Focus

Water savings in irrigation: some technical solutions available from companies

This review takes stock of the various innovations presented by companies at the "Water Savings in Irrigation" conference on 13 and 14 November 2019 in Montpellier. These solutions are offered by the technology sector, in particular in relation to limiting water losses during distribution, but some also come from the digital sector, designed for monitoring crop water requirements and the performance of the irrigation system at plot level.

Water conservation in irrigation is a key issue in the discourse of manufacturers in general. Although there is often confusion between saving and improving water productivity, the fact remains that the result of the proposed innovations always translates into an improvement of the local situation (saving per plot) or the more global situation (regional economy). However, there are often ripple effects which mean, for example, that a saving in one place can result in an extension of the area irrigated, thus increasing local net consumption, which will deprive downstream users of a share of the resource that had previously been at their disposal.

The companies which gave a short presentation (five minutes) of their innovations during the "Water Savings in Irrigation" conference in Montpellier on 13 and 14 November 2019 mainly focused their talks on materials, tools and technologies to improve the performance of water distribution or use, monitoring the efficiency of irrigation management and defining the right irrigation requirements for plants. Each of these companies is pursuing the goal of better use of water resources through improved water efficiency, savings on pumping water and better management of extreme climatic situations, while at the same time safeguarding the quality of production.

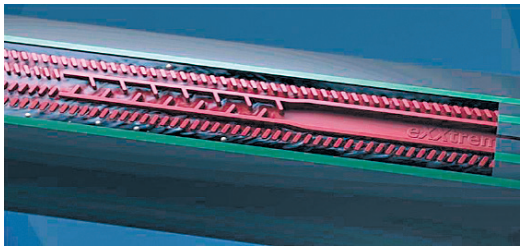
Equipment for the distribution of irrigation water

Irritec presented the micro-irrigation pipe ***EXXtreme tape™*** (Figure ❶), that can work with water that may contain particles in suspension by means of a double inlet with a continuous large surface area filter inside the pipe. This characteristic allows an application efficiency close to 100%, even in the event of a significant accumulation of particles in the piping system. Moreover, thanks to this ability to maintain high efficiency, it is also possible to apply water-soluble fertilisers [1].

Companies and presenters

- Irritec (Italy): Andrea RISSO
- Lindsay (United States with subsidiary in France): Yvain MIRABAL
- AQUA4D® Water Solutions (Switzerland): Charles-Henri FAURE
- Hydrosoph (Portugal): Sandra PIRES
- SCP (France): Alice RACTMADOUX
- Agroressources (France): Nathalie BROUSSARD
- Solem (France): Frédéric COMTE
- ITK (France): Damien FUMEY

❶ **Micro-irrigation sheath with EXXtreme continuous labyrinth (Irritec).**



❷ **Remote control of a swivel using a smartphone with the FieldNet Advisor system (Lindsay).**

1. https://pdf.agriexpo.online/fr/pdf/irritec/exxtreme-tape/169375-23315.html
2. https://www.lindsay.com/uploads/files/sections/1029-lindsay_fieldnet_whitepaper_advisor_0118_web.pdf

Also in the area of distribution equipment, **Lindsay** offers the ***FieldNet Advisor*** integrated solution for managing water inflow under centre pivot or moving lateral. This solution takes into account local conditions (meteorology, depth and soil type) and the progress of the crop (stage of development) to calculate the short-term water requirement (Figure ❷). It allows water savings of up to 15%[2] compared to a standard scheduling method with capacitive probes based on a local water quantity assessment, without compromising and indeed even increasing efficiency.

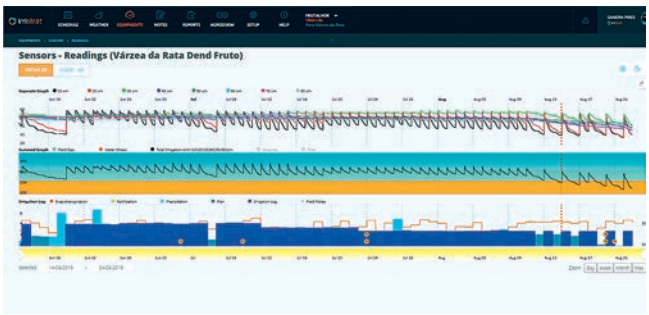
Finally, **Aqua4D® Water Solutions** presented the ***Aqua4D®*** technology (Photo ❶) which, by treating the water with very low frequency electromagnetic resonance fields, improves the storage capacity of the soil (up to 3,5%, CIT, 2018[3]). Numerous farm field experiences have shown improvements in the efficiency of water use by plants. This system seems to encourage the penetration and storage of water in the soil and limit the effects of salinity, thanks to an improvement of the micro- and macro-porosity of the soil highlighted by a recent scientific publication[4], although it is not currently possible to explain the mechanisms involved.

Analysis of water distribution or application capacities

The various solutions proposed are based on monitoring involving the use of sensors linked in various ways. **Hydrosoph** presltureents the ***Irristrat™*** platform (Figure ❸), a web service for irrigation management that combines various real-time monitoring: climate, crop development and soil humidity, which it cross-references with geo-referenced vegetation index maps to develop an irrigation schedule and in addition, to diagnose the performance of the irrigation system at plot level. This platform processes and simplifies the information by making it available in an accessible way in the form of maps, graphs, SMS and reports[5]. The system proposed by the **Société du Canal de Provence** (SCP) in partnership with **Fruition Sciences** concerns the customised ***SCP-AgriData*** platform (Figure ❹), which is capable of easily integrating and processing a great number of public and non-public digital information sources (meteorology, soils, maturity, etc.). This information is put into a combined form and cross-referenced with data from moisture sensors or sensors on the plant that reveal its physiological state, or vegetation maps. This becomes input data for the implementation of short-term decision support or spatialized diagnosis of irrigation. **Agroressources** also offers a solution for improving irrigation management, mainly for arboriculture and viticulture, based on the ***Pepista*** method, which evaluates the availability of water in the soil for a plant, using soil water tension sensors (tensiometers, Photo ❷) and also accurately evaluates the water status of the plant and its daily growth using precision dendrometers (Pepista, Photo ❸). This combination makes it possible to optimise irrigation, to reduce water inputs without affecting yields (up to -30%), to diagnose

❶ System Aqua4D treatment units set up for melon irrigation in Brazil.

❸ IrristratTM web service interface (Hydrosoph).



❹ SCP-AgriData integrative data platform (SCP-Fruition Sciences).

❷ Tensiometers and monitor used for monitoring the availability of water in the soil.

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3. https://aqua4d-irrigation.com/fr
4. https://www.sciencedirect.com/science/article/pii/S0167198720304724?via%3Dihub
5. http://www.hidrosoph.com/FR/style/pdf/irristrat_en.pdf

❸ Pepista micro-morphometric sensor or precision dendrometer.

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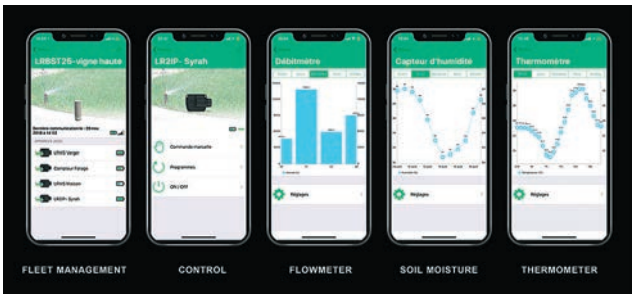
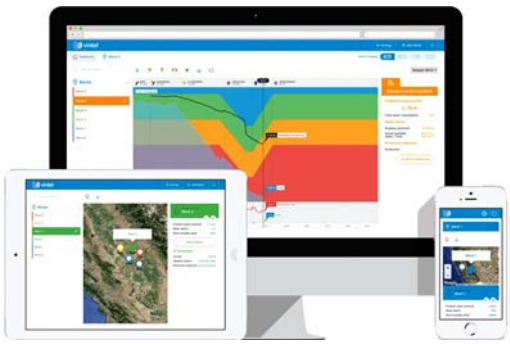
❺ Programming platform and real-time irrigation control of the SoLoRa system (Solem).



❻ Platform for monitoring the water status of a plot with Vintel software (ITK).



❹ Sap flow sensors used for 360viti application.

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problematic plots (poor tree growth, etc.) and to study the plant's reactions to extreme climatic variations (heat waves), or the effect of shade, among other things. These same tools can be used to approach the issue of water management at the plot level from a more strategic angle for prospective studies.

Tracking the water needs of the plots

Solem has developed ***SoLoRa*** irrigation controllers connected to geo-localized sensors via a dedicated Lora machine-to-machine communication network (range 20 km). This controller can be adapted to any type of solenoid valve and flow meter. The data is used to determine the level of fulfilment of the crop's requirements in order to predict future irrigation and, of course, to monitor all the sensors/actuators via a dashboard (Figure ❺). Dedicated to viticulture, **ITK** has designed ***Vintel***, a software suite that provides dynamic modelling of the water and nitrogen balance at the level of an irrigation block (Figure ❻). It simulates the water potential of the plant (basic potential and potential at solar noon), adjusted on the basis of measured data (water potential, water content in the soil, etc.) in order to guide irrigation management according to the wine quality criteria that have been established, over a five-day period. The originality of this model is its ability to take into account the historical data of a plot and the inter-row cover. The use of this decision-support tool allows real water savings (up to € 200/ha in the Gard in a 2019 trial). In the same field, **Fruition Sciences** is developing the ***360viti*** application to monitor plant transpiration by measuring the sap flow, whose sensors are integrated into a Lora network (Photo ❹). The company has developed irrigation decision-support software whose purpose is to regulate irrigation to meet winemaking quality criteria by adjusting a water comfort index. This control method results in more widely spaced irrigation than conventional methods based on soil sensors and therefore savings in water input (up to 50% of the water resource saved[6]). In particular, it makes it possible to increase the resilience of the vines during heat waves.

It should be noted that the innovations and solutions presented by the companies are not universal but can be adapted to each specific situation. This means that improved efficiency of water use in irrigation can be achieved in different ways depending on the situation and the context, giving rise to appropriate decisions, supported by the tools presented. This choice is the result of a trade-off between several criteria that are sometimes difficult to reconcile.

In conclusion, we can say that the different technical and software solutions offered by the manufacturers are geared to fostering water use efficiency through piloting or better uniformity (Fieldnet, Irritec, Hydrosoph), promote water and pumping energy savings (Fieldnet, Irritec, Fruition, Solem, Hydrosoph, Aqua4D), help to better manage heat extremes and peak demand periods (Fruition), improve quality and production (Agroressources, Fruition, SCP, ITK, Fieldnet). ■

6. http://www.set-revue.fr/recherche-et-developpement-une-plateforme-web-de-centralisation-et-danalyse-des-donnees-numeriques

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