## McDonald's Europe Flagship Farms

# Wheat – Gut Piesdorf GbR, Germany

## Introduction

Gut Piesdorf demonstrates that, by farming within climatic conditions and available natural resources, it is possible to produce a quality, marketable product (wheat). The economic objective is to reduce inputs whilst increasing yields and to work with the natural processes that occur within the environment.

The key initiatives undertaken by Gut Piesdorf GbR can be summarised as follows:

- The farm is certified with GlobalGAP – an assurance programme inspected by an independent third party company that covers a wide range of practices and policies in the area of food quality and safety, environmental standards and worker welfare.
- The farm is DLG Sustainability certified. This certification comprises ecological, economic and social indicators (equivalent to the McDonald's 3 Es approach) – including: soil protection, water, resource use, biodiversity, plant protection, food safety and hygiene, safety at work, staff training and the impacts of agriculture on the climate.
- The farm has invested in the N-Sensor, a tractor-mounted tool that measures the percentage of light reflected from the crop as the tractor passes through the field. This information allows the N-Sensor to measure the crop's nitrogen requirement and automatically vary the fertiliser application rates accordingly. The N-Sensor system has reduced nitrogen fertiliser use on the farm by 5% with no loss of yield.
- A Global Positioning System (GPS) is fitted to the sprayer, limiting application inaccuracies by automatically switching off the sprayer boom sections when they pass over previously treated areas, or if they go beyond the field boundaries. Improving application accuracy saves on inputs (and their associated costs), limits crop stress and reduces application time and operator stress.
- Soil testing for nitrogen is carried out in spring to ensure nitrogen application rates are matched to soil reserves and plant requirements, reducing over-application and losses. In early summer wheat leaf samples are taken and used to calculate the plants' nitrogen levels. Nitrogen applications are then matched to crop requirements to ensure protein levels in the seed meet milling quality requirements.
- The farm has significantly increased the use of organic manures to improve soil structure. The practice has already lowered input costs by reducing the amount of artificial nitrogen, potash and phosphate fertilisers needed. This, in turn, has reduced the farm's carbon footprint as artificial nitrogen fertilisers, in particular, are highly energy-intensive to manufacture.
- Management practices over the last 20 years have increased soil humus levels to 3%. Humus increases the water holding capacity of soil and for every 1% of humus present in soil, 25kg of nitrogen per hectare can be released. The principle component of humus is carbon; a 1% increase in soil humus levels has the potential to sequester an extra 88 tonnes/hectare of $CO_2$.

"In Piesdorf, the soil fertility and climate conditions give us the opportunity to grow high quality premium wheat. Achieving this potential under the principles of sustainability has been the key aim of our farming for several years. I am delighted that McDonald's recognises these efforts and has selected us as a Flagship Farm.

It gives us the opportunity to communicate the benefits of sustainable agriculture to the public and to share experiences with the community of Flagship Farmers."

Hubertus von Daniels,
Gut Piesdorf GbR, Germany

## Summary of actions

The table below summarises the key areas of good practice displayed by Gut Piesdorf, and the benefits (EN **environmental** / EC **economic** / ET **ethical)** that arise from taking these actions.

| | Action | Benefits |
|---|---|---|
| **Assurance/ Certification** | **GlobalGAP approved** | EN Environmental requirements within the standard ensure production methods do not adversely affect the natural environment<br>EC Being audited and approved under the scheme improves the marketability of produce grown<br>ET Requirements covering quality, food safety and staff welfare are all independently checked and verified |
| | **DLG Sustainability certified** | EN Monitors the farm's nutrient balance, energy use, GHG emissions, along with natural resource protection<br>EC Measures farm income, debt, capital investment and profitability<br>ET Covers worker remuneration, holiday, health and safety |
| **Crop Initiatives** | **N-Sensor** | EN Has reduced nitrogen usage and limits over application, reducing environmental impact<br>EC Nitrogen usage has fallen by 5% with no yield loss. Improves combine efficiency |
| | **Nitrogen testing** | EN Ensures nitrogen applications are in line with crop requirements which reduces the risk of nitrogen entering water sources<br>EC Ensures that protein levels in the wheat seed are suitable for milling quality |
| | **GPS fitted to sprayer** | EN The system reduces application errors, limiting any risks to the environment<br>EC Accurate and precise application of inputs improves the effectiveness of the plant protection products and reduces the quantity required |
| **Product Quality** | **Growing milling wheats** | EC Producing a quality product which has a high market demand<br>ET Producing a quality affordable food |
| | **Pre-harvest monitoring and risk assessment** | ET Ensures quality and food safety of wheat that is used for milling |
| | **Good relationship between the farm and mill** | ET Communication and feedback between the farm and the mill is vital to ensure continuing quality of the raw materials and to develop a strong business relationship<br>ET This relationship ensures elements such as food safety and raw material quality is achieved |
| | **Air cooling stored grain** | EN Eliminates the requirement to use chemicals to control storage pests (insects)<br>EC Cheaper alternative to chemical control<br>ET No chemicals used on stored grain and reduced risk of mycotoxin growth improves food safety |
| **Water** | **Rain water capture from buildings** | EN Rain water is used in the sprayer, which reduces the requirement of using water from other sources<br>EC Cost saving initiative as the system will operate for many years, capturing a free natural resource |
| **Soil Health** | **Humus levels increasing** | EN Increases the $CO_2$ sequestration potential of the soil<br>EN Increases the water holding capacity of soil<br>EC Humus releases nitrogen into the soil, reducing the amount of artificial fertiliser required |
| | **Applying organic manures to the farmland** | EN Reduces reliance on artificial fertilisers, so reducing the carbon emissions associated with the crop<br>EC Improved soil health increases crop production output, whilst reducing input costs |
| | **Crop rotations** | EN Helps improve soil fertility, reducing the need to apply synthetic fertilisers<br>EC Reduces disease and pest incidence through natural processes rather than chemical control |
| **Community** | **Farm staff undertake litter picking** | ET Improves the local area's visual appearance for everybody |

## Background

Hubertus von Daniels-Spangeberg started farming over 30 years ago. In 1991, after the re-unification of Germany, he moved to Harzvorland, in the district of Harz, in Saxony-Anhalt, where he re-established his grandfather's 300 hectare farming business, Gut Piesdorf GbR. In 1992, the business went into partnership with a local family V. Stromberg, between them they now farm over 837 hectares.

The region of Harzvorland is an ideal wheat producing region due to the climatic conditions and is recognised as one of the 21 most productive wheat regions in the EU.

The business operates a rotation consisting of 50% wheat, 25% oilseed rape, 15% spinach or peas and 10% sugar beet. The farm has a good relationship with the local flour mill, which is operated by Saalmuhle. Both businesses work closely together, with Saalmuhle providing information on varietal selection and cultivation methods, as well as carrying out pre-harvest risk assessments to evaluate pest, disease and potential mycotoxin risks.

**Facts: German Agriculture**
Germany consists of a total of 36 million hectares of land; around 48% (over 17 million hectares) is used for agriculture and one third of this area is devoted to crop production. Agriculture accounted for 0.9% of Germany's GDP in 2009.

**Facts: Cereal Production**
Cereals (including rice) constitute the most widely grown crop group in the world. Wheat has been the staple food in Europe for 8,000 years and is now cultivated worldwide. In 2007, worldwide wheat production was 607 million tonnes, making it the leading source of vegetable protein for human consumption. In 2009, Germany produced 25.2 million tonnes of wheat, making it the third biggest producer in Europe (after Russia and France). Germany is the eighth largest producer of wheat in the world, and the sixth largest wheat exporter.

**Facts: GlobalGAP**

The GlobalGAP integrated farm assurance programme is an on-farm standard that covers the certification of the whole of the agricultural production process. It has established itself as a key reference for good agricultural practice (GAP) in the global market place.

*(Source: GlobalGAP)*

# Assurance/Certification

## GlobalGAP Approved

Gut Piesdorf is independently inspected and approved under the requirements of the GlobalGAP farm assurance scheme. The GlobalGAP standards are primarily designed to uphold and maintain consumer confidence in the quality and food safety standards of the raw materials grown on the farm.

Environmental criteria include factors such as:

- Chemical treatments/dressings
- Site history and site management
- Soil management
- Fertiliser application/storage
- Irrigation/fertigation
- Plant protection product

Ethical criteria include factors such as:

- Food quality
- Pests, disease, injury
- Staff welfare

## DLG Sustainability certified

Gut Piesdorf also complies with the DLG Sustainability Standard. This standard, administered by the German Agricultural Society - Deutsche Landwirtschafts-Gesellschaft, prides itself on boosting efficiency, sharpening profile and creating image. The standard is unique as its comprehensive list of indicators capture sustainability as a whole, in a like manner to the 3Es (ethics, environment and economics) that underpin the McDonald's supply chain vision for sustainability.

The table below shows the indicators used in the standard:

| Economics | Social (Ethics) | Environment |
|---|---|---|
| Farm income | Wages | Nitrogen balance |
| Rel. factor payments | Working time | Phosphorous balance |
| Full use of medium-term debt service limit | Training | Humus balance |
| Change in equity capital | Holidays | Energy intensity |
| Net investment | Employee affairs | Greenhouse gases |
| Profit rate | Safety at work and health protection | Plant protection intensity |
| | Social commitment | Harmful soil compaction |
| | | Soil Erosion |
| | | Biodiversity |

*(Source: DLG)*

Performance must be good under every pillar – it is not enough, for example, to offset good results in economics with bad results in the ecological pillar.

This standard highlights the strengths and weakness in farm procedures allowing the farmer the possibility to improve procedures, efficiency (e.g. fertilizer, plant protection), and personnel management. Sustainable production protects soil, water, climate and biodiversity. Farmers with the DLG Sustainability Certificate can market their products as sustainably produced, and earn public recognition as a result.

Engaging with a number of assurance programmes has given Gut Piesdorf GbR the potential to continually find ways to progress sustainably.

## Crop Initiatives

### N-Sensor and Nitrogen Testing

EC Inaccurate nitrogen applications increase crop input costs.

Nitrogen is removed from the soil by a plant's root system during the uptake of water; it plays a major role in plant growth, root development and yield. Despite nitrogen being one of the most abundant elements on earth, nitrogen deficiency is possibly the most common nutritional problem affecting crops worldwide. It has been reported that nearly half of the world's population depends on nitrogen-based fertiliser for food.

Nitrogen fertiliser manufacturing captures naturally occurring nitrogen from the atmosphere, and combines it with hydrogen from natural gas under heat and pressure to form anhydrous ammonia. The price of nitrogen fertilisers is therefore intrinsically linked to the price of natural gas (it is estimated that natural gas makes up 90% of the costs associated with nitrogen fertiliser) which has seen unprecedented rises in recent years.

Poor and inaccurate nitrogen applications not only increase crop input costs, but can also lead to nitrogen leaching from soils into local water sources. This can have a profound and serious impact on the environment and is a leading component of eutrophication.

Eutrophication is the process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. (Source: Art, 1993)

EC N-Sensor has led to a 5% reduction in nitrogen usage

Gut Piesdorf has recognised the benefits of good fertiliser management. The practices carried out on the farm include frequent nitrogen testing of the soil and plants and the use of an N-Sensor.

The testing regime at Gut Piesdorf ensures that nitrogen applications are in line with crop requirements and sufficient nutrients are available for the growing crop. This limits the environmental impact of fertiliser application, and increases the production of high quality bread-making wheats. The specification for bread-making wheat is a protein level of around 13% in the seed. This is ultimately affected by the availability and uptake of nitrogen at specific growth stages and requires well-timed applications to ensure adequate nitrogen is available to the plant.

In tandem with nitrogen testing, the farm has been using an N-Sensor to help serve the crop's nitrogen demand. The sensor analyses the crops' light reflectance and then calculates the optimum nitrogen rate for that area. The operator enters in the target application rate, with maximum and minimum rates also programmed into the N-Sensor's control box. The N-Sensor can then make real-time adjustments to the application rate.

For Gut Piesdorf, using the N-Sensor has enabled them to deliver precise levels of nitrogen according to the crops' requirements. The farm has estimated that nitrogen usage has been reduced by 5%, with no loss of yield or reduced crop variability.

**Fact: N-Sensor Payback**
Payback for N-Sensor can be expressed as 'return on capital employed', which is over 50% for a farm growing 250 hectares of wheat and 100 hectares of OSR, although this varies depending on farm size, hectares of crops grown etc.

**Fact:**
Because of the difficulties of fertilising with precision and the added uncertainty of weather, survey data shows that over the last nine years, only 27% of Group 1 samples in the UK achieved the full milling specification.
*(Source: N Management for Milling Wheat in 2009 by Roger Sylvester-Bradley – ADAS)*

## GPS System

Gut Piesdorf has fitted a Global Positioning System (GPS) to their sprayer. The system automatically switches off the spraying boom when it passes over a previously sprayed area, or when they go beyond field boundaries. This has the advantage of decreasing pesticide application inaccuracies by limiting overlaps and ensuring that all areas of the crop receive the necessary applications.

The system saves on chemical inputs (and their associated costs), it also limits crop stress, and reduces application time and operator stress (as the driver does not have to calculate when to switch off the sprayer). Studies have revealed a significant reduction in off-target applications after fitting a GPS system to the sprayer.

The GPS technology is also used on the fertiliser spreader which operates together with the N-Sensor.

One of the positive side effects reported by farmers using the Yara N-Sensor for site-specific N fertilisation is an improved combine harvest of the crop. Since harvesting costs account for up to 30% of total machinery costs in arable farming, inefficient combine performance can cause additional costs by setting crop yield and quality at risk (Sørensen, 2003). Variable rate nitrogen fertilisation improved combine performance by 9 to 33%, irrespective of varying growth and harvest conditions. Assessment of crop properties gave evidence that the improvement is mainly due to more even crop stands. (Effects of N-Sensor based variable rate N fertilisation on combine harvest)

# Product Quality

## Growing Milling Wheats

Whilst almost any wheat can be milled into flour, the best premiums are paid for high quality wheats which are suitable for bread-making.

Gut Piesdorf farm is situated in the region of Harzvorland, which is an ideal wheat producing region due to its climatic conditions and is recognised as being one of the 21 most productive wheat growing regions in the European Union.

**Fact:**
The bakery products market (for human consumption) in Western Europe covers 16 countries, and was estimated to be worth around 98.4 billion Euros in 2008, or 8.9% of the food and drink market of 1.1 trillion Euros.

The farm's unique location has given it the opportunity to produce high quality milling wheats and the resources to be able to grow a product that is in great demand.

## Pre-Harvest Monitoring and Risk Assessment

When grain is harvested, it contains a wide range of potential spoilage and toxigenic organisms. This population is largely affected by in-field conditions and the harvesting process and can be further exacerbated during the storage period.

Two of these organisms are the fusarium mycotoxins deoxynivalenol (DON) and zearalenone (ZON), both of which have maximum legal thresholds set for wheat intended for human consumption. The farmer and processor are legally obliged to ensure that any grain destined for human consumption is safe.

Gut Piesdorf and Saalmuhle have identified the importance of working together to improve food safety which requires a farm-to-table approach, based on risk analysis and sharing responsibilities to reduce any potential hazards.

The pre-harvest risk assessment carried out between the two businesses has been developed primarily for the protection of human health and food safety. The risk assessment identifies any potential in-field issues which allows the farm to implement measures to mitigate any identified risks, such as the application of a fungicide.

## Good Relationship with Buyer

A strong buyer-supplier relationship results in benefits for both parties. Good communication between the Gut Piesdorf and its buyer Saalmuhle enables both businesses to set mutual goals. This ensures that elements such as food safety and raw material quality are achieved.

"In a supplier-buyer relationship it is paramount that there exists a mutual understanding underscored with respect and a sincere wish for each party to prosper."
*(Ireton, 2007)*

The businesses work closely together, with Saalmuhle providing information on varietal selection and cultivation methods, as well as carrying out pre-harvest risk assessments to evaluate pest, disease and potential mycotoxin risks.

## Air Cooling Stored Grain

Gut Piesdorf uses air cooling for stored grain, as it is the simplest and most effective way of controlling insect activity. Once the wheat is in store, temperature probes are placed into the grain and cooling can begin. The aim is to reduce the stored grain temperatures as quickly as possible – ideally below 15ºC – as this prevents saw-toothed grain beetle from developing. This is one of the most serious bulk grain storage pests as it has an exceptionally high breeding potential and severe infestations can cause localised temperature increases, leading to sprouting and high economic losses.

**Fact: Grain Pests**
Insects are a major cause of damage in stored grain. Field insect pests and some storage species damage grain on the head and promote fungal growth in the moist environment of the ripening grain. In storage, many insect species attack grain, and the moisture that can accumulate from their activities provides ideal conditions for fungi. To avoid moisture and mould problems, it is essential that numbers of insects in stored grain is kept to a minimum.

*(Source: Food & Agriculture Organisation of the United Nations, Mycotoxins in Grain)*

Grain temperatures are monitored via a cooling system control panel. Monitoring and recording temperatures ensures uniform cooling throughout the bulk store. The areas that are not being cooled adequately can be identified and corrective action can be implemented.

EC

Blowing ambient air through the bulk store is a low cost way to cool grain – typical costs are 3-8 Euro cents per tonne.

(Source: HGCA, The Grain Storage Guide, 2nd Edition)

## Water

### Rain Water Capture from Buildings

EC Harvesting rainwater reduces input costs.

'Harvested rain water' is the term used for rainwater that is captured from the roof of buildings which would otherwise have gone down the drains, been lost through evaporation, or soaked into the ground. Gut Piesdorf has installed a Rain Water Harvesting (RWH) system on the roof of its grain store to collect water for use in their sprayer. This has allowed the farm to reduce the requirements of purchased water leading to a reduction of input costs.

**Benefits of Rainwater Harvesting:**

- Typical charges for mains water are currently between €1 and €2 per cubic metre and are expected to rise in the future. Using RWH for some or all water use on-farm could reduce this expenditure, although savings would have to be offset against capital and operational outlay of the RWH equipment.
- Rain water is also considered better than mains water for some crop protection products.
- RWH can reduce dependence on supply from rivers and groundwater sources – now under increasing demand from a growing population.
- RWH can also reduce the risk of localised flooding where water from large roof areas is not managed correctly.

*(Source: Environment Agency, 2009)*

## Soil Health

### Humus Levels Increasing

There are several complex interactions that occur between the biological, chemical and physical properties of soil, and good soil management practices should aim to optimise these natural processes to increase production in the most sustainable way. Soil organic matter, soil structure and the maintenance of a flourishing soil microbial population are some of the key elements to maintaining good fertile soils.

EN A 1% increase in soil humus can sequester an extra 88 tonnes/hectare of $CO_2$.

Good soil structure is largely down to skilled soil management and cultivation techniques; incorporating crop residues and waste helps improve the organic matter within the soil which in turn increases humus levels. Humus is the main by-product of the microbial breakdown of organic matter in the soil and is important in maintaining soil structure. It also increases the soil's water-holding capacity and stores nitrogen, phosphorus and sulphur in their organic forms. A well-structured soil allows roots to grow easily and use a larger area in search of nutrients and water, which in turn provides the ideal growing medium for crops.

When the farm was purchased 20 years ago, the soil humus levels where lower than anticipated. Following the implementation of several soil management practices, levels have now risen to 3%. The process has increased not only crop production and yields, but also the soil's carbon sequestration potential – an important factor in reducing the GHG emissions from food production.

EN Gut Piesdorf has increased humus levels to 3%.

Because wheat requires large quantities of nitrogen, an extensive root system is essential in allowing unrestricted uptake. Plants with roots restricted by compaction may show signs of nitrogen deficiency even when adequate nitrogen is present in the soil. This is why Gut Piesdorf manage their soils carefully, avoiding any field operations when the soils are wet and using equipment and machinery with low ground pressure. For the 2011 harvest, a new tracked combine was purchased to further limit the impact of large machinery on soil structure.

**Fact: Humus**

Humus is one of the most important components of organic matter. It stores from 20 to 30 times its weight in water. This means rain and irrigation water is not lost through leaching and evaporation, but rather is stored in the soil for later use by the plants.

*(Handrek 1990, Stevenson 1998, Handrek & Black 2002).*

### Applying Animal Manures to Land

Animal manure is an economical and sustainable source for crop nutrients. It also helps to build and maintain soil organic matter, which increases humus levels (see: 'Humus Levels Increasing' above). Gut Piesdorf has significantly increased the level of organic manures being applied across the farmland in an effort to reduce the farm's reliance on artificial fertilisers.

EC Using organic manure can reduce fertiliser costs by up to €60/hectare.

This policy has meant that maintenance levels of phosphate and potash are supplied via organic manures, which can potentially reduce fertiliser costs by up to €60/hectare. To ensure nutrient levels are in line with crop requirements, soil testing was started ten years ago. This identifies soils that require additional phosphate and potash (pH and magnesium levels are also tested), and this is supplied by mineral fertiliser which is applied accurately by the GPS-controlled fertiliser spreader.

**Fact: Organic Carbon**

According to Dr Christine Jones (2006), one of Australia's leading experts on carbon sequestration: "For every 1 t/ha increase in soil, organic carbon (OC) represents 3.67 tonnes of $CO_2$ sequestered from the atmosphere and removed from the greenhouse gas equation. For example, a 1% increase in organic carbon in the top 20 cm (8 inches) of soil represents a 24 t/ha increase in soil OC which equates to 88 t/ha of $CO_2$ sequestered."

EN

Use of organic manure reduces the farm's carbon footprint, as artificial nitrogen fertilisers in particular are highly energy intensive to manufacture.

One of the main problems with applying organic manures is the variability in their application and nutrient content – this increases the difficulty of estimating nitrogen requirements. Organic manures gradually release nitrogen making it difficult to calculate when and how much to apply for the growing crop. This is where the use of the N-Sensor (see: Crop Initiatives) is crucial, as it enables nitrogen applications to be balanced across the crop according to nitrogen availability and demand.

## Crop Rotations

Gut Piesdorf has reintroduced crop rotation as part of its farming practice. The practice of crop rotation was established back in the 17th century by Jethro Tull with the Norfolk four-course rotation. The system had become fairly common on farms by 1800, remaining almost standard practice on most British farms for the best part of the following century. During the first three quarters of the 19th century, it was adopted across much of continental Europe.

EN

Crop rotation reduces pests and improves soil fertility.

However, the practice became simplified or eliminated in the 1960s and 1970s in most industrialised countries, partly due to specialisation and production intensification.

It is evident now that crop rotation has a number of benefits such as improving soil fertility, and weed, disease and pest control. Changing crops annually reduces the chance of particular soil deficiencies developing, as the balance of nutrients removed from the soil tends to even out over time. Crops with dense foliage suppress weed growth and weed seed problems in following crops. Soil pests and diseases tend to attack specific plant families over and over again. By rotating crops between sites, the pests tend to decline in the period when their host plants are absent, so helping reduce the build-up of damaging populations of spores, eggs and pests.

Gut Piesdorf has recognised this as an opportunity to maximise crop growth on the farm whilst reducing the inputs required.

## Community

### Litter Picking

Workers at Gut Piesdorf frequently litter pick around the farm. This visually improves the area for all local people and visitors, generally builds morale and is beneficial to the environment.

### Future

Next year the farm is considering introducing Skylark plots in the wheat fields. Skylarks do not feed effectively in winter-sown crops, which grow too tall and dense. Skylark plots in winter cereals create and maintain important feeding areas during the breeding season, helping the birds to find vital insect food for their chicks.

# Appendix

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 16 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 ✓