SATELLITE IMAGERY IN AGRICULTURE: FIELD-LEVEL DETAIL ON A GLOBAL SCALE

This was the Planet’s monitoring solution in support of Precision Agriculture presented by Karsten Frotscher (Product Marketing Manager, Planet, Germany). The aim: to overcome the challenging transition from traditional medium resolution imagery to high resolution tasking for Precision Ag. Planet is a SF-based data and analytics company that manufactures and operates its own fleet of satellites, the PlanetScope constellations. In 2015, Planet acquired BlackBridge and its RapidEye constellation and, more recently, Terrabella’s Skysats. “The mission is to image the entire planet every day to make global change visible, accessible and actionable”.

Although satellite imagery has been available for 45 years, one of the main problems for companies is that they are not even leveraging them yet. Up to now, users could get global daily coverage, but at a very low resolution such as from MODIS. In addition, it was possible to acquire medium to high resolution, but typically only getting low coverage from tasking satellites and/or taking days, sometimes weeks to gain access to data, and expensive. In summary: limited coverage, low revisit rates and/or slow and inefficient access. “This was limiting the possibility of frequent monitoring of our area of interest and the creation of new business workflows, processes, and value”. Planet’s solution is to provide daily coverage of the world with a detail of 3-4 m/pixel. Recently (February 2017) Planet launched 88 “PlanetScope” satellites. The complete PlanetScope constellation will be of approximately 120 satellites able to imagine 150 million km²/day in the RGB and NIR spectral bands. “We don’t need to “task” our satellites, since they are always collecting imagery around the Earth. You don’t need to wait weeks for an image, since they’re always up-to-date and available through online tools”.

In his presentation, Mr K. Frotscher also pointed out that massive image capturing is one thing, but providing easy and efficient access is equally important in support of time-critical in-season applications in agriculture. For that, the company has built a data pipeline in the cloud, which automatically looks at the firehose of data, geo and ortho-rectifies the individual images, creates a machine readable catalog and makes the data set available programmatically through Application Programming Interfaces. In conclusion, “by providing daily global imagery and putting in the hands of farmers in a matter of hours not days, we’re going to improve decision support for farmers. We’re going to help them understand cause and effect relationships between environmental factors and farm management decisions”.

BIOPHYSICAL PARAMETERS FOR A PRODUCTIVE AND SUSTAINABLE AGRICULTURE

“We are providing satellite imagery services for more than 30 years. Nevertheless, for effective applications of remote sensing in Precision Ag we need to overcome the limi-
tations of low robustness vegetation indices, or sensitive to light conditions and that require ground measurements calibration to access biomass. This can be achieved through biophysical parameters derived from images and associated with agronomic expert knowledge for final farming recommendations. These are some of the main conclusions of the presentation by Charlotte Gabriel-Robez (Agriculture Marketing Manager, Airbus Defence and Space, France) in the Technical Session of Precision Ag, in which she talked about the “interest & benefits of biophysical parameters for a productive and sustainable agriculture.”

Today there are multiple remote sensing data types and resolutions for every need: high/low spatial resolution, sensors with different spectral resolutions (number of bands), higher temporal resolutions of revisit times, etc. Nevertheless, most of the solutions in agriculture have been based in relative evaluation of differences in vegetation development through spectral indices, which are sensitive to light conditions, viewing angle and other parameters. Because of that, the purpose of Airbus is to provide farmers and technicians with biophysical parameters allowing absolute quantification of the biomass and nitrogen, making unnecessary ground measurements. An example of these imagery derived biophysical parameters mentioned by Mrs. Gabriel-Robez was an index-based insurance to decide possible compensations to farmers for grassland production or the advice to farmers for nitrogen saving in wheat growing to increase protein and yield based on detection of nitrogen status and biomass quantification. This allows saving between 10 to 17% of nitrogen and increasing yield by 10-15%. This type of services are consolidating Airbus as one of the main providers in Europe in terms of services based on remote sensing, having at present about 18,000 farmers in 9 countries as clients, covering 800,000 ha.

A REMOTE SENSING SYSTEM IMPLEMENTED FOR USE IN WOODY CROPS

Another solution for Precision Ag based on remote sensing was presented by Mauro José Bernal González (Manager of Crop Scan, Bioibérica SA, Spain). The tool is Crop-Scan®, a crop stress diagnosis technology that can diagnose each tree.

Initially (1975), the company Bioibérica was dedicated to the investigation of biomolecules with significant biological and therapeutic properties. Gradually the company began to specialise in the production of these type of biomolecules for the pharmaceutical, veterinary and agricultural industries. At present, it produces over 100 products designed to improve the health of people, animals and plants and we are present in more than 65 countries. “Aware that plants also are living organisms, since 1986 Bioibérica began to provide solutions to combat plant stress due to different causes: weather conditions, salinity, pests, diseases, transplants, pesticides”.

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Mr Bernal González said. All these are factors that have a negative impact on the quality and quantity of harvests. Then, the plant health strategic lines of the company were presented: a) the production of natural products based on aminoacids, b) biological attractants for fruit crop fly pests and c) stress diagnosis based on remote sensing.

The stress diagnosis line of Bioibérica is based on Crop-Scan®, “which is the first crop scanning service from manned aircraft to diagnose the stress before the farmer can detect the symptoms visually”. Crop-Scan® was developed in cooperation with the Spanish National Research Council (CSIC), the largest public institution dedicated to research in Spain and the third largest in Europe. The tool is based on thermal and hyperspectral cameras installed on manned aircraft. The images enable various maps to be elaborated, with pixel details starting from “5 cm”. These maps can indicate: 

- The temperature of the crop and its hydration through the computation of the Crop Water Stress Index (CWSI): water content map.
- The chlorophyll content, which can be related to nutritional deficiencies and the leaves’ nitrogen, iron or zinc content, through different spectral index (TCARI, MCARI, OSAVI indices): chlorophyll map.
- The productivity, quantity, quality and development of the vegetation, through visible and NIR reflectance (NDVI and LAI indices): vigour map.
- An index related to photosynthesis and therefore to the fruit quality parameters, such as sugar and acidity content (PRI index): map of photosynthetic efficiency.

Initially Crop-Scan® is designed for use in woody crops, such as olive trees for example. In this respect, a case study of an olive grove located in Granada (Spain) was presented. For that, different types of images with 15-20 cm resolution were acquired: vigour, chlorophyll content, water stress and map photosynthetic efficiency were created. The example showed how, depending on the type of sensor used, it is possible to delineate zones with distinct problems of water stress, vegetation development, etc., and where different recommendations could be made. “The farmer can have a reliable and rapid photograph of “the state of each tree” on large plots, with a cost between 12 and 20 € per hectare and receiving the report in less than 72 hours. In addition, technical support from agronomists to aid in interpreting the results is given”.

TURNING DATA INTO INSIGHT FOR FARMERS

“Each farm is different. Every field is unique”, said Mr Martin Rand (Commercial Director of VitalFields, a European subsidiary of The Climate Corporation, Estonia). “Because of that, the Climate
Corporation created Climate FieldView™ to make data-driven decisions to maximize returns on every piece of land. The aim is to help farmers sustainably increase their productivity with digital tools, connecting information from different sources (field-soil-atmosphere) to take right management decisions. Mr Rand remembered that yield is a function of several factors as genetics, environment and farming practices plus “variability”. A study of the University of Illinois about corn production states that, apart from the variability of weather and climate, more than 2/3 of the biggest influencers of yield in the field are controllable factors. And today, as Mr Rand said, “with Precision Ag tools, there is a big opportunity to narrow field variability”.

One of these solutions can be FieldView™, a centralized field data management system that allows having all field data in one place. It allows collection, storage and display field data in one easy-to-use digital platform that can be accessed from the field, office or home. The tool also helps to analyze the crop performance by soil type, by field, or even by field regions; and maps side-by-side to better understand field variability. Climate FieldView™ uses a proprietary process to deliver consistent, high-quality satellite images so farmers and technicians can identify in-season challenges and take action to protect yield. Customized plans for each field to manage variability and maximize yield with variable rate planting prescriptions and nitrogen monitoring can also be performed with the tool.

**PRECISION AGRICULTURE: THE VISION OF A NETWORK OF COOPERATIVES**

How is the real vision of Precision Ag from the point of view of farmer organizations? Thierry Darbin (Precision Agriculture Chief Officer, InVivo Agriculture, France) offered this point of view from the testimony of a network of 31 cooperatives associated with the InVivo Group. InVivo Group is the leading French agricultural cooperative group, joining 220 member cooperatives in 31 countries around the world and being organized around four fields of expertise: Agriculture, Animal Nutrition and Health, Retail and Wine.

French agricultural land supposes about 18 Mha of arable land and 10 Mha of perennial crops. Of those, and according to figures presented by Mr Darbin, only 17% of the farmers use decision support tools to adapt their practices according to weather and crop conditions, and only 14% of the farmers use remote-sensing data to adjust nitrogen fertilization on a yearly basis. Yield maps are much less frequent, being used only by 8% of the consulted farmers. However, 40% use parcel-based management software’s, which is a promising number to later adopt other PA practices.

"Overall, farmers feel that they have reached a limit in terms of inputs use. As a result, they expect new approaches and/or new technical concepts to keep on progressing..."
“Overall, farmers feel that they have reached a limit in terms of inputs use. As a result, they expect new approaches and/or new technical concepts to keep on progressing and innovating”.

THIERRY DARBIN (PRECISION AGRICULTURE CHIEF OFFICER, INVIVO AGRICULTURE, FRANCE)

and innovating”. “You cannot put new wine into old bottles”, Mr Darbin said. With this, he tried to illustrate the decreasing trend in the use of decision support tools observed in the last years. However, Precision Ag tools are gaining adepts little by little, because there is an increasing awareness about site-specific variability. “Why use the same rate everywhere when soils & crop yields are so variable in the field?” In this line, another recent market study based on 6,000 French farmers revealed that 69% of the farmers have already implemented some PA strategies in their farms, but 96% of those have not yet resorted to applying variable rates.

From the surveys carried out about Precision Ag, several key aspects may be highlighted: a) farmers prefer local, close support, “somebody that already knows me and my farm”; b) soil is recognized as the main source of variability, “everything starts from soils”; c) farmers should understand, adhere and be at the centre of the system; d) a full and turnkey solution is needed, “from intra-field soil diagnosis, zoning, characterization, variable-rates application, to hotline and financial facilities”; and e) PA is a process of continuous improvement for a visible progress.

A mode of conclusion, Mr Darbin stated that there is a real and strong interest in implementing PA from French farmers. This will be the best way to keep on progressing while meeting the expectations of society (higher yields, better products, sustainable agriculture and environmentally respectful). Then, the real success of PA will pass by bringing stakeholders together, adapt existing agronomic models and decision-making rules to the new technological paradigm, and by producing simple overall and coherent solutions.

PRECISION AGRICULTURE: WHY NOT (YET) A HUGE SUCCESS?

After 25 years of PA, “why is Precision Agriculture not (yet) a huge success?” This is the big question that Mr Andrej Mertelj (CEO, Datalab Agro AG, Switzerland) launched the audience of the 15th NewAg International Conference in Berlin. Actually, he defined the moment as the “battle for the eyeballs”.

“The battle for the eyeballs” was a term introduced years ago by Andy Grove, Intel’s former chief executive, when Intel, the world’s largest microchipmaker, launched the Pentium MMX microprocessor. He described the ensuing battle for the home market as “the battle for the eyeballs”. Now it is the same with Precision Ag: many independent solutions by small or big companies working initially (or not) in the agricultural sector are being launched...
for a huge potential market. However, many farmers that are being offered PA services do not yet see clearly the benefits of implementing PA in their farms. Uncertainties and indecision are being produced in farmers when they are pushed to adopt one or another solution. For example, farmers say: "I want to be able to transfer the data from red to yellow tractor, but they have different protocols"; "I will buy the service or I am willing to pay if I can see a proven benefit" (but remember, you cannot expect results overnight with PA); or "I don’t like paying for something which is going to be outdated within a few months". This mess or lack of standard data, protocols, etc., results in a high cost of opportunity. Mr Mertelj gave some examples of this in his presentation. For example, it took 9 years of hard negotiations to standardize the ISOBUS connector. "Vendor locks should not be a strategy anymore. Share the data!" Also, the public administrations should make the data freely accessible. This, together with the definition of standards, should not be anymore an obstacle for the real adoption of PA. "We don’t have such luxury (to wait for long time to establish the standards) anymore!"