McDonald's Europe Flagship Farms

Wheat – Rannu Seeme, Estonia

Introduction

The focus of this case study is to show how a small family farming enterprise has managed to expand and grow into a large, viable arable operation. The farm has increased wheat yields whilst maintaining the quality required for the premium milling market.

The key initiatives undertaken by Rannu Seeme can be summarised as follows:

- The farm was accredited under the requirements of the GLOBALG.A.P. quality assurance scheme in June 2012. GLOBALG.A.P. ensures certified standards of practice in areas such as food safety/quality, environmental management, record keeping and worker welfare, which are all independently audited.
- A Global Positioning System (GPS) is fitted to the crop sprayer and fertiliser spreader, enabling accurate application of inputs, and minimising off–target applications. GPS is also fitted to the combine, which measures crop output across individual fields during harvest which allows yield data to be used to improve future fertiliser application decisions.
- Average annual wheat yields produced on the farm are 7 tonnes per hectare (with 8 tonnes per hectare achieved in 2012). This is 50% higher than the average Estonian wheat yield of 4.63 tonnes/hectare.
- Producing high quality wheat for the expanding premium milling wheat market has provided access to a secure and valuable market for the business.
- The farm undertakes field trials in partnership with two institutes. The results of these trials are shared on–line, at farmer meetings and at training days held on the unit. The farm's commitment and enthusiasm to share its initiatives and good practices provides a valuable source of information and knowledge for other farmers.
- The farm is a member of a large co–operative (representing a total of 80,000 hectares of farmland). The co–operative provides group purchasing of plant protection products (PPPs), fertilisers and fuel, and markets all crops produced on the farm. This has increased trading strength and reduced prices paid for inputs.
- The farm operates an apprenticeship programme, providing a work placement for young people wanting to pursue a career in agriculture.

> "The changes which have occurred in the Estonian agricultural sector over the last few years have allowed the farm to prosper and expand to its current size. Although there are obvious benefits of economies of scale for such a large arable farm, the notable aspect is the aim to increase yields and quality whilst controlling and limiting inputs. This focused approach has allowed the farm to grow the high quality wheat required by the milling industry, whilst consistently achieving yields which are 50% above the national average. Madis is eager to learn and improve crop production on his farm, working with different industry stakeholders to identify good practice, which he is then enthusiastic to share with other farmers."

Karl Williams, Flagship Farms Programme Manager, FAI

Summary of actions and benefits

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

	Action	Benefits
Certification / assurance	**GLOBALG.A.P Assured**	EN Ensures that environmental standards and legislation are met by the farm EC Offers a recognised brand which allows the farm to market their wheat to purchasers and consumers ET Ensures high standards of food quality, food safety and worker welfare
Crop initiatives	**Using GPS technology for application of crop inputs**	EN PPP and fertilisers are accurately applied, reducing environmental impacts EC Reduces the quantity needed and ensures fertiliser applications are matched to the soil reserves EC Harvest and yield data collected from the combine help improve decision making for the next crop
	Monitoring for pests and diseases	EN Applying PPPs therapeutically (e.g. only when there is a proven need) may reduce their use and limit any impacts EC PPPs are only applied when recognised threshold levels are exceeded, ensuring an effective response and economic benefit
	Targeted nitrogen applications	EC Using the N–Sensor ensures that nitrogen applications meet crop demand, helping achieve optimum crop response to N input EN Applications are matched to N availability in the soil and crop demand which limits losses to the environment
Product Quality	**High quality milling wheat grown**	EC Achieves the quality parameters required for the premium milling market resulting in additional bonus payments ET Meeting customer specifications for product quality ensures access to a secure market
	Practices achieving good yields	EC Average winter wheat yield is 50% higher than Estonian average which results in considerable economic gains EN Productivity is increased by 50% from available land resources
	Industry collaboration	ET Provides a valuable source of information and knowledge transfer to other farmers
	Member of a co–operative	EC Increases purchasing power which helps reduce input costs. Crops are also marketed through the group helping achieve the best possible prices
Soil Health	**Nutrient mapping of soils**	EN Allows variable fertiliser applications which match soil requirements and limits over–application EC Provides an accurate representation of the nutrient status of the soil allowing fertilisers to be applied according to soil indexes and crop requirements
	Incorporating crop residues (straw)	EN Uses available soil nitrogen to breakdown the incorporated crop residues which could be lost over the winter through leaching EC Increases levels of soil organic matter and returns around 35–40 kg/hectare K2O (Potash) back to the soil
Staff	**Good training and working conditions**	ET Has resulted in excellent working relationships and staff commitment
	Apprenticeship	ET The farm has been providing work experience and training to apprentices since 2008
Ecosystem protection	**Providing wildlife feeding areas**	EN Foraging habitats for wildlife are planted annually in a woodland area EC Reduces crop damage by wildlife which are searching and foraging for food

“At Rannu Seeme there are three generations of agronomists and 75 years of experience growing cereals, expanding from five hectares of land in the 1980’s to 2700 hectares in 2013. Close cooperation with Estonian research institutions, the Agricultural University and the Plant Breeding Institute have help us implement the most current and innovative methods of growing cereals. We have established research fields to test the potential and persistence of various cereal species, along with practices designed to restrict the spread of plant disease and pests and the optimisation of fertilisers. We share this information in our farm open days with more than 1000 farmers from the Baltic region and further afield, with some of the more time critical information shared through the internet. One of the main goals of Rannu Seeme is to be as environmental–friendly as possible, while achieving yields of the highest possible quality. Timing of the application of inputs is one of the solutions that have enabled us to achieve our goals.

The Rannu Seeme owners have been awarded “Farmer of the Year” in Estonia and we are also honored to be one of the members of the strong family of McDonald’s Flagship Farms.”

Madis Ajaots

Madis Ajaots

Background

Madis Ajaots (partner and director of Rannu Seeme) is a third generation farmer who started his agricultural career with five hectares in 1989. In 1993, OÜ Rannu Seeme was founded and at the time was growing seven hectares of wheat. In 2012 the total current area under cultivation is 2,255 hectares, of which 705 hectares is used to grow wheat (624 ha winter wheat and 81 ha spring wheat). In addition, the farm grows winter and spring oilseed rape, barley, oats, rye, field beans and hay. The company specialises in producing premium quality crops for supply into the human food chain and seed markets. The focus is on growing varieties of seed that have been specifically developed for the Estonian agricultural sector.

The company is also registered with the Plant Production Inspectorate as a seed centre and has a license for producing, packaging and marketing cereal, oilseed and grass seed.

Facts: Estonian agriculture

The farmed agricultural area of Estonia in 2010 was 941,000 hectares, with 60% (566,600 ha) of this land dedicated to arable crop production. Over half of this area (297,000 hectares) in 2011 was being cultivated for cereal production. The area of spring and winter wheat in particular has been increasing annually. In 2012 the average yield per hectare for winter wheat and spring wheat was 4.66 tonnes/ha and 3.10 tonnes/ha respectively. In 2010, 45% (148,200 t) of wheat, 50% (126,400 t) of barley and 49% (12,200 t) of rye produced in Estonia were sold for export.

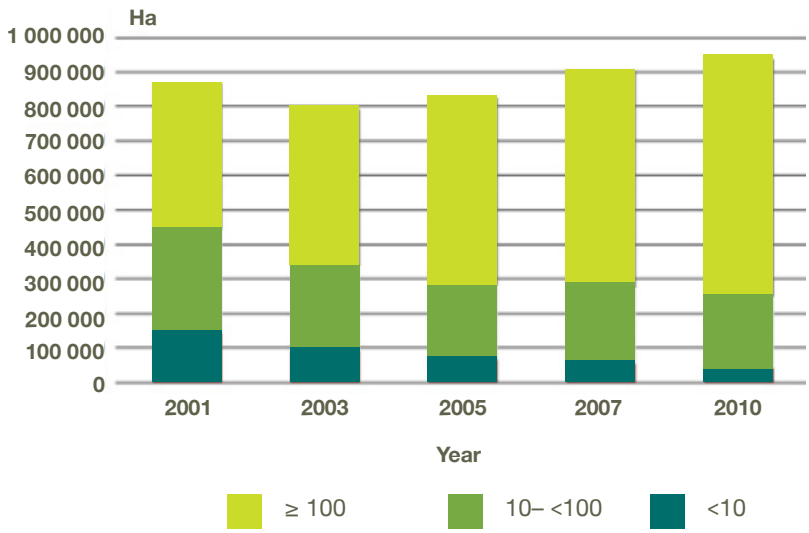
Source: Statistics Estonia

Facts: Estonian farming structure

Traditionally, agriculture has played an important role in the Estonian economy. Changes in land–rights and agricultural reforms have resulted in considerable restructuring of the agricultural sector over the past century. Estonian agriculture consists of many small–holder family farms and a small number of very large enterprises Agriculture currently employs around 4% of the population, two–thirds of which are family labour, although increasing technological developments has negatively impacted the size of the labour force. The number of large–scale producers has also increased and these now produce three–quarters of the total agricultural output (see Figure 1).

Source: Statistics Estonia

Figure 1. Agricultural area by size of holding (Statistics Estonia)



Certification / assurance

GLOBALG.A.P assured

Rannu Seeme Farm was accredited under the GLOBALG.A.P. farm assurance scheme in June 2012 for Combinable Crop production. The GLOBALG.A.P. assurance scheme is intended to support consumer confidence in food quality and safety, by certifying that approved farms are maintaining good agricultural practices.

EN ET

GLOBALG.A.P ensures ethical and environmentally sound farming practices

The benefit to the farm is that it provides independent verification of their farming practices and systems, which improves the marketability of their crops. The value to the customer and consumer is that it ensures Rannu Seeme complies with all relevant legal regulations and applies good agricultural practices on the farm.

Crop Initiatives

GPS technology

Rannu Seeme has invested in a Global Positioning System (GPS) to assist in the operation of the crop sprayer and fertiliser spreader, and to provide positioning data at harvest to identify yields / outputs of specific areas / fields.

EC

Studies have revealed a significant reduction in off–target applications after fitting a GPS system to a sprayer

GPS technology allows for improved accuracy during the application of Plant Protection Products (PPP), by automatically controlling the on/off function on the sprayer's boom sections to avoid off target applications and reduce application overlaps. Reducing overlaps and double applications helps to limit crop stress (abiotic stress) which can reduce plant growth and productivity. The GPS system helps reduce total PPP use and their associated costs.

> "Average nitrogen reduction per year is estimated to be about 7–8% using crop canopy sensors."
>
> *(Madis Ajaots, Rannu Seeme)*

The GPS technology also allows application rates of phosphorus, potash, and lime to be varied across individual fields based on site–specific data provided by soil analysis and field mapping. The variable application rates are then matched to soil requirements and crop demands.

> "University trials investigating the use of precision farming have shown clearly the positive effect using precision agricultural technology"
>
> *(Madis Ajaots, Rannu Seeme)*

Rannu Seeme also uses the GPS technology on the combine harvester to accurately measure the crop yields. Yield maps of each field are then produced and can be used to improve fertiliser management decisions for the following crop.

Monitoring for pests and disease

EC

Ag Leader OptRx can save €20–37 per hectare (€8–15 per acre)

During the spring / summer period, yellow insect traps are placed in the fields to help monitor pest occurrence with weekly inspections undertaken. Once established pest threshold levels have been exceeded an approved control programme can be implemented, before excessive levels are reached which can cause crop damage and economic losses. The type of pest can also be used to help determine the specific type of strategy and PPP requirements.

Disease type and incidence are also monitored during the weekly inspections, with a specific PPP strategy being implemented to deal with identified disease outbreaks in an effective and timely manner. This ensures that PPP's are only used when there is a specific and identified need; which provides the most economic response to their application.

> "N–sensing technology improves crop yields by 8% and reduces fertiliser use; both improve fuel efficiency"
>
> *(Intelligent Energy Europe, 2012)*

All data from the weekly monitoring / inspections are promptly published on–line to allow other farmers access to the data. As the farm is situated in Southern Estonia the weather provides favourable conditions meaning that crops are around 5–7 days more advanced than the rest of the country; this means that the data gathered by the farm provides information to help other farmers adjust their future management decisions and PPP regimes.

Targeted nitrogen applications

The farm also leases an Ag Leader OptRx crop sensor from a local plant breeding centre. The sensor is mounted on the tractor and measures light waves reflected from the crop's leaves which is used to help evaluate crop health and vigour. The light absorbance is correlated against a scale which determines plant nitrogen levels; this then allows instantaneous changes in fertiliser applications to match crop needs. The resulting crop is more uniform, and can help improve efficiency at harvest. Figures from Ag Leader OptRx suggest a saving of €20–37 per hectare (€8–15 per acre) can be achieved.

Over–application of nitrogen fertiliser can promote mineralisation and loss of soil carbon, resulting in declining microbial soil populations and impaired soil health. Estimates suggest that 15% of the land in the EU–27 Member States in 2005 had excesses of nitrogen exceeding 40kg/hectare (EEA, 2012). Previously, the farm applied nitrogen to the soil without restrictions. In 2004, the farm joined with Environmentally Friendly Management Support (R.D.P 2.3.1), the requirements of which include strict limitation on nitrogen use. This action has helped to protect the soil health on the farm and ensure future productivity of the land.

European Environment Agency (EEA; 2012) The State of Soil in Europe: A contribution of the JRC to the European Environment Agency's Environment State and Outlook Report–SOER 2010.

Product Quality

High quality and high yielding wheat

Wheat quality is dependent on a range of features such as specific weight, protein quality and content (see following Table). The farm's aim is to grow wheats that meet the specification parameters for milling wheat. Furthermore, the farm is also consistently achieving yields of 7 tonnes per hectare, 50% higher than the average Estonian winter wheat yield.

The farm supplies wheat to the Tartu Mill, which is one of the largest grain processors in the Baltic region. They process up to 100,000 tonnes of grain annually and export finished products to the global market. Close cooperation with Tartu Mill has allowed the farm to optimise grain quality for the milling and baking processes. Rannu Seeme is currently growing three high quality varieties of winter wheat and one variety of spring wheat for the premium milling sector. New varieties are being tested on the farm in collaboration with Tartu Mill. These tests are considering suitability for bread making and potential increases in yield and pest/disease resistance. By creating close relationships with the customer and meeting product specifications, Rannu Seeme has created stable access to and future economic security in a profitable global market. In particular, by increasing the amount of winter wheat grown instead of spring wheat, the farm has increased overall average yields from 3.5 tonnes per hectare to 5.5 tonnes per hectare, a 57% increase in average overall yield. In 2012, 8 tonnes per hectare of winter wheat was produced; this is 72% over the national average yield of 4.66 tonnes per hectare.

Grain feature	Specification
Yield	High yield desirable (The Global average in 2007 was 2.8 t/ha[1])
Specific weight	Bulk density of the grain (kg/hl) measured in a chondrometer. Commercial minimum in Europe is 76kg/hl.
Protein Quality/Gluten Content	Gluten content >13% is desirable for bread–making flour. Gluten retains the gas produced in fermentation and supports starch and bran for bread to rise.
Hagberg Falling Number (HFN)	Gives an estimate of amylase activity. Measured as time (sec) taken for a plunger to pass through a heated mixture of grain and water. Threshold is 250 sec. Low HFN indicates high enzyme activity, degradation of the grain and onset of sprouting.
Moisture content	If >15% quality reduces in stored grain as the risk of mould growth increases.
Grain Hardness	Affects grain processing, fermentability, water absorption and baking. Measured by crushing single grains in a Single Kernel Characterisation System (SKCS).

Food and Agriculture Organisation, 2009: http://www.fao.org

Industry collaboration

The farm makes a great effort to collaborate with industry experts and the farming community in order to promote the use of good practice and increase profitability in the cereal farming sector. Field trials are being carried out in collaboration with The Estonian University of Life Sciences and The Estonian Research Institute of Agriculture. These studies aim to develop practical guidelines for precision farming technology and optimise fertiliser applications of different soil types using digital techniques. Results from these studies are shared through online databases, farmer meetings and on–farm training days held at Rannu Seeme. The farm's commitment to this program enables valuable transfer of information throughout the farming sector, strengthening community relations, advancing the use of sustainable agricultural practice and benefiting the local farming economy.

ET

Study results are shared with fellow farmers

Co–operative membership

The farm is a member of a large cooperative group, the Kevili Agricultural Association, which includes 140 cereal farmers, growing on 80,000 hectares of farmland throughout Estonia. The cooperative is controlled by the farmers and provides numerous economic and operational benefits to its members. Group purchasing allows individual farmers to obtain inputs for lower prices, including PPPs, fertilisers, seeds and fuel. Joint activities in crop marketing and sales provide a competitive advantage, generating the best possible prices for individuals. Long–term contracts and direct access to domestic and foreign markets help to protect members against market fluctuations. Kevili currently sells 50% of all oil seed (rape) produced in Estonia.

The cooperation also provides specialist training, consultation, technical support and marketing for its members and provides a platform for farmers of different sizes and specialisations to connect. The size and diversity represented by the cooperative has enabled members to actively participate in rural and agricultural policy decisions in Estonia.

EC

ET

Cooperative membership allows individual farmers to obtain inputs for lower prices

Soil Health

Nutrient mapping of soils

Rannu Seeme farm's wheat yields surpass the national annual average and meet the requirements of the premium milling market. In order to achieve this level of productivity the farm undertakes a number of practices to maintain and improve soil health and fertility.

Soil nutrient testing is routinely undertaken every four years across the farm's soils. Soil samples are collected from allocated points across the field and sent to an independent laboratory for analysis. Samples are tested for levels of Phosphate (P), Potash, (K), Magnesium (Mg) and pH. The results are then correlated by software to provide a detailed field map which indicates the nutrient indexes and soil pH variations. The field maps are then integrated with the GPS technology which allows precise management of nutrient applications and optimum use of existing soil fertility. This leads to even crop growth across the field improving yield and profitability. Industry specialists providing the technology currently expect savings on fertiliser costs of up to 30% (PhieldTek, UK).

EN

Reducing fertiliser inputs has vast benefits for the environment

Crop residue incorporation

Typically soil is composed of 45% mineral content, 25% air, 25% water and 5% organic matter. Soil Organic Matter (SOM) is essential for soil health and fertility, benefitting the soil's biological, chemical and physical properties. Studies have estimated that at levels below 3.4% SOM, soil health is dramatically impaired (Kemper and Koch, 1966; Greenland et al., 1975; Huber et al., 2008). Around 45% of the mineral soils in Europe are classified as having low or very low (0–3.4%) soil organic matter, and 45% have medium content (3.4–0.2%) (Rusco et al., 2001). Intensive farming practices have played a key role in the loss of soil organic matter, often repeatedly removing nutrients from the soil without effective replacement.

Facts: Beneficial effects of organic matter on soil quality

- Supports microbial growth and biodiversity through provision of carbon and energy sources; this in turn increases nutrient levels in soil through decomposition (leading to a reduction in fertiliser requirement)
- Promotes soil cohesion and reduces erosion risk
- Preserves soil nutrients and water content
- Reduces compacting of soil particles

FAO/IAEA, 1996–2001)*

In cereal production, removal of the whole crop (grain and residual straw) constitutes a potential loss of a valuable source of SOM thus representing a potential decline in soil health. One study found that exporting 30–50% of cereal crop residues lead to reductions in organic carbon matter of 7% and 21%, respectively. Removing all the residual straw from the land caused a 38% decrease in SOM (Gobin et al., 2011).

At Rannu Seeme farm, following harvesting, the remaining straw is chopped and ploughed into the soil to a depth of 20–25 centimetres. The reincorporation of organic matter into the soil translates into improved productivity and crop yields and a reduction in fertiliser requirements for following crops. This also aids in the prevention of environmental damage caused by chemical leaching. An added benefit of this method is that it returns 35–40kg Potash (K2O) per hectare to the soil which is supplied by the cereal straw.

Facts: benefits of improving soil composition

By improving soil composition, the land is easier to manage and better able to adapt to changes in rainfall and drought conditions. One study achieved local wheat yield gains of 4 tonnes per hectare (in areas where water–logging was common) and a 10% reduction in cultivation time. Additionally, increased ease of tractor and machinery operations generated fuel savings of 20–30% across the farm (KeySoil, UK).

Staff

Good working conditions

Good management and crop productivity are achieved on the farm through engaging a highly trained, efficient workforce. Rannu Seeme employs 11 full–time staff, a further 14 part–time staff are employed during the summer harvest. Working conditions and employment relations are highly valued and farm staff are enthusiastic and committed to the success of the enterprise. Training is provided to all employees and provides them with the skills and knowledge to undertake their roles in a safe and efficient manner.

Apprenticeships

Since 2008, the farm has been running an apprenticeship programme offering work placements to young people starting a career in agriculture. By providing this valuable opportunity the farm is helping new / young entrants gain the necessary experience and knowledge to pursue a career in agriculture. This is also an important way of encouraging the next generation of farmers into the agricultural sector.

Ecosystem protection

Providing wildlife feeding areas

In 2008, 22.5% of Estonia's agricultural land was classified as 'High Nature Value' (farmland that supports local wildlife) (Paracchini, et al., 2008*). Ecological practices that encourage biodiversity and habitat conservation are essential for the future sustainability of agriculture. Fields over 20 hectares at Rannu Seeme are bordered by a three metre wildlife strip and the farm has set aside 4 hectares of farmland for use as a feeding area for the local wildlife. The farm plants the feeding area with rape or cereals to provide food and cover crops for birds and larger mammals, including elk and wild boar. The farm also places grain and seed in the vicinity to provide additional feed for the wildlife.

Providing a suitable habitat and adequate food is vital for farmland bird populations. A recent survey reported a decline in the number of farmland birds in Estonia between 2007–2010, including the Common Redshank (Tringa tetanus) and the Yellow Wagtail (Motacilla flava) (Kuresoo, et al. 2011**). Feeding stations also provide a secure food source for animals during winter months when feed is in short supply. Providing ample food stores additionally helps to protect crops against damage caused by animals foraging.

**Paracchini, M. L., Petersen, J.E., Hoogeveen, Y., Bamps, C., Burfield, I. & van Swaay, C. (2008) High Nature Value Farmland in Europe: An estimate of the distribution patterns on the basis of land cover and biodiversity data. European Commission Joint Research Centre Institute for Environment and Sustainability.*

***Kuresoo, A., Pehlak, H. & Nellis, R. Population trends of common birds in Estonia in 1983–2010. Estonian Journal of Ecology, 2011, 60, 2, 88–110*

Appendix – Good Practice Matrix for Rannu Seeme

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