

Satellite Applications

Case Study

The Courtyard Partnership

Pioneers in using satellite data to adopt more sustainable farming practices



Technology Strategy Board
Driving Innovation

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The Company

Company Name	The Courtyard Partnership
Managing Director	Mark Gillingham
No. of employees	29
Launched	1991
Location	Dorcan, Swindon
Sector	Precision Agriculture

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Courtyard Partnership
– driving a technology
revolution in modern
farming.

Overview

The Courtyard Partnership is one of a small group of companies driving a technology revolution in modern farming. They are pioneers in a new era of 'precision agriculture' combining data from satellite imaging and in-depth soil analysis, with satellite positioning technology. Their goal is to help farmers precisely manage variations in soil type across individual fields, and so improve yields, while adopting more sustainable farming practices.

- Ordnance Survey data and satellite imagery is used to create a digital farm map. Satellite instruments measure 'soil brightness' - the reflectance of sunlight off the soil surface to determine soil texture, organic matter and moisture content. This data is combined with soil sample analysis from the field and the farmer's knowledge to create soil zones.
- Courtyard Partnership's Intelligent Precision Farming (IPF) software uses space data to monitor the health of crops across the zones, enabling farmers to adjust the level of inputs (seed, pesticides or fertiliser) according to the needs of each field, or areas within a field.
- These 'variable rate' plans are digital maps compatible with the Global Positioning System (GPS) on farm vehicles, enabling them to automatically alter the amount of seed or fertiliser distributed.

Feeding a Growing Population

A growing population and the impacts of climate change are putting farmers under increasing pressure and they are turning to technology for answers.

By 2037, the UK population is predicted to reach over 70 million – that is an increase of 10 million people over the next 25 years¹. At a global scale, the United Nation's predicts that by 2075, the world's population will peak at around 9.5 billion people – around an extra three billion people by the end of this century².



A growing population

Whilst measures to tackle food waste are integral to feeding a growing population, farmers have to maximise the yields possible from finite (sometimes decreasing) land-resource, whilst protecting its fertility for future generations.

Farmers can 'zone' land more accurately and monitor the day to day health of crops.

Using IPF desktop toolkit, farmers can monitor crop growth from their desktop by accessing "EyeCrop".

Climate change is compounding the challenge. Summer 2012 was the wettest in the UK since records began in 1912, the heavy rainfall following a Spring drought. The upshot was a poor wheat harvest and smaller than normal fruit and vegetable crops³. A knock-on effect of lower wheat yields was an increase in feed cost for livestock farmers.

The opportunities created by data-based precision farming are clear. Farmers can 'zone' land more accurately and monitor the day to day health of crops to improve the targeting of inputs, from seed to fertiliser. Reduced waste means lower costs, while better management means yields grow. Crucially, precision farming does not require large teams of people or expensive new kit.

Space based applications provide other benefits too, including reducing the amount of carbon released from the land.

Farmers have traditionally driven in fairly random patterns across their fields, depending on the type of vehicle or implements being used. This inevitably compacts the ground. Root systems live off and store carbon, so compacted soil has to be 'loosened,' or cultivated, at the beginning of the growing season. This disturbs the nutrient content and causes the release of carbon.

Today, farmers are increasingly using GPS to create – and stick to - virtual traffic lanes across fields. Not only does this reduce compaction it often cuts the number of miles driven, sometimes by a significant margin, pushing down fuel costs.

Innovation at the Courtyard Partnership

In 2004, The Courtyard Partnership launched its "Intelligent Precision Farming" (IPF) service, an easy to use software platform for farmers that combined the company's heritage in soil science with the latest satellite imagery analysis.

IPF creates a digital farm map based on soil brightness imaging from space, soil sampling and the farmer's historical knowledge of managing the land. Soil brightness scanning from space is used to give an indication of soil texture, organic matter and soil moisture down to a five metre resolution, creating highly accurate soil management zones.

Farmers then build 'variable rate' plans to accurately adjust levels of inputs from seed to fertiliser according to the soil zone. The maps are digital files compatible with GPS on farm machinery, so that rates can be changed automatically in the field.

Using IPF desktop toolkit, farmers can monitor crop growth from their desktop by accessing "EyeCrop". high resolution satellite images that provide ground cover, chlorophyll and Normalised Difference Vegetation Index (NDVI) data. Ground cover indicates the percentage of ground covered by vegetation.

Chlorophyll shows the level of nitrogen nutrition of the plants and the NDVI index show differences in plant vigour, a combination of the 'thickness' of the crop (number of plants) and its 'greenness'.

"National crop yields have improved 15% in the past 15 years, but we have been able to improve the yields of IPF users by 18% in just three years," says Managing Director, Mark Gillingham, "And compared with national average yields for 2012, our customers are achieving 18% more wheat and 34% more winter oilseed rape. These are very significant improvements."

"Farming contributes 7% of the UK's greenhouse gas emissions, to cut emissions, efficient use of fertiliser is essential, whilst ensuring that production is not affected," says Gillingham. "Using IPF precision farming techniques, we estimate that we can save approximately 20 kg/ha of nitrogen, 10 kg/ha of phosphate and 10 kg/ha of potassium. And for an average 400 hectare farm, IPF could save 8800 litres of diesel, which is enough for a small car to travel 289,000 kilometres, and would save 45 tonnes of carbon dioxide emissions."



Using satellite data for precision farming

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At the Hendred Estate's 80% of land is now untouched by vehicles, leaving root systems and carbon stores intact.

Our customers are achieving 18% more wheat and 34% more winter oilseed rape.

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Case Study:

Hendred Estate, Oxfordshire

Hendred Estate is a 3,500 hectare arable and sheep farm near Didcot, Oxfordshire on alkaline soils predominantly silty, clay loams over chalk.

Hendred Estate is an early adopter of a satellite enabled controlled traffic system to reduce soil compaction. The technology comprises a Global Positioning System (just like sat-nav in a car) in conjunction with a Real Time Kinematic (RTK) ground station to provide real-time corrections.



Julian Gold, Hendred Estate

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Since installing the system, Farm Manager, Julian Gold, believes 80% of his land is now untouched by vehicles, leaving root systems and carbon stores intact. "The challenge now," says Gold "is to find new ways to maintain the condition of the tracks."

Julian started working with The Courtyard Partnership using the Intelligent Precision Farming service to improve yields and reduce costly inputs.

"We call it the Robin Hood and King John approach," says Gold. "By accurately zoning the fields if the rich areas are thriving then we can concentrate on giving the poor areas the extra seed or fertiliser they need, and if the poor area is not improving, by later in the season we can add more inputs to get the maximum yield from the richer soils."

Future Developments

Scientists are exploring the possibility of satellite imagery to help predict moisture stress in crops, an early indicator of disease. For instance, Septoria, a fungal disease has a latent period of three weeks, if satellite imaging could see the disease before the leaf spots become visible to the naked eye, farmers could increase and target pesticides to reduce losses.



Palmoil 2011

"Precision farming means we have the ability to build resilience in to the system," says Gillingham. "We are using data to transform modern farming, to make it more efficient and more sustainable. "We are at the early stages of this technology, but to date the results have been impressive and increasing numbers of farmers are expressing an interest in our service."

Sources

1. Hall J, The Independent. "UK population will soar by nearly 10 million by 2037 with immigration attributed to projected increase", 6 November 2013.
2. Institution of Mechanical Engineers. "Global Food: Waste Not, Want Not", January 2013.
3. BBC News, "Wet weather set to hit UK food prices", 10 October 2012