problems of scarcity, reduce conflicts between users and increase, stabilize and ensure the production. This paper shows possible alternatives for the water use efficiency in agriculture, based on guidelines developed in Europe and the United States, seeking to establish criteria for appropriate use for Brazilian conditions. After a participatory process of consultation, both in Europe as the U.S. guidelines have been published with orientations for the use of irrigation methods with less waste. The guidelines indicate managements and technological solutions, such as: use of measurement systems, information and control, planning of irrigation, improved irrigation techniques, adequate management of irrigation according to the climate, soil management and the cultivated species, and use of plant coverage. There are technological and managements solutions that can contribute to the efficient use and optimization of water use in irrigated agriculture in Brazil. To implement these solutions it is needed to evaluate the potential for improvement and set targets for the coming years.

Key words: efficiency of irrigation, water conservation, water use in optimization.

Introduction

The water is a critical natural resource in the production of food from animal or vegetable origin, and it is not just a simple input. The availability and distribution within the earth system may facilitate or impede the agricultural production, especially in regions where there is occurrence of droughts or where the distribution of annual rainfall is irregular.

The efficient use of water, with appropriate knowledge and use of alternatives that optimize its use can help increase its availability, reducing problems of deficit caused by the increase of social demand on the supply environment. There are several alternatives and techniques that enable the use of food production with an appropriate volume to achieve sustainability in the availability of water for food production. Such measures, in relation to agricultural property, may be grouped into domestic property - *on farm* or small scale or local, and external to the property - *off farm*. Specific problems or individual situations in local, regional or national level may require specific solutions.

Reinforcing the importance of local peculiarities, there are measures of rational use of water associated with the agricultural parcel to the preservation of available water resources: the use of properly designed equipment, which have more chances to reach the quantity optimization (greater efficiency, according to the characteristics of climate, soil and local culture), the opportunity of water supply (local water allocation) to crops, the management of water used (when and how to apply for the productive activity), avoiding to have disabilities or lack of water and reducing losses by evaporation, deep percolation, as well as encouraging the zero runoff, and agricultural use of procedures that make the whole production system technical, economic, environmental and socially sustainable, such as measures for the conservation of soil and water, tillage, spraying agronomically appropriate, processing or hygiene of foods to be marketed, appropriate management, among others.

In national, regional and local level, it also must be considerate the cultural and social peculiarities that contribute to the existing legislation in these levels. In other countries many studies were conducted to systematize the main strategies related to sustainable use of water resources (EUROPEAN COMMISSION, 1998, AUSTRALIA, 2001, NEBRASKA, 2003, TEXAS, 2004).

In Brazil, however, even considering the existing legislation, especially the Law 9433/97 on the watershed as the management unit, there is the initiative of conducting research with the various factors involved, aimed at efficient use of water for sustainable agricultural production.

Considering the various dimensions associated with the theme water and assuming the collective vision, this work aims to develop and offer strategies

for the efficient use of water in agriculture and establish criteria to appropriate use for the Brazilian conditions, reaching the level of agricultural property.

Material and methods

In order to accomplish this work were analyzed documents that systematize the main strategies related to sustainable use of water resources, as the guidelines developed by the European Commission (EUROPEAN COMISSION, 1998), the Task Force Environment-Water, the National Program for Efficient Water Use in Portugal (PORTUGAL, 2001) and the guidelines of the states of Nebraska and Texas (NEBRASKA, 2003; TEXAS, 2004) in the United States.

Some aspects of the Brazilian legislation were also considered, particularly the Law No. 9433 of 8 January 1997 (BRAZIL, 1997), establishing the National Water Resources Policy and creating the National System of Water Resources Management. This work takes the importance of collective and individual vision, involving the role of tools, materials and best management undertaken by the farmer, which should be aware of the effective use of water resources.

Based on these documents, methods and techniques of irrigation to the planning of agricultural activities that have improved water use efficiency were discussed, in addition to the need for capacity building, training and guidance to the farmer, important aspects for the best use of the natural resource water.

Results and discussion

The guidelines for the efficient use of water produced in 1996 by the European Community set priorities for research, listening to the various socio-economic factors involved in water and reinforcing the importance of coordinating European, national and private, of research activities in order to simulate an environment conducive to innovation in the area. The four mainly objectives set by the European Commission were to combat pollution, the rational use of water, combating chronic deficit and the management and prevention of crisis situations.

The ten priority lines of action outlined by the European guidelines for the efficient use of water were: assessment and monitoring of water available; management at local and regional of natural resource, pollution sources, dispersion and impacts, the water treatment system; urban systems of water, water in agriculture, industry conservation of water, socio-economic structure, international cooperation and promotion of research on water.

The European guidelines recognize that agriculture is a sector that presents forms of diffuse pollution (not localized) and consumes large amount of water, requiring methods and techniques of production that pollute and consume less quantity of water and reuse it. The agricultural research, to be held by the Agronomic Science, should prioritize the development of good environmental practices and promote regional development with international cooperation.

These guidelines say that various technologies and strategies for the rational use of water have been developed in isolation; however, the most effective way to promote water conservation and reduce pollution in agriculture is to adopt a system to manage the entry of inputs, including water itself.

Some of the possible strategies for rational use of water are to promote efficient irrigation practices (accurate irrigation) in water use, as the study of the requirements of crops in different production systems and physical-geographical conditions, and mechanisms of water pollution related to irrigation, and create an agenda for irrigation recommendation, including weather, measure of soil moisture and automatic irrigation systems, involving remote sensing and sensors for rain.

Among the good-agriculture practices (precision agriculture), as new methods of cultivation, fertilizer and applying pesticides technology, which present potential for reducing use and water pollution, and also supporting tools, there are decisions or operating practices that assist farmers to implement an accurate irrigation in the existing context.

Besides the efficient use, the European guidelines cite the promotion of reuse of water, especially for the regulation of water quality for agricultural reuse, seeking to protect the consumer of

food and public health. It should be given a particular attention to the drainage water recycling and reuse of urban water served.

Texas and Nebraska (USA) have such a guideline. The Guide to Good Management Practices and Water Conservation of the State of Texas (TEXAS, 2004), for example, mentions that the effort to conserve the local water has been developed to meet several goals, such as to avoid the loss of agricultural areas, store water for short or long term, provide environmental protection and prevent or delay high costs of new water supply systems. This guideline resulted from the work of several groups of volunteers with experience and interest in the efficient use of water, and subsequently was approved by the legislature. This is an important and not so encouraged aspect in our country and could be practiced on the farm level, through appropriate policies for financing.

In order to see which are being conducted properly, in the state of Nebraska (NEBRASKA, 2003) the management of surface and underground water resources are separated from what the guidelines recommend as effective actions for integrating the two sectors, and annual control of the actions developed in the basin or sub-basin.

The improvements suggested by the Guidelines of Texas, for the adoption of best management practices of water use, are divided into six categories: management of the use of irrigation water, management systems of the irrigated area, water supply systems, water distribution systems to the districts, various systems and analysis of effective cost for water users.

The guideline of irrigation systems used in the early 70 in Texas reports that farmers who use water from the Ogallala aquifer have been pioneers in the use of low pressure in central pivot, and achieved a reduction of water use between 30 and 50%.

There is potential for efficiency improvement in the use of off-farm structures, especially the administrative improvements, operational and maintenance of water infrastructure in driving and distribution, letting room for further optimization measures.

When necessary, to minimize the loss of water by intense evaporation, ground cover plants can be used for it, or also can be adopted the system of crop tillage and manage the soil with scarifiers. It can also contribute to the efficiency in water use in agricultural activities the adjustment of the volume of irrigation to crops water needs and reduce the losses in transport and distribution.

The aspects tied to the sustainability of water source, which requires greater individual participation or in association with irrigation in the river basin committees in order to promote adequate recovery of the springs surface water and groundwater and set priorities for water for human consumption are other aspects that should be part of the measures related to the sustainability of the water business.

Conclusions

Several studies systematizes the key strategies related to sustainable use of water resources, focusing on the European guidelines, the *Task Force Environment-Water*, the National Program for Efficient Water Use in Portugal and prepared by the states of Nebraska and Texas in the United States .

There are alternatives to improve water use efficiency at the level of farming systems and the collective. To be used, such alternatives should be low cost and easy to join, which requires knowledge and proper management.

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