McDonald's Flagship Farms

Potatoes – Van Den Borne, Netherlands

Introduction

This case study demonstrates how technology, innovation and a strong business sense have resulted in a well-capitalised, results focused business. The farm has a strong ethos of innovation which results in continually assessing and re-assessing practices to get the best from their farming enterprise. Working collaboratively with the industry, Farm Frites, and enthusiastic to share best practice this farm demonstrates some of the key elements of what it is to be a Flagship Farm.

The key initiatives undertaken by the 'Van den Borne' farm are:

- Precision farming
  - Real-time variable fertiliser applications based on soil nutrient availability and crop requirements
  - Soil sampling and scanning ensure applicable soil properties are measured and relevant actions are taken – from addressing areas of compaction through to monitoring of nutrient profiles
  - Position of tramlines are calculated to ensure that field operations are undertaken in the most efficient
  - Global Positioning System (GPS) assists with efficient field operations and reduces overlaps
  - Unmanned aerial vehicles (UAV's) are used to scan fields to provide data to help determine management decisions and actions
  - Crop measurements and monitoring provides further data to determine management decisions and actions
  - Variable rate crop protection applications optimise chemical use and efficacy
  - Yield measurement at harvesting provides data to help define future management decisions
  - Decision support software & hardware provide real-time data to determine management actions
- The farm has constructed a straw bio-bed system where any residues from spraying are deposited and then allowed to degrade. The basis of the system is that it uses wind and sunlight to evaporate the water constituent and the remaining chemical residue is broken down within the straw bio-bed.
- The farm provides potatoes to the local community food bank.
- The farm has calculated its 'Carbon Footprint' with the total direct and indirect greenhouse gas emissions being assessed; the aim is to devise an action plan to reduce both emissions and energy use.
- The farm has several field borders planted with species rich flowering plants and insect hotels have been placed in appropriate locations around the farm. A local beekeeper also has hives on the farm.

Being selected as a McDonald's Flagship Farm is a real honour, and is recognition for several years of hard work and effort in producing potatoes sustainably. This recognition provides us with the motivation to continue to improve our business and develop sustainable solutions for the future.

The Van den Borne Brothers

The family's approach comes from a commitment to their workers, their ethics and their business sense.

Regular assessment ensures the farm stays productive while investment in technology and modern equipment is safeguarding the farm's future – ensuring that Van Den Borne Farm will not just be a flagship farm of today but tomorrow as well.

Karl Williams,
Flagship Farm Programme Director, FAI Farms

Summary of actions

The table below summarises the key areas of good practice displayed by Van den Borne Farm, and the benefits (EN environmental EC economic ET ethical) that arise from taking these actions.

	Action	Benefits
Assurance/ Certification	GlobalGAP accredited	EC EN ET Ensures raw materials are produced to high standard of food safety, environmental care and also ensures that worker welfare is protected, this generates customer confidence and increases market value and access for the farms produce
	Aequor Approved Apprenticeship Provider	ET The farm is certified as an approved apprenticeship provider for students from agricultural vocational schools
Sufficient high quality production	Implementation of Precision Agriculture	EC EN ET The implementation of precision agriculture technologies to help reduce inputs, improve yields/quality/efficiency and provide detailed management feedback & advice
Supplier relationships	Close working relationship with Farm Frites	EC EN ET The farm works closely with Farm Frites (their potato purchaser and processor) on trials for new potato varieties and other sustainability challenges
Water data mangement	Dacom Soil Moisture Meters	EC EN Soil moisture meters provide accurate data to help inform irrigation episodes and quantities to optimise water use and crop growth
	On farm weather station	EC EN ET Helps provide data on potential rainfall events to help inform irrigation scheduling/ planning and also identifies potential weather conditions which could increase disease risk
	Rain water collection	EC EN Rain water is collected from the roofs of buildings and used in the application of plant protection products (PPPs)
Soil Management	Soil Mapping of Nutrients	EC EN The natural variability in key soil nutrients (P, K, and pH) is mapped and the information used to form the basis of nutrient management and application. These detailed maps provide for optimal application of inputs and maximising crop growth
	Increasing Soil Organic Matter (SOM) Levels	EC EN ET 5,000 tonnes of compost are made and stored on farm which is spread and incorporated onto farmland and helps increase the SOM content, improving soil fertility, water holding capacity, and structure which benefits crop growing conditions
	Robust Crop Rotation	EC EN The farm operates a minimum 5 year crop rotation to minimise pest and disease incidence, with rotations aimed at reducing nematode populations
	Unmanned Aerial Vehicles	EC EN Whole field monitoring and scanning provides data to help determine management decisions and actions

Climate change mitigation	**Carbon Footprint Measurement**	EC EN ET	Total direct & indirect greenhouse gas emissions calculated, with a view to devising an action plan to reduce emissions and energy use
Biodiversity	**Habitat Areas**	EC EN ET	Field margins have been planted with flower rich species mix to create biodiversity hotspots, with the aim of increasing insect habitats
Waste	**Pesticide Residue Management**	EC EN ET	Construction of a pesticide residue storage and disposal system where all the chemical residues from spraying are collected and degraded
Community Investment	**Support For Local Initiatives**	ET	Potatoes are supplied to a local foodbank which distributes food to local people in need

Potatoes growing next to the farm

Background

The company was founded in 1952 by Jan van den Borne when he purchased the farm in the region of Reusel, Noord-Brabant. In 1965 Jan purchased his first combine, allowing him to increase the farmed area significantly. Around 1970, the farm began growing potatoes for the chip (crisp) industry. Since 1984 a collaboration was initiated between van den Borne and Farm Frites with the start of a factory in Lommel. This factory is in the neighbourhood of the farm which makes it attractive and sustainable to transport potatoes. Over the last 45 years the business has expanded rapidly and now grows 550 hectares of potatoes, 50 hectares of sugar beet and 300 hectares of maize. The farm's soil is predominantly sandy and over 50% of the area can be irrigated; the farm has 140 potato fields which are on average four hectares in size.

Here Jacob van den Borne describes more about his farming operation:

When did you and your brother acquire the family business?

My brother, Jan, and I started running and managing the farm in 2006.

What is the most important part of your farming system and how does precision agriculture help?

The soil is the foundation for everything we do on the farm and the need to assess and scan the soil is an important focus of our precision farming practices. For example, just after potato plant emergence we take a soil measurement to assess all nutrients in the soil which is then used to define the management of inputs for the growing crop. We are aiming to test and help develop a mobile Near Infra–Red (NIR) sensor which will be able to determine in 'real–time' the soil nutrients available.

How does the NIR system work and what benefits does it provide?

The NIR system works by measuring the amount of Nitrogen, Phosphorus, Potassium, pH and organic matter levels in the soil. This information ensures we are able to better calculate the quantity of fertilizer that we need to apply to obtain the optimum yields in a sustainable way.

You are using and Unmanned Aerial Vehicles (UAV's) to monitor the crop, what information do they provide?

We use the UAV's for multiple purposes and the images provided can be used to monitor the emergence of the potatoes and we are able to calculate crop emergence percentage and also identify areas of poor emergence. We also use the UAV's throughout the growing season to monitor the crop condition. We use several different kinds of cameras or sensors, ranging from an RGB camera which delivers the three basic colour components (red, green, and blue) and is used to measure the level of plant biomass in the field. We also use multispectral cameras, hyperspectral cameras and thermal cameras to monitor the crop.

What benefits does this data provide?

We are able to monitor crop health status and detect early stages of plant disease which allows us to act early. We are also able to monitor crop nitrogen levels, water status and any crop losses.

What other precision farming techniques have you incorporated into your farming operation?

We utilise the Global Positioning System (GPS) to assists with efficient field operations and applications. When applying pesticides, the system reduces overlaps by automatically switching boom sections off when they pass over a previously sprayed area, this reduces chemical use, limits crop stress, and reduces application time.

EC

EN

Studies have shown a significant 6.2% reduction in off– target applications after fitting a GPS system to their sprayer.

We have also invested in real-time variable fertiliser applications based on soil nutrient mapping and crop requirements. This helps to enhance nutrient management and improve placement and increase nutrient uptake efficiency, which represents a significant potential cost saving and a reduction in nutrients entering water systems.

What is your crop rotation and why?

We have a crop rotation ratio for potatoes of 1 in 5 or 6 years. An important part of any rotation is to take account of soil fertility, weeds, disease and pest control. Prior to planting potatoes, we grow sugar beet, as we have found this helps to control nematode populations, which can have a very damaging effect on potatoes. The most damaging nematode to potatoes being Meloïdogyne chitwoodi, and by growing sugar beet has helped reduce the presence of these pests by 80%.

We have also discovered that soils with low organic matter have a higher incidence of nematodes. We are able to identify areas with low organic matter during soil scanning as they have a lower conductivity, all these results are recorded on a digital map so we can implement management practices to rectify the issue.

How are you increasing soil organic matter levels?

We have an area on the farm for processing and storing approximately 5,000 tonnes of compost, this is made from garden and vegetable waste sourced from the local area. We spread the compost at a variable rate based on the results of soil scanning and we are able to target increased application rates of compost on areas of low conductivity. This benefits soil heath, and fertility whilst reducing nematode populations.

Water management is crucial in potato production, how is this managed?

For the past seven years we have used Dacom soil moisture sensors to help monitor and manage irrigation quantities and timings. We use data from our soil scanner to detect the optimum area to locate the sensors and we are currently busy developing a model to predict the soil moisture per 6m3. We have also developed a water monitoring system which can be retrofitted to every water pump and measures quantity use per minute. We can also link this data to the GPS location of the well, so we can closely monitor and record usage. Our objective is to increase potato yields whilst reducing the volume of irrigation water by 20%.

How is it possible to increase yields whilst reducing water usage by 20%? On average, 20% of the applied irrigation water is not utilised by the plants and is lost, either through evaporation or by it moving through the soil away from the plant's root zone. Therefore, we are increasing irrigation events whilst reducing application rates, this allows us to keep soil moisture levels to the required level for the plant, whilst minimising water losses and increasing yields.

EC EN

The double tank fitted to the farm's sprayer has helped reduced the application of herbicide by up to 20%.

What other data is helping you reduce inputs?

For the last 15 years we have been utilising data from the Dacom system to help provide information to guide crop management decisions. We are continually updating our machinery and equipment with the aim of minimising the quantity and number of applications of plant protection products. The sprayer has sensors to detect the biomass of the crop and will automatically adjust the amount of chemical or nitrogen applied based on pre-set parameters.

We have invested in a double tank for our sprayer, as this enables us to use two separate products with one pass of the sprayer. At places in a field where a certain weed may be growing, we can apply the additional product just to that area without having to apply it over the whole field.

We are currently busy researching the effect of variable rate spraying on weeds on the basis of organic matter, and haulm spraying on the basis of crop biomass.

The biomass sensors, what benefits do these provide?

The are several benefits of this technology, being able to measure plant biomass means we are able to apply inputs based on a specific need or requirement of that plant.

EN

Plant biomass sensors have resulted in a 20% reduction in fertiliser use, whilst achieving a 1% yield increase, and a 60% reduction in haulm killing application rates.

For example, large, leafy plants require less nitrogen, than their smaller counterparts, but may require more chemical protection against blight (Phytophtora). Being able to detect the biomass of the plant means we are able to better fulfil the needs of the crop, rather than just treating the whole field the same. At the plant level they receive what is needed, for example, correct nutrient levels and optimal crop protection. The impact has been a 20% reduction in fertiliser use, whilst achieving a 1% yield increase.

Potato Variety, Ivory Russet

Shortly prior to harvest we apply a haulm killing product to make harvesting easier. The benefit of detecting plant biomass means we can be more targeted in our application of chemical, where more biomass is detected, more product is used and at places where the plant is already dead, less product is used. We apply usually apply 3 litres per hectare of chemical where the haulm is still growing, down to 1 litre per hectare where the haulm is already dying, this has equated to a 60% reduction in application rates.

How do you manage all the data and information?

Since 2012, we have worked together with Dacom to develop a phone application to record all crop information, including cultivations and inputs for every field, which is updated by our employees as they complete a task. We keep contact to improve the software and to expand its application.
We have also invested over €60K working with a company to help develop software which will capture the data from our precision farming system so it will provide advice and 'task cards' (cloudfarm). We hope to combine this application with the system to provide a better management software system. We are aiming to make this application available so other farmers using precision farming can benefit from this data.

You work closely with Farm Frites, what benefits does this bring to your business?

We have a great business relationship with Farm Frites, and this starts with the selection of the varieties we grow that are best suited to supplying Farm Frites customers, like McDonald's. The main varieties for Farm Frites are Fontane, Ivory Russet and other varieties.
We also carry out a number of trials in collaboration with Farm Frites to select the best varieties on the basis of fields trials. For more than six years, we have held trials on our farm with different seed potato suppliers.
Last year, we started a project with Agrico to provide support to five seed potato growers to help increase the quality of their potatoes using precision farming techniques.

Phytobac System

How are you disposing of pesticide residues?

We have an area on the farm where we any spray residues are collected and degraded. The system is called Phytobac™ and it is designed to deal with chemical residues from the outside of the sprayer and tank washings. The dirty water first flows into a settlement tank, where the dirt settles as sediment. The remaining liquid is then moved to a second tank from where it is applied in small doses into the substrate container filled with farm soil and straw. The straw serves as an additional source of carbon which promotes microbial degradation. Measurement and control elements regulate the soil moisture levels, creating ideal living conditions for microorganisms such as bacteria and fungi. The enzymes in these tiny organisms helps break down residues of the chemicals whilst the water evaporates.

How are you reducing water consumption?

We have invested in a rainwater harvesting system, and this collects rainfall from around 20,000m2 of building roof, which equates to almost 16 million litres of water collected annually. As it contains very few impurities we use this water in the sprayer to apply the plant protection products to the crops. We have also built a water purification system which cleans and purifies the water we use to wash the potatoes. Being able to wash potatoes on farm allows us to remove stones and dirt, which are then not transported to the factory.

What engagement do you have with the local community?

We are very supportive and involved with the local community and we provide potatoes to the local community food bank on a regular basis.

What are you doing in relation to your carbon footprint?

The farm has calculated its 'Carbon Footprint' with the total direct and indirect greenhouse gas emissions being assessed. We are devising an action plan to reduce emissions and energy use.

What new practices are you looking to implement in the future?

In the coming years, we are going to start a pilot with controlled traffic farming (CTF). CTF uses the GPS signal to create designated traffic lanes across the fields rather than driving machinery across the field. This reduces soil compaction significantly, and the benefits the soil structure on the un-trafficked, potentially leading to yield increases of 7%.
But, this system requires a lot of capital investment and we have to consider all our machines, we are planning to do this step by step. The cost of investment in CTF will be around €100K

What environmental practices are undertaken to maintain / increase biodiversity?

We have several hectares of our flowers planted around our fields. We have a local beekeeper bring his hives onto the farm as pollinators for the flowers. We also have erected insect hotels around the farm and documenting the insects we see around the farm.
We have constructed a bird hide to allow people to watch and photograph the birds, and also provided a nest box for an owl which is on the farm.

Good Practice Matrix for Van Den Borne

The following matrix has been developed by McDonald's to help assess the sustainability of the agricultural production within the supply chain. Flagship farms have been identified that demonstrate best practice in one or more of the 17 key areas in the matrix, whilst also operating to general high agricultural standards in all other areas.

A ✓ in the matrix below indicates good practices demonstrated in this case study.

Ethical (Acceptable Practices) ET

Human health & welfare
- i Employee health & welfare
- ii Food safety

Animal health & welfare
- i Nutrition
- ii Medication & growth promoters
- iii Genetic selection
- iv Animal cloning
- v Husbandry
- vi Transport
- vii Slaughter

Business ethics & supplier relationships

Rural landscape preservation ✓

Environment (protecting the planet) EN

Climate change
- i Greenhouse gas emissions
- ii Energy efficiency & renewables ✓

Natural resources – soil
- i Soil fertility & health ✓
- ii Soil erosion, desertification & salinisation ✓
- iii Soil contamination ✓

Natural resources – water
- i Water pollution
- ii Water usage efficiency ✓

Natural resources – air
- i Air emissions

Agrotechnology
- i Agrochemical usage ✓
- ii Bioconcentration & persistent organic pollutants ✓
- iii Genetically modified organisms

Ecosystem protection
- i High conservation Value Land (HCVL)
- ii Habitat & species preservation ✓

Waste
- i Production waste
- ii Hazardous waste ✓
- iii Waste to landfill

Economics (long–term economic viability) EC

Sufficient high quality production
- i Producer income security & access to market ✓
- ii Agricultural input costs ✓
- iii Crop & livestock disease ✓

Community investment
- i Local employment & sourcing
- ii Support for community programmes ✓