INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE
54th IEC Meeting, Montpellier, France
19 September, 2003

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Winner of WatSave Technology Award 2003

(For cheap and simple irrigation scheduling using wetting front detectors to promote water conservation in irrigated agriculture)

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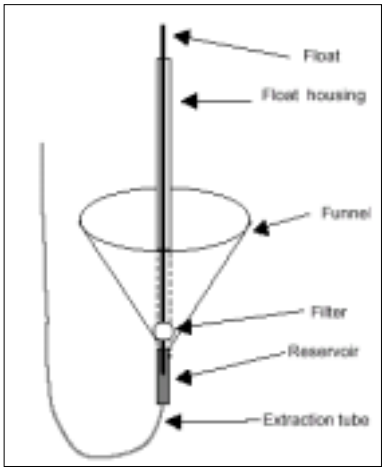
Brief Description of the Wetting Front Detector: A New Tool to Help Farmers Save Water :

Currently a wide range of methods and devices are available for irrigation scheduling. These include either physical measurement of the soil water content by means of e.g. tensiometers and neutron probes, or simulation models using data from automatic weather stations and crop growth parameters. However, in practice it is found that irrigation scheduling is not widely applied mainly because methods are not always user-friendly and farmers have insufficient knowledge of scheduling tools. These problems occur in both commercial and subsistence farming, but are particularly of concern in small-scale subsistence and emerging farming because of amongst others a lack of training and widespread illiteracy.

Irrigation farmers face the challenge to increase food production while competition for water which is currently allocated to irrigated agriculture is also increasing. Therefore, scheduling tools will have to be applied to use available water efficiently and to maximize crop productivity and improve food security.

One of the priorities in South Africa is that key constraints facing small-scale subsistence farmers must be identified and adaptive research done to overcome these problems. It is important for the farmers to decide when and how much to irrigate or to decide to stop irrigating in order to meet the water requirements of food crops under water scarce conditions. In this regard the wetting front detector developed by the CSIRO in Australia has shown exceptional merit. It gives a visual signal when the wetting front reaches the required soil depth. The device is simple to manufacture, easy to use and needs no calibration for soil types. A version of the wetting front detector containing no electronic components, has been developed for resource-poor farmers.



Schematic of prototype wetting front detector

How the Wetting Front Detector Works:

The Wetting Front Detector is simply a funnel, a filter and a float, buried in the root zone. The detector gives a signal to the irrigator when water, percolating through the soil, has reached it. The detector works on the principle of flow line convergence. Irrigation water or rain moving downwards through the soil is concentrated when the water molecules enter the wide end of the funnel. The soil in the funnel becomes wetter as the funnel narrows and the funnel shape has been designed so that the soil at its base reaches saturation. Once saturation has occurred free water flows through a filter into a small reservoir and activates a float.

The wetting front detector can be used to schedule irrigation because the time it takes for water to reach a certain depth depends on the initial water content of the particular soil. If the soil is dry before irrigation the wetting front moves slowly because the water must fill the soil pores on its way down. Therefore a lot of water is needed before the detector will respond. If the soil is quite wet before irrigation, then the wetting front will move faster through the soil. This is because the soil pores are already mostly filled with water so there is little space for additional water to be stored. Thus a short irrigation will cause the detector to respond. Free water produced at the base of the funnel by convergence activates the float in the detector. Water is withdrawn from the funnel by capillary action after the wetting front dissipates.

The Wetting Front Detector is conceptually simple – farmers can see exactly how it works. It gives a yes/no answer as to whether the wetting front has moved past a given depth and requires no calibration for soil type. The primary goal is to reach farmers who are not making use of available models or equipment due to their complexity or cost. The detector also traps a sample of water from each wetting front that can be extracted and used for monitoring nitrate movement and salt accumulation/leaching.

In a project which is nearing completion in 2003, participatory action research was undertaken which involves (a) application of the tool, (b) training of farmers and (c) field evaluation of findings.

Through the project the following has been achieved:

1. Introduce farmers to the wetting front detector method and install detectors on selected farms.
2. Develop appropriate guidelines for the use of wetting front detectors for different crops.
3. Evaluate factors affecting the perceived acceptability of this irrigation scheduling technology by small-scale subsistence farmers.
4. Determine from users their perception of whether the wetting front detectors saved water and/or increased yield.

The project has demonstrated acceptance of the wetting front detector by small-scale subsistence farmers for practical irrigation scheduling under varying farming conditions.

Several hundred prototype detectors have been distributed to farmers in South Africa and Australia, operating at both small and commercial scales. In almost all cases the farmers were very keen to try them out, regardless of their level of education or scale of operation.

The Wetting Front Detector was designed to be cheap and “farmer friendly”. However, it also needs to be sufficiently accurate so that it can identify over and under irrigation. The detectors will be available commercially from a South African company by the end of 2003.