WEATHER FORECASTING
integrates into decision support tools

Agriculture is seeing an increasing number of sensors that focus on meteorological and agronomic features. Those sources of information, combined with the increasing use of decision support tools are more and more often regarded as essential by farmers who want to optimise and rationalise their day-to-day work.

According to Gartner (an American new technology advice and research company), the overall number of connected objects should reach 30 billion units in 2020, compared with just 1 billion in 2009. According to the Institut Montaigne (a French independent think-tank), the economic potential of the Internet of Things (IoT) in France will reach 74 billion euros by 2020, and 138 billion euros by 2025. IoT is the generic term for all electronic devices using radio communication networks and interacting with each other. They are generally easy to use, and generate a large volume of data.

A new “narrow band” network

The innovation lies, notably, in the way data is transferred. The so-called “narrow band” system, which uses radio waves, enables long distance connectivity with reduced energy consumption and at a very low cost. New players are joining the existing operators and are positioning themselves in this market with the deployment of their narrow band communication networks. Some of them are relying on network interoperability and offer multi-operator solutions; their aim is to ensure service coverage, simplicity, reliability and continuity.

Those new technologies, naturally, offer many possible agricultural applications. Livestock farmers and grape growers were the first to adopt them, but they are now becoming available to all sectors of production, and particularly present in arable framing. Consequently, the agro-climatic characteristics of a field and of a specific crop are taken into consideration to a much greater extent than before, including to control diseases and pests, and to manage water resources and fertilisation.

Start-up companies from around the world are now offering innovative concepts to agriculture. They include Libelium in Spain, CropX in the United-States, and Weenat *(see insert)* and Biopic (for livestock farming) in France.

It is estimated that the economic potential of the Internet of Things in France will reach **138** billion euros by 2025.

Coverage of all farming areas

Some solutions already provide information at field level. The development of decision support tools and lower costs have contributed to the spread of weather stations. However, their density remains too low to ensure optimum coverage of all farmed areas. The pooling of networks between different operators partly solves this problem, even if some networks are deployed for different purposes. The huge variety of equipment and technologies used, as well as the constraints arising from data ownership issues can however impede this type of pooling.

At the same time, other technologies designed to produce ever more precise information on atmospheric conditions have been developed (satellite or radar networks). They "feed" digital weather forecasting models. The amalgamation of all this data, and therefore its optimisation, helps to produce reliable and precise information for all areas of a given territory, through the implementation of spatial data production methods. In theory, it is becoming possible to do without a weather station for each field, and therefore be free of all the associated constraints.

ARVALIS tested high-resolution (2.5km) spatial data produced by Météo France, using the "MILEOS" decision support tool to control mildew in potatoes. A comparison was carried out between the treatment calendars established for 26 parcels all equipped with a real weather station, using actual data, and using spatial data. The results highlighted a significant difference between fields, and a general tendency to underestimate the risk of disease, with, on average, two unscheduled treatments when using spatial data. The calculation algorithms have consequently been adjusted and a new testing phase has been planned in 2016.

« The specific characteristics of a parcel or a crop are being taken into consideration to a greater extent than before »

Increasingly large amounts of information representing the diversity of agro-climatic situations on the ground are going to help improve the precision of cropping models.

Advice takes on a new dimension

The data derived from those new technologies constitutes an important source of knowledge that must be optimised. However, many challenges remain and must be addressed: creating tools capable of processing such a mass of information, standardising exchanges in order to promote interoperability between the various information holders, and making this knowledge available to users.

Solutions that, through an Internet interface, group together tools designed to monitor agronomic and weather conditions at field level in near real time already exist abroad (Yield Prophet in Australia, Agro Climate in the United-States, Weather farm in Canada) and are being developed in France.

After the data amalgamation sector, companies such as Monsanto (who bought over the Climate Corporation), John Deere and Dupont Pioneer are now entering the advice consultancy sector. They all implement tools designed to support short and medium term decisions, with a strong weather forecasting dimension to better understand climatic variations.

The digital revolution is underway. The way in which agricultural advice is generated is beginning to change. Although the benefits to farmers, and on a wider scale to society, have been demonstrated, some questions remain regarding the reliability of the data, its ownership, and its security. We must therefore exercise vigilance as regards the quality of the service offered, in order to establish a win-win situation and serene relationships between all the stakeholders. We can however be sure that in the not too distant future, access to increasing amounts of information will help improve the level of precision and reliability of forecasting models.

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December 2015

Data acquisition forms the basis of digital technologies. Companies such as Weenat are developing individual sensors that communicate in real time. Its manager and co-founder, Jérôme Leroy, outlines its characteristics below.

Perspectives Agricoles: What benefits do current field sensors provide?
Jérôme Leroy: Current technologies, and the fact that they are still progressing, make it easier to acquire multiple agronomic data, without the need for complex infrastructure. They meet the need for very localised data arising from the variety of agronomic, soil and climatic conditions encountered on the ground. Farmers' production objectives (to be more efficient while reducing environmental impact) require an increasingly precise control of crop monitoring, and therefore of agronomic and meteorological information management. For example, we are considering, in collaboration with ARVALIS, using the Irrinov forecasting model to trigger potato irrigation.

P. A.: How would that work in practice?
J.L.: We are selling specialised sensors as well as an Internet application designed to help collect key parameters at field level in order to optimise interventions and irrigation. Those geolocalised sensors are spread out over all or part of the farm, depending on the farmer's needs. They have a five-year life span, at the end of which we exchange them for new ones. Sensors can be easily moved during the cropping season and they monitor different crops when they most need it. They are effectively "mini weather stations" that measure the hygrometry, soil and air temperature, and are linked to tensiometric or capacitive probes to measure soil humidity. In addition to the acquisition of more precise data, sensors also make it easier to monitor distant parcels.

P.A.: What developments are likely?
J.L.: The field of application is huge. Our job is to combine different types of sensors that have an agronomic application with narrow band communication systems characterised by the fact that they are cheap to implement. The data collected can potentially be used by the various decision support software available. In order to limit risks linked to safety quality and weather, we are trying to take into account the adequacy of the varieties used for the soil type. The purpose of field sensors is also to complement other technologies such as drones or satellites.