United Kingdom Study Tour: AIM Seed & Tuber Quality Working Group

Nov 17-24th, 2023 submitted by Ryan Barrett, Research and Agronomy Specialist

On Nov 16th, eight members of the AIM Seed and Tuber Quality Working Group departed for the United Kingdom on a study tour focused on the production, storage, grading and distribution of high quality seed potatoes. Scotland has had a well-earned reputation for many years for its seed production, particularly in how the industry is structured and regulated. Our group members wanted to learn about this industry first-hand while also better understanding the greater British potato industry by attending the British Potato Show in Harrogate, Yorkshire.

Cygnet PB

After arriving in Edinburgh early on the morning of Nov 17th, the group's first stop was to Cygnet PB, the largest independent potato breeding company in the UK. Owned by Doug Hartley, Cygnet has seed from its varieties grown in 40 countries, including Canada. Its distribution and marketing arm, Cygnet PEP, handles one-quarter of Scottish potato seed exports. Cygnet used to be a public breeding enterprise, developing the "Maris" range of varieties (including Maris Piper and Maris Peer), before it was purchased by Mr. Hartley. Cygnet has since purchased two other breeding programs, including the Irish breeding program in 2016. It maintains a breeding site in Cambridge as well as 460 acres of seed production at the site we visited in Blairfield, near Kinross.

Among the recent varieties that have excelled for Cygnet:

- Kingsman, a long-type dual-purpose variety that has performed well in trials at Cavendish Farms in previous years. It does have a light yellow flesh. This variety has seen increasing acreage in the UK in the last few years. Seed on this variety was grown at Fox Island in 2023. Seen to be drought resistant and requiring lower nitrogen rates.
- Elland, a long-type dual-purpose variety that also has a light yellow flesh. This variety carried dual resistance for Pale Cyst Nematode (PCN), leading to rapid increase in acreage in Scotland and England recently. Has been contracted by McCain for fries. Seed on this variety was also grown at Fox Island in 2023.
- Manhattan, a round table variety with cream flesh
- Saxon, a long, white table variety
- Skywalker, a white table variety
- Bambino, a white creamer variety

Elland has been getting particular attention as it is resistant to *Globodera pallida*, enabling growers to grow this variety while also decreasing the PCN levels in affected fields.

Most of the seed in their pipeline is grown on an eight year rotation, largely on rented land. Spraying and harvesting is largely contracted, as is land preparation.

At this visit, we were able to discuss the different varieties that Cygnet markets but also how they produce seed themselves. They had already begun to grade and size seed for export to North Africa.



Tour group at Cygnet PB, with owner Doug Hartley (far left).



Viewing the tissue culture room at Gentech Propagation Ltd. in Dundee

Gentech Propagation Ltd.

Our second stop on Nov 17th was to Gentech Propagation Ltd. in Dundee. This business is also owned by Doug Hartley but is operated separately from Cygnet. This facility was the first in the world to provide minitubers in glasshouses at a large scale. Dundee was chosen as the site for the facility due to the large amount of sunlight hours Dundee receives each year during the growing season.

Approximately one million minitubers are produced from this facility each year, with an average cost of approximately 60 pence GBP (~\$1.00 CAD) per minituber. Planting begins in February and continues until June. Harvest begins in July and continues until November. Each variety is grown for approximately 22 weeks from planting to harvest.

All plantlet propagation and cutting is done on-site with material sources from and overseen by SASA, the Scottish Agricultural Science Agency, which is responsible for overseeing all aspects of the seed potato industry in Scotland. SASA does regular inspections of the facility, and all plant material has to come from them. Gentech maintains a collection of clean plant material on the varieties it regularly plants (60+ varieties), and 30 plantlets are planted in each box in a mixture of 80% peat. Each plantlet produces between 1 and 3 minitubers, depending on the variety. Light is largely natural for most of the year, though supplemental light is used in the glasshouses early in the season. Plantlet collections are maintained on racks with a combination of red/blue light and white LED light sources. Water and nutrients are supplied through an above ground sprinkler system in each glasshouse.

Gentech is one of four minituber facilities in Scotland licensed by SASA, producing around \$1 million CAD worth of minitubers each year. These are done on contract for many companies, not just Cygnet.

Hume Farms

The next morning (Nov 18th), we began our day at the farm of the Hume Family in the Angus region north of Dundee. This visit, as well as a second farm visit in the afternoon, was organized by McCain GB. The Humes grow seed for McCain as well as for other buyers, and also grow some ware potatoes on land where PCN levels have made seed production impossible. Father Lindsay along with sons Jamie and Ross grow 240 acres of potatoes, primarily seed. Jamie's wife Holly works with McCain and is also Canadian, with her mother coming from Ontario. They visited PEI in 2022.

They also grow barley, oats, and canola. They primarily grow on a seven year rotation, but up to a 10 or 11 year rotation on some fields. They are trying to grow more PCN resistant varieties in recent years. Oil and aphicides are used to help control virus, though they don't love using oil as they feel it can suppress yield. PVY is an increasing issue in Scotland and wireworm is also a growing issue, with no chemical control options available.

Among the varieties grown on this farm: Innovator, Cara, Ramses, Eurostar, Maris Piper, Elland, and King Russet. King Russet is a new variety controlled by McCain that also has dual PCN resistance and is liked by producers. Though the majority of seed from the Humes stays in the UK, they do export seed to Egypt and Saudi Arabia. They were grading for export the week of our visit, with 5 to 7 people engaged in grading. They installed a mostly new Tong grading system in 2023, capable of grading and sizing both their seed and ware potatoes. The Humes only finished digging a few days before our visit, due to the very wet conditions this year in Scotland.



Grading facility at Hume Farms in Angus



Inspecting a new destoner at Scanstone in Forfar

Scanstone

Our second stop of the morning was to Scanstone in Forfar, a family-owned equipment manufacturer. It was established by Gordon Skea in 2005 after taking over the old Reekie business, which was well known for stone separators. Potato production would be largely not possible in Scotland and northern England without use of stone separators, which remove or bury stone during the land preparation ahead of potato planting. Along with destoners, Scanstone also builds bed tillers, bed formers, hillers, toppers and windrowers. Gordon was our tour guide along with his daughter Alison Patterson, who handles export sales for the company. Gordon's son lives in England in Norfolk and does sales for the company there. William is also the partner of Sophie Bambridge of B&C Farming, a leading seed producer in England who we visited on our 2019 trip.

Scanstone sells equipment all over the UK and to 20 countries, with significant sales in Northern Europe. They have made significant changes to their production in recent years, bringing most of their part manufacturing in-house due to significant delays in getting parts during the pandemic. With high energy costs after the Ukraine war started last year, they've also invested in solar panels to reduce their energy purchases. They make 50 destoners and 200 total machines per year. They don't build to forecast instead of building to order. They have one hiller at a farm in Alberta. They recently installed new laser cutters and large metal bending equipment. They have a total staff of 30-40 people, with a core work crew of Polish workers.



Visiting with Willy Officer, Ardoch



Officer Farm

Following lunch at Scanstone, we headed east to the Officer family farm, where we met William Officer, the fourth generation farming on this farm in Ardoch. They grow 330 acres of potatoes, mostly seed. They also grow daffodils and some grains on a mixture of owned and rented land. They grow a significant amount of their acreage for McCain and also have a haulage contract for McCain, running a fleet of transfer trucks. 210 acres of their production is seed, with 100 acres grown for McCain. Among the varieties grown for McCain were Royal, Maris Piper, Innovator, King Russet, and Shepody. Fields are largely within a 12 mile radius of the farm, and they just finished digging due to the poor weather. They own 30% of their farmed ground, with the remaining 70% on one-year rental agreements. Most fields are in a seven or eight year crop rotation, largely with grains and canola. They recently invested in new storages for seed potatoes, as they hold on to graded seed for McCain for several months before they can be delivered to buyers in England. They appeared to work closely with

McCain and had a very positive and respectful business relationship.

At both farms we visited this day, and at virtually all UK seed farms, seed potatoes are harvested into boxes (1 tonne or 1.4 tonne boxes) and then moved to an ambient temperature shed for cool down and skin set. After harvest, grading starts and continues throughout the fall and winter. Seed is graded and sized, and seed is sold by size (28-35 mm, 35-45 mm, 45-55 mm, 55-60 mm). There are only a couple of farms in England that cut seed, and only for North American varieties such as Shepody or Russet Burbank. Seed storages have modern ventilation systems that largely pull air through the boxes, keeping temperatures at 3-4 C.

Our thanks to Kate MacLaughlan and staff with McCain GB for helping us to arrange these farm visits. McCain operates four French fry factories in the UK, has 200 processing growers and 60 seed growers. The majority of their seed is grown in Scotland. They have 700,000 tonnes of contracts with growers for processing, and 32,000 tonnes in seed contracts. High grade seed is all grown in the extreme north of Scotland (Black Isle, Aberdeen), and then bulk up generations grown in southern Scotland. They contract around 13 varieties, with 4-5 newer varieties on the ascendency recently. Royal is their largest contracted variety but can't be used for McDonalds. For McDonalds, they rely mostly on Innovator, Shepody, Pentland Dell, and Russet Burbank. King Russet has also been newly approved for McDonalds.

After finishing at the Officer farm, we headed to the nearby Fettercairn Distillery to tour the second oldest whiskey distillery in Scotland (started in 1824). They use more than 6,000 tonnes of barley per year for their malt, producing more than 2.2 million L of whiskey per year. All whiskey is aged at least 12 years in barrels, with the oldest whiskies aged for 50 years (and worth £22,000 per bottle).

James Hutton Institute

Following a touristy day spent in Edinburgh on Sunday, we started our Monday (Nov 20th) at the James Hutton Institute in Dundee. We were met by Ian Toth, blackleg researcher and new head of the National Potato Innovation Centre, as well as Jonathan Snape, overall director of JHI.

The JHI has two facilities (Dundee and Aberdeen) and focuses primarily on projects related to sustainability, food security, and the trade-offs between these two. They have a heavy focus on potatoes, barley, and berries, the largest economic crops for Scotland. They work in the areas of breeding, crop protection, crop management, fertility, and soil health. They employ 550 staff and over 100 Ph.D. students, with about 100 people working full time or part time on potatoes. 60% of JHI funding comes from the Scottish government, while the remaining 40% comes from the UK government, industry funding, or other sources.

James Hutton Institute is a non-profit, but they also operate James Hutton Limited (JHL), a for-profit business for commercialization of varieties, contract research, etc. However, all profits are donated back to JHI. They have 250 acres of farmland as well as glasshouses, labs, and a new vertical farming centre.

One project that we did not see (off-site) but we wish to learn more about is their Centre for Sustainable Farming, where they have being looking at whether regenerative farming practices are actually successful. They have 6 fields engaged in trials for 20 years now looking at these questions. They did note that they see some long-term benefit to regen practices, but it is the hardest to make economically successful in the potato production.



New 6 bay, 4 tonne/each storage research facility at James Hutton Institute

We had a series of shorter sessions with individual researchers or program leads, including:

- Blackleg (Ian Toth)
 - Blackleghub.ac.uk
 - Blackleg does reside in soils naturally and is a big issue in Scotland
 - Pectobacterium will move with over-irrigation
 - Free-living nematodes appear to be a vector for blackleg spread/infection
 - Recently looking at whether different cover crops have an effect (positive or negative) on blackleg
 - o Researching bacteriocins proteins that will kill targeted bacteria
 - o Blackleg infection rates generally higher with irrigation, even when planting 0% BL seed
 - Inverse relationship with common scab. Trying to find balance between BL and scab is tricky
 - Also looking at bacteriophages (viruses that target blackleg bacteria)
 - Varieties with higher levels of salicylic acid (SA) produced have higher resistance to blackleg. Future breeding focus? Can we breed cover crops with higher SA levels?
- Soil Health Kenneth Loades
 - Much of their recent work has been on tillage intensity and depth...can these be reduced without compromising yield
 - Potatoes definitely change nematode communities in soil. Trying to understand the effect of these community changes
 - Doing a lot of work on soil compaction, improving soil elasticity with addition of compost
 - Mapping traffic on fields (controlled traffic farming) to reduce compaction

- Variety Development/Agri-Business Development Jamie Smith
 - Host Vertical farming start-up, which has included mini-tuber production. Very innovative business to design cost-effective systems for vertical farming for high value crops and seed production.
 - JHI tries to find the customer and then breed for the needs of the customer, rather than breed varieties and then find the customer afterwards
 - JHI does own breeding crosses but also does crossing contracts for other breeders
 - Covers all markets
 - Retailers hold all of the power in table potato variety choices. New better varieties come along, but Maris Piper still #1 because it has name brand recognition. One of a few varieties marketed by name.
 - o Recent JHI varieties: Lady Balfour, Sorrento, Gemson, Jester
 - Main markers of interest when planning crosses: dual PCN resistance, tobacco rattle virus, blight resistance, and skin spot resistance
- Breeding Ingo Hein
 - JHI manages the Commonwealth Potato Collection, mostly wild potato cultivars from South America.
 - \circ $\;$ Bringing genes from CPC to commercial varieties for resistance to pests and diseases
 - Using markers to find new resistance genes. Have sequenced full genome for 1300+ varieties
 - Some old disease resistance genes no longer effective. Focused on ID of new markers.
 Rpi-R8 new candidate gene for late blight resistance
 - Developed Carousel, late blight resistance at multiple sites
 - IDed new markers for PCN, late blight, wart, PVY and PLRV
 - They have been working on pathotypes 1 and 3 of potato wart, but their approach could be used to screen for resistance genes on other pathotypes
- Late Blight Dave Cooke
 - There are multiple clonal lineages of LB present in the UK all the time, and recombination of lines happens often
 - There is a new strain found in the EU this past year which is resistant to both Revus as well as Orondis
 - 2023 was the worst LB year in the EU in 30 years. Combined with wet harvest, tuber rot will be a challenge in many places
 - There has been too much reliance in the UK on one or two chemistries that are now showing reduced efficacy. Access to contact fungicides like mancozeb and chlorothalonil has been largely eliminated.

Scottish Agronomy

After lunch at the James Hutton Institute, we headed south to the Kinross area to the offices of Scottish Agronomy, a grower cooperative managed by Eric Anderson. Scottish Agronomy has 240 farmer members, who pay dues for agronomy services. Company has 5 agronomists as well as 15 total staff to perform on-farm trials, contracted trials, and variety evaluation trials across Scotland. They do 5 variety

evaluation trials for cereals and multiple potato variety trials. Funding is primarily farm memberships as well as contracts with companies for contracted research. Scottish Agronomy does not sell products, just advice. They also do training and external consulting, including with a PEI farm.

We had a wide ranging conversation with Eric covering multiple topics, including:

- PVY:
 - \circ $\;$ Goal is to have as little as possible, but no more than 0.5% at field inspection.
 - Post-harvest seed testing for virus is not required, only managed through visual inspection.
 - Carrot aphids are becoming a big vector of PVY. Green peach aphids also a growing issue.
 - They also see resistance to pyrethroids among peach aphids. UK growers have fewer aphicide options with restrictions on number of applications. As well, oil applications are restricted to early in the season in most cases. Mineral oils are not used as often or as widely as in Canada/PEI.
 - Some growers try and reduce virus with the addition of chopped straw between the rows on early generation seed. The colour difference between the plants and the straw makes these areas less attractive to aphids (different wavelength from bareground).
 - \circ $\;$ Other growers are using borders of rapidly establishing crops like oats $\;$
 - Oil application started at 30% establishment. Oil burn more of a factor when mixed with fungicides.
- Seed production/agronomy
 - N rates differ by determinate/indeterminate varieties. On seed crops, 100-120 kg/ha N is common. Higher rates for commercial production (ware).
 - Foliar phosphate applications are increasingly common. 5.5 kg/ha in 200L of water early season.
 - o Green sprouting (chitting) becoming less common
 - \circ $\,$ Drones and rogueing buggies for scouting are not common $\,$
 - Shrink of 3-5% in box storage is common
 - \circ $\,$ Common rotation with potatoes on 8 year rotation:
 - Potato winter wheat winter barley winter oilseed rape (canola) winter wheat spring barley spring barley or oats potato
 - Grass/legume uncommon in potato rotation
 - Some winter beans grown. These are tolerant of low temperatures and used for cattle feed

Greenseed International

After leaving Scottish Agronomy, we headed south for England, stopping for the night near the town of Alnwick in Northumberland. Near Alnwick we visited Greenseed International, the seed producing arm of the Spearhead potato group of companies. Their operation is located on the site of an estate farm in Rock Midstead where they rent facilities. Almost all field operations are contracted to custom operators and all potatoes are grown on rented land, most of which is owned by large estates. One of the largest landlords is the Duke of Northumberland, who owns more than 100,000 acres of land. We met with Jon

Logan, the seed farm manager at Greenseed. David Humphries is the overall manager and agronomist for Greenseed but was not able to be there for our visit.

Greenseed grows about 500 acres of seed, mostly of early generation seed. They use 1.1 T boxes, with 3 refrigerated storages and one ambient temp storage on site. They have a "drying wall" in their grading building which helps to dry down and warm up seed before it passes over the grader. They can grade 18.5 T of seed per hour on their grading line with 4 people (1 on the forklift, 2 in the grading room, 1 looking after everything else). Seed is sized into 5 sizes, with the oversize headed for the table market. 35-45 mm is the sweet spot and is the most valuable size. Will sell as low as 25 mm diameter, especially when seed is tight.



Grading set up at Greenseed



Group at Greenseed with Jon Logan, Farm Manager

After harvest (which is done directly into boxes using mostly self-propelled harvesters), seed will dry down with high air for 4-6 weeks before bringing temps down to 4 C. Some varieties stored lower if at risk of sprouting. Most stuff will be graded by end of December, currently grading 500 T of seed per week. Delivery happens between February and May (when farms can accept it), but like to move seed as soon as they can. 10% total shrink (including dirt) is acceptable by end of storage season.

Additional notes:

- Only seed treatment applied during grading is Gavel
- Grow as many as 42 varieties, multiple generations
- Key mantra on this farm is "attention to detail", needed with so many varieties
- Employ and "overthrow" tarp that goes over the top and end of rows of boxes to close off route for air escape. Then pull air through the pile and exhaust from building to keep temperature and moisture levels low. Sort of reverse of inflated bag and blowing air into storage which is common with new Dutch systems, but with similar end result.
- Temperature probes used throughout the storage
- PCN not generally an issue on this farm
- Company has a minituber facility in Edinburgh
- Seed grown on 7-8 year rotation
- Work with large agronomy company for in-season crop management, which includes all spraying
- Don't generally irrigate seed, except for one sprinkler system close to main farm.
- Yield target is 40 T/ha (360 cwt/ac) on most varieties
- Grimme 3 row planters for seed, 6 row planter for creamer/table. 36 inch rows
- Employ straw bedding for aphid control after emergence on high-gen seed.
- Active in aphid monitoring
- Plant headlands with peas for aphid distraction.
- All plants are topped before chemical desiccation. Don't have access to diquat (Reglone) anymore.

British Potato Show – Harrogate

Over two days, our group attended the British Potato Show in Harrogate, Yorkshire. This is the largest potato show in the country and takes place every two years. A limited number of conference presentations take place, with the primary emphasis being on the trade show. Most attendees have to travel some distance to the show, as it is half-way between the main seed growing region in Scotland and the main ware production areas of Norfolk, Suffolk, Cambridgeshire and Lincolnshire.



There are likely too many companies and products to mention, but each member of the group was able to investigate different products or services, either simply for interest sake or for potential exploration/testing back home. Among some highlights:

- Multiple companies selling seaweed extracts as biostimulants to help reduce oxidative stress in plants.
- Diversity of potato handling/grading equipment, including optical sorters and new robotic packaging machines
- A prototype machine using ground-penetrating radar to predict yield and size profile without having to dig potatoes.
- Multiple alternative sprout suppressing products, as CIPC is not long available in the UK and EU
- Redeployable drip irrigation technologies, allowing drip line to be re-used for up to 10 years
- A number of soil water monitoring and weather monitoring systems for irrigation scheduling
- Many variety agents/breeding companies from across Europe



Dewulf 4 row self propelled harvester

Among some of the key take home messages from conference presentations:

- With the wind-down of AHDB, which previously did research and agronomy progams for UK growers, a number of other organizations are coming to the forefront. James Hutton Institute is one of these, which will be the home of the new National Potato Innovation Centre (NPIC) which is seeking funding to get established.
- There are other companies working at linking producers with researchers and government funds to address concerns of the industry. Government not involved in direct research, unlike in Canada.

- Development of new novel PCN trap crops as well as developing agronomy handbooks to grow these crops. Cause PCN eggs to hatch but not infect/multiply
- Ongoing research by McCain, Pepsico, other parties on reducing tillage intensity as part of regen ag push. How to reduce soil disturbance in whole rotation, but also in potato phase
- Researching microbe-derived fungicides against late blight
- Fungicide resistance in late blight very scary in 2022 and 2023. Research shows unsurprisingly that mixing chemistries and rotating chemistries helps slow down onset of resistance significantly
- Cedric Porter of World Potato Markets shared that consumption of potatoes continues to trend down, but UK still has higher consumption rate than many countries.
- UK is 2nd biggest importer of fries after the USA
- UK only 60% self-sufficient in potato, was over 90% just 25-30 years ago. Is there room for more potatoes in the UK?
- UK is still banned from selling seed to the EU, a cause of tension post-Brexit. There are ongoing discussions to change this, but not much progress has been made. The UK exports much more seed than it imports.



Prototype of system to detect amount/size profile of potatoes in the hill, without the need for removal.

James Stockdale Farms

After the British Potato Show, our group headed east to the Yorkshire coast to the Scarborough area. Our first visit on the morning of Nov 24th was to James Stockdale Farms, a large seed and processing grower. We were toured around by the farm manager, John Clark. Stockdales grow 1500 acres of potatoes, 500 ac of seed and 1000 ac of processing potatoes. Almost all of the seed varieties they grow are processing varieties. A lot of their production goes to McCain (over 14,000 T), as they have a factory only 3 miles from the farm. As well, Stockdale Farms delivers 100% of the potatoes to that plant, with other contract growers delivering to Stockdales. Depending on the time of year and condition of the potatoes, these potatoes may be washed or dry graded before headed to the plant. Stockdales operate a fleet of trucks (20 trucks, 100 trailers) to keep the plant supplied as well as to deliver their own potatoes to other clients. 6,000 T of chip (crisp) potatoes are produced, most of which have to get trucked a longer distance away.

90% of their potatoes are grown on rented land. There is a large diversity in the type of ground they grow on. In a relatively small geographical area, they farm sandy loam soils, heavy clay soils over chalk (Yorkshire Wolds), and high organic matter peat soils. Fertility and variety choices depend heavily on soil type.

Among the varieties grown: Innovator, Shepody (only variety cut for planting), Pentland Dell, Royal, Elland, Taurus, Lady Rosetta.

Stockdale Farms is one of the largest seed growers in England. They are one of 14 seed producing farms in England, much smaller in number than Scotland. They do post harvest testing on their seed for virus, as aphids are much more common in England than in Scotland.



Grading room at James Stockdale Farms, Scarborough

Additional notes:

- Planting starts end of March/first of April. Harvest Sept and October
- N rates largely 180 kg/ha, up to 200 + for some varieties. Very little N credit from previous crops. Do credit if they use manure or digestate sources. 100 kg/ha on seed.
- Goal is to get full canopy by June 21st (longest day)
- 90% of land has history of PCN. Starting to use Velum Prime for control of nematodes, as they get lots of feeding damage from free-living (root lesion) nematodes
- 80% of their land has to be destoned (lots of flint rocks)
- Using polysulphate (polyhalite) from ICL. They like that it provides K but also Calcium and Sulphur. Did trials and saw positive response every year. 200 kg/ha rate.
- 4-5 tillage operations within 2-3 days to get prepared for potatoes. Lots of soil disturbance.
- Use liquid fertilizer on planter (12-17-9). Dry N use (urea) not common.

- Farm owns 1000 acres of land
- 7 year rotation for processing, 9-10 years for seed. Aiming for longer rotation if they can get access to land. Always try and access some virgin potato land each year if possible.
- Not getting heavy frosts anymore in their area. Aphid numbers going up, late blight increasing.
- Do a lot of aphid trapping. Have to leave blank rows between varieties and seed lots...generally see 5 times the aphids in the blank rows. Experimenting with different barrier crops to grow in those blank rows.
- Seeing more leafroll and PVY in Scottish seed.
- Margins getting tight on seed, lots of shift to ware crops across the country
- Culls to cattle feed or biodigesters locally
- Have some storage issues this year due to wet harvest. Some stuff needs to be shipped immediately due to this.
- Use an independent agronomist who assists with making spray plans. John does most of the fertility plans, but works together with agronomist on this.
- McCain pays for shuttling potatoes from Stockdales to the plant. Growers responsible for getting potatoes to Stockdales
- Most varieties grown on tonnage contracts, some varieties (Shepody) grown on area contract.
- Yield goal between 42 and 60 T/ha, depending on variety.
- Wheat yields largely 4 T/ac. Best yields around 5 T/ac. 3 nitrogen applications/year, all liquid.
- Spring barley yields more like 3 T/acre
- Biodigestate a big source of N fertility, and cheaper than chemical fertilizer. Fields with digestate added tend to do better in dry weather (more organic matter).
- Only 15-20% of crop is irrigated. None on seed.
- Spray Gavel at harvest on crop.
- DMN and ethylene primary sprout inhibitors, some use of mint oil.
- Only farm we visited where they have all of their own sprayers and harvesters. Don't use custom operators due to size of farm.
- 12 full time employees, 25 at harvest



Innovators in new storage at James Stockdale Farms

Airy Hill Farm

After Stockdales, we headed just a few minutes down the road to visit Airy Hill Farm, home of the Pick family. We were shown around by James Pick, who visited PEI in 2022 as part of his Nuffield Scholar tours. Their farm grows exclusively for McCain, growing 383 acres in 2023. While they own 650 acres of land, only about 135 acres of this land is suitable for growing potatoes, so the majority of their potatoes are grown on rented land. New storages were built in 2014 and 2017, and the farm has been investing significantly in improving soil health for many years. James' grandfather also operates a small beef herd, finishing about 75 head at a time. Most of their acres are not irrigated, and they grow land on a wide range of soil types, just like Stockdales. Soil type can vary widely from one field to the next or even within fields. Most potatoes are on a 6 or 7 year rotation. Historically this was in rotation with cereals and canola mostly, but they have started adding grass to some rotations in the last year or two.

James is ahead of the curve when it comes to reduced tillage and soil health improvement. His farm was the only one we visited that did not use a moldboard plow, using vertical tillage ahead of potatoes and largely no-till or strip-till to establish other crops. He feels this has enabled him to rehabilitate some fields that needed help and improved yields, especially in dry years. They grow cover crops in the fall ahead of potatoes, taking us to one of his fields with a mustard, peas, phacelia and buckwheat cover crop mixture. This is seeded in September after wheat is taken off. Ideally it is grazed by sheep in the winter or is killed before potato tillage in the spring.



Cover crop of mustard, peas, phacelia and buckwheat at Airy Hill Farms, the year before potato.

Additional notes:

- Also using polysulphate, along with other K sources. Don't apply P or K on grain crops, just potato year
- Have been cover cropping for more than 10 years.
- Variable rate seeding of cereals on most fields.
- Like to grow barley before potatoes now, as it allows 2 extra weeks of cover crop growth
- Have moved to bury most stones instead of removing them from field for less soil disturbance

- Not struggling with PCN in their area.
- Aim for 20 T/ac (440 cwt/ac) but only around 15.5 T/ac this year due to wet weather
- Light land is 3.5 to 4.0% organic matter. Heavy land 4.5 to 8.0% OM
- Biggest challenges: weather and finding/keeping good staff
- 4 full time staff, seasonally up to 9
- Experimenting with reduced fungicide applications. Instead using silica and salicylic acid (SA)
- Use 2 applications of seaweed extract to reduce plant stress in dry years. Feel that it is working for them
- Also using more manure to reduce applied N rates.
- 160-170 kg/ha N (140-150 lbs/ac) N for Innovator and Royal with yield goal of 440 cwt/ac.



Recently harvested field at Airy Hill Farms – evidence of the challenging fall conditions in 2023.



An example of fresh potato packaging at Marks & Spencers. Each bag had the variety name, the name of the farm, and the location of the farm where the potatoes came from.

Summary Notes:

Given the diversity of visits across a large geographic area, it is hard to make too many generalizations about potato farming in the UK. However, a few themes were consistent across most of our visits and our time at the show:

- 1. Standard practice in the UK seed industry is to harvest directly into boxes, move those boxes into a shed for gradual cool down and drying, and then movement into cold storage. High air capacity fans/ventilation and boxes piled 7 or 8 high is the norm.
- 2. Grading throughout the late fall and winter is also commonplace, with modern grading lines, sizing into 4 to 6 sizes, and moving boxes back into storage. Most grading lines operate with 4 to 6 people.
- 3. Seed larger than 65 mm diameter is largely sold for table stock. Almost no seed cutting is done, except for a couple of varieties like Shepody.
- 4. Soil disturbance ahead of potato planting is very significant, with bed tilling, bed forming, destoning, clod busting and hilling all performed. There is a research trend toward reducing tillage but few farms we visited were engaged in reduced tillage. This may be different in parts of the country that are less stony.
- 5. Very little, if any, irrigation is done on seed acres.
- 6. Rotation length is much longer in the UK than here, but this is largely due to PCN concerns. Rotations are not complex; in fact, they usually are just a mix of cereal crops with the occasion year of canola or beans. It is very uncommon to have a full year cover crop ahead of potatoes. It is also uncommon to have grass/legume ahead of potatoes, as most of the potato growing areas do not have many livestock (dairy/beef).
- 7. The majority of farms we visited grow only a small percentage (10-30%) of their potatoes on their own land, with the rest of their acreage grown on one-year rental agreements with other farms who largely grow grains and oilseeds. Large land-holding estates are common in the UK, with many of these estates directly involved in agriculture as well as renting land to tenant farmers. Very little land ever comes available for sale, and when it does, it largely sells to these same large estates.
- 8. Nitrogen rates per tonne of potatoes are lower than in PEI. Like PEI, there is a trend toward identifying more N-efficient varieties. Phosphorus and nitrogen are largely applied in liquid forms.
- 9. Polysulphate as a K and Ca source is becoming standard practice for many farms. This makes sense, as the primary source for it is in the UK.

- 10. Margins are getting tighter in the seed business in the UK, and there are fewer of the seed-only farms in existence. Increasing seed acres are being grown in England in recent years, but still at much lower numbers than Scotland.
- 11. PCN is a massive issue in Scotland and some parts of England. With no chemical treatment options, it is being addressed through rotation and dual resistant varieties, primarily.
- 12. The use of mineral oils is at an early stage in the UK (especially Scotland), in part hampered by regulations. Access to aphicides is much more restricted than Canada. Climate change is increasing aphid populations and virus transmission.

It was a pleasure to travel with an excellent group. I feel that each group member was able to make the most of this opportunity to learn in a way that helps both their business but also the entire industry. Our group will undoubtedly use some of the key learnings from this trip to inform our research and extension plans for the near future as part the AIM program.

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Tour group at Scottish Agronomy