Netherlands – United Kingdom Seed Study Tour

by Ryan Barrett, AIM Project Lead
on behalf of the AIM Seed Management Working Group
November 2017

On November 18th, a group of seven growers and industry representatives departed for Europe on a mission to understand more about seed production practices in the Netherlands and the United Kingdom. The travel group consisted of:

Project Lead: Ryan Barrett
Seed Working Group members: John Ramsay (Chair), Paul MacAulay, Peter Townshend, Pat Clarkin, Mary Kay Sonier
Cavendish Farms representative: Kendall Brown, Seed Farm Manager

This trip was made possible by the funding available under the Agronomy Initiative for Marketable yield (AIM), funded by the processing growers, Cavendish Farms, the Province of PEI, and Agriculture & Agri-Food Canada.

Brief trip summary:

- 3 days in the Netherlands, 5 days in the United Kingdom
- Focus on seed production, but with exploration of all parts of potato production on-farm
- Action Items listed at the end of this report, but key areas for future development in PEI would include:
    - seed sizing, and adjusting seed spacing at planting to the seed size;
    - increasing the size of seed pieces (mostly whole tubers);
    - reducing the amount of cut seed;
    - reducing the amount of oversize seed in seed lots;
    - exploring better ways to store and grade our seed (dedicated seed storages);
    - and exploring the use of ethylene for certain varieties for increase tuber numbers and uniform emergence.
- In both countries, we made a number of good contacts for future research projects or extension efforts. Particularly at the BP2017 show, the group members made a number of connections that should prove fruitful in future years.
- In both countries, we heard a lot about paying attention to soil health, soil compaction and crop rotation. This is also a major topic in PEI and interesting that they are finding many of the same struggles in Europe. Definitely a move in those countries to look at different cover crops, lengthening rotations, and reducing tillage.
- Variety development in those countries almost exclusively private. Varieties are being developing increasingly with disease/pest resistance built in, but still meeting the needs of processors/consumers.

Koops Farm

Upon arriving in Amsterdam on the afternoon of November 19th, the group proceeded by car to the farm of Egbert and Rolf Koops near Zeewolde, about 45 minutes from Amsterdam. Egbert is a brother to Fred Koops, HZPC representative based in PEI. The Koops family farms 100 ha of flat, reclaimed polder land. This is a heavy clay land with neutral pH and is farmed very intensively. They have a four year rotation: potato, winter wheat, sugar beet, and onion/tulip bulbs. Potato was 1 in 3 and onions and tulips 1 in 6.

Their primary crop is Innovators for McCain Foods for French fry processing. They also grow some seed varieties for HZPC. They do not have a contract for their processing acres, which this year will mean very low prices due to oversupply in Western Europe. We heard that 60-70% of the processing volume is contracted in the Netherlands.

One of the immediate take-aways from this farm was the investment in technology given the relatively small size of the farm. They mentioned that they can apply for capital investment programs to receive subsidization for equipment purchases. However, most of the equipment was relatively new and all was owned, not leased or shared with other growers. Equipment seemed generally smaller than that commonly used in PEI (and North America) and they used wagons and tractors rather than trucks in moving product from field to storage at harvest. It was explained that slow, wet springs and wet falls can necessitate having to own all of this equipment so harvest isn't delayed too late. Potatoes are planted in mid-late April and harvested in September. Tramlines used (common in NL).

Seed is normally sized in January. 35-50 mm is the preferred seed size for Innovator, and it is planted whole mostly. They only cut seed at times of shortage. Processing crops are usually stored until Jan/Feb. They have multiple storage compartments with different storage conditions, including storage of onions.

Average yields on processing crops are 45-50 T/ha (400-440 cwt/ac), while yields on seed crops are 35-40 T/ha (310-350 cwt/ac). Seed prices are about 0.20-0.25 euro per kg. This year, processing prices are more like 0.05 euro per kg, much below cost of production.

As seemed standard in Holland they were planting using a 30" row width. They used tramlines for sprayer tracks – the tires which were wider. Seed spacing depended on seed size and variety but generally 18-20 cm for seed (7-8") and 30 cm (12") for processing.

Manure is used as part of the fertility program, as most parts of the Netherlands have an excess of manure available and most crop farmers get paid to take it. The Koops operate a 4 row planter, a 2 row harvester, and a tow sprayer.

Seed/Tillage equipment used only for 25 ha of winter wheat!

Agrico Research

On Monday, November 20th, we first headed to the Agrico Research Farm just outside of Emmeloord, the center of the seed industry in the Netherlands. Agrico is a cooperative of 650 seed growers, with 80% of all seed production destined for export. They have developed a number of varieties and they do trials all over Europe, the Middle East and North Africa, and they have distributors and representatives all over the world with daughter companies in places such as the UK, and North America.. Fontane is a relatively new popular processing variety that they have developed and that is heavily used. We spent the morning with Adrie Omtzigt, a Product Manager with Agrico. He provided us with an overview of the company and a tour of their new research facilities. A few key points:

- Sustainability is a buzzword in the Netherlands as well, but a lot of it is currently window dressing as growers are not getting compensated to farm sustainably in most cases.
- Organic prices are generally 1.5 to 2 times higher than regular table prices.
- Bintje is now only about 5% of the processing market.
- There has been a significant move toward smaller tractors and equipment due to the challenge of soil compaction, especially as they often have to harvest in wet conditions. Also a movement toward residue tillage, but that has been slower to be adopted.
- Most soils in the polderlands are only 1 to 2% organic matter. High OM fields sometimes give issues with storability, as they retain too much water and mineralize N at unpredictable times in the year.
- Over-mechanization of farms due in large part to biosecurity (wart, PCN, blackleg) and short harvesting windows.
- Agrico growers producing 13,000 ha of seed potatoes, export to 80 countries.
- All seed has to go through the company (not direct from grower to grower) but processors often identify seed producers to the purchasing grower.

- All seed is sized into multiple sizes. Range of usable seed is generally 28 to 55 mm, with the preferable size being 35-55. Undersize goes to cattle feed. Oversize goes to fresh market, starch, or cattle feed.
- Seeing some emergence issues after plowdown of cover crops treated with glyphosate, not being properly broken down.
- There are starting to be concerns on the use/rate of mineral oil, potentially as soil contaminant. Use of a "sticker" instead on some farms.
- Very little irrigation is done, seed can only be irrigated from well water (not surface), due to Dickeya and other bacterial disease concerns (such as brown rot)
- Blackleg is a major concern and challenge
- Seed is generally graded starting in November until January, either for export or domestic use. Potatoes are stored at around 12C when grading to reduce damage. After grading, temp lowered to 4C, though can be up to 6.5C if using ethylene.
- In the past, plant oils like mint or clove oil were used as seed stimulants/sprout inhibitors. This has become less common now with the advent of ethylene (Restrain)
- There is a need to control carbon dioxide levels, as these increase with use of ethylene
- There are also many growers using box rotators to stimulate seed and break apical dominance.
- It is not possible to cut seed being grown for seed…not allowed. Some cutting is done for processing crops, but not common.
- Agrico representatives respond directly to complaints from buyers – they will travel to the market where there is a concern to address the issue – they do not rely on NAK to do this.
- LambWeston is reportedly looking for varieties that will produce 100 T/ha (880 cwt/ac)

New variety evaluation for cooking characteristics at Agrico

All samples from research plots in these trays on rollers to minimize labour.

Agrico Farm Tours

We visited three farms that Monday afternoon:

- Nico & Matthijs Gebbink.
- Arjen Stevens
- Michael Bouma

Notes from those three visits include:

- Gebbinks grow about 100 ha of seed, a moderate size seed farm. Start all production from minitubers and plant for 3 years until sold. Grow 9 varieties of all uses.
- Plant minitubers by hand. First warmed up to 20C at increased humidity for two weeks. Plant early in April, planting minitubers first. Also the first acreage to be harvested in July.
- Any cutting of tops is done after spray with Reglone, due to risk of virus and bacteria spread.
- Minitubers were harvested by hand but recently developed a new machine to help with this. Minituber crop left on top of the ground for one day to dry before picked up. Grow 1 ha of minitubers.
- Gebbinks had a square hole screen grader (Continental Dykstra brand) that sized into 5 different sizes. Three of these sizes would be sellable for seed: 28-35, 35-45, 45-55.

- They use Restrain on all varieties that they will be planting themselves – not on seed that is sold. They say that customers are not asking for it and they do not want to incur the extra cost. Start the generators in late December, ramp up until planting time.
- They feel that use of ethylene makes germination process more equal with uniform emergence. Also a higher set number for most varieties but not all.
- 35-55 mm seed attracts highest price
- Can take seed out of ethylene and put back in and it will still stay dormant.
- Grade their own seed 2-3 weeks before planting.
- Ethylene requires min 90 days for application. Spreads easily in storage but needs good ventilation.
- Generator is rented from the company.
- CO2 is managed through refresh 2x per day. Only 5-10 min at a time of outside air. Have a new Toslma system.
- Slow cooling of seed in storage. Starts at around 18C at harvest, tuber temp decreased about 2/10th of a degree per week. This helps with silver scurf
- Estimate that ethylene costs about 200 euro/ha but benefit of 800 euro/ha
- Getting about 45-48 T/ha on commercial seed yield – they felt that they had very good soil and their yield was above average in Netherlands.
- Still using a cup planter, not belt, but not growing many long varieties.
- Do some irrigation at tuber initiation to mitigate common scab. Need insurance for irrigation though.

At Gebbink Farm

Sorting seed into 5 size categories with dust exhaust systems over each box.

- At Stevens Farm, he works part time with Agrico, farms part time –crops and hogs
- Grows only 12 ha of seed, 18 ha in 2018
- 4 year rotation: potatoes/wheat/onions or tulips/sugar beet
- Contracts storage space with Gebbinks across the road
- He only uses ethylene on the Rudolph variety where he feels he sees an impact.
- Grade seed into tote bags for shipping
- Ships some for export, some to local producers
- Tries to ship as much as he can early, not just before planting
- Uses Japanese oats and brassica species as green manure crops
- Plows in the spring to help with soil erosion
- Like other farms, all potatoes stored in boxes. Cost about 100 euro per box. 1.3 MT/box
- As an open air storage, with open ends. Good until early December, when much of that seed will be moved. Less common to find these open storages now but were popular a number of years ago.
- Seed for local growers increasingly graded into vented tote bags.

Open ended box storage at Stevens Farm

- Michael Bouma farms with father, brother and uncle. Large seed farm for NL, 350 ha in total crops. 160 ha of seed potatoes
- Rotate with wheat, chicory, sugar beets and flower bulbs
- 100% Agrico grower
- Start with minitubers, then multiply for 4 years before selling commercially
- 1.5 ha of minitubers
- 15 varieties grown, 80% in boxes
- Also use ethylene on seed for his own planting, but only on specific varieties where he feels it has a positive impact, get 1-2 tubers extra per plant. Provides more uniform seed size. Most money is in the 35-50 mm seed, so consistent size is best.
- Estimate additional returns of 1000 euro/ha from ethylene use
- Big investment in grading/palletizing equipment. Can operate with little extra labour
- Need to grow intensive crops here to make money, as land is 120,000 euro/ha to buy, or 3000-3500 euro/ha for rent
- Grow a lot of Fontane which goes to Belgium and Germany for processing
- Virus testing is done at 200 tubers per field. If retest needed, goes to 400 tubers
- Stopped using mineral oil due to use of irrigation. Instead, use additive that improve foliage penetration of insecticide for aphids. Low aphid pressure in area. (called Prolong)
- Two 2 row harvesters. 25 km from furthest field
- Gross yields of 50T/ha
- Bacteria (Dickeya/pectobacterium) much bigger issue than viruses
- One pass cultivation and planting for potatoes, deep tillage equipment

Lots of investment in automatic grading/palletizing equipment at Bouma Farm

Tolsma

On Tuesday morning, we visited with Jan van Maldegam, Marketing Manager for Tolsma in Emmerloord. He also farms part time. Modern facility in industrial part of the town.

Tolsma started as a private family business in 1952. From the beginning, all R&D and manufacturing has been internal, using all privately developed and manufactured components. Now a large shareholder company with the Grisnich arm manufacturing grading/handling equipment. Partnership with Cavendish started in 2013, and have a presence all over the world.

Tolsma systems rely on advanced control systems and high efficiency, smaller fans that can exchange larger volumes of air. This enables fans to only run for a small amount of time per day, saving cost as well as shrink. After sales support is a big component of business as well.

Some new products in development or recently developed include:

- Feeding weather forecast data into climate control computer
- Track and trace system (RFID) for handling boxes with forklifts
- Mobile refrigeration units (modular)
- High efficiency EC fans
- In-storage yield observation unit for measuring shrink
- Smaller grading machine from Grisnich
- 3D sample analyzer, using optical sensors

- Airbag system, used for separating rows of boxes to force air through line of boxes. Enables longer line of boxes than normal (20-25 instead of 10-12 deep)

Modular, mobile refrigeration equipment at Tolsma

New automatic shrink evaluation tools to place in storage

HZPC Grading and Distribution

We then headed across the road to visit with HZPC and Paul Oomen at two facilities. The first is a facility used solely for grading samples from their research trials and grower samples. They grade about 20,000 samples here per year at a rate of about 200 samples per day. It consists of a fully automated optical grader which sizes and detects defects/greening. These samples then proceed to an automatic specific gravity/solids content machine, before going to colour/cooking tests by hand.

Also on site is their daughter company facility, a large, privately owned cold storage, packing and distribution center. About 10% of HZPC seed goes through this facility, primarily for export. Most

growers now do own grading, but still a sizeable volume done here. They will also do grading on contract for individual growers and other companies such as Agrico and Stet Holland (which is another daughter company of HZPC?)

Largely box storage, but some is received in bulk and then graded into boxes. When we visited, they were grading for North Africa. All boxes are carefully recorded and tracked. Pack into multiple types of containers: totes, 25 kg bags, 10 kgs bags, small plastic bags for home gardeners. Majority still goes in jute bags for export.

Automatic grading equipment at HZPC, including ability to do specific gravity.

Marien Verhage

Paul Oomen and Eise Timmerman from HZPC arranged a visit to the Verhage farm, just outside of Emmeloord. They are a 4th generation farm, established since 1951 (shortly after the land in this area was reclaimed). They specialize in growing seed, with 60 ha in potatoes each year as well as some other rotation crops. They also trade land with a local dairy farm. Quality is particularly emphasized, but yield has caught up in recent years. Quite a bit of their production is Innovator and other processing varieties. Other notes:

- Store up to 2800 boxes
- Also provide custom storage for other growers
- 40 to 55 T/ha in yield, dependent on variety
- Innovator yields can be a bit lower, as they set fewer tubers per plant
- Aim for 35-50 mm for processing seed. 50-60 mm is cut for processing if seed is in short supply
- Sell some seed to other seed producers, but primarily goes for export or for local processing

- Most seed going to processing growers is graded and delivered right before planting, but some are getting seed earlier, especially if they want to use ethylene at home
- Had a small separate storage unit just for ethylene. Not used for all varieties…only those where it shows a return.
- Again, growers treat with ethylene for their own seed that they are multiplying up. Not for seed they are selling.
- Have been using ethylene for 6 years and very happy with it. Rent of generator is expensive but feel are getting return on investment. Use computer control to ensure proper air refreshment for CO2
- Grades own seed in January and then puts back into storage. Potatoes are graded for size earlier in season (shaker grader) and then graded for quality when packing for a specific order.
- Plants late April, harvest Sept-Oct
- Fertility program: 20-80 kg/ha N at hilling. Can apply mid-season N as well. No N applied before planting. Get substantial N from manure as well as other nutrients.
- Phosphate as liquid applied at planting…pretty normal in NL
- 1/3 K spread in March before planting. 1/3 applied at hilling. 1/3 with N later in summer if needed.
- No foliar nutrition used
- Calcium rich soil so no extra Ca applied. Neutral pH
- Estimate 1200 euro/ha in spray costs. 8 euro/L for mineral oil

Take home messages from Netherlands:

1. Seed production is focused on global sales, as well as within Europe sales. The big seed houses control much of the seed production through contracts and then sell the seed to the end user both globally and local processors. For companies such as Agrico, which is a co-op, the seed pricing is not necessarily set out as a specific price in a contract but is a pooled system (similar to grain in PEI?)
2. In field production – row spacing for seed seems fairly standard at 30" and in row spacing depends on seed size and variety.
3. A major concern at harvest seemed to be getting the tubers dried down and they use high throughputs of air to get this done (as is done with a Tolsma system).
4. Box storage is the standard for seed production. Allows for easy handling/movement/grading of seed. Seed goes right into the boxes from the field and stays in boxes until it leaves the farm. While up-front cost of boxes is high, it allows for easy movement/grading with limited personnel. Also allows for good air flow through seed and it is easier to manage the multiple seed lots (classes and varieties) many of the people we visited were growing.
5. Differing opinions on grading times/storage temperatures, but trend is toward earlier grading in late fall/early winter. Try and spread out grading through the whole winter, except for right around Christmas. Of course, early export movement is done first, followed by more domestic and own seed grading later in the season. We also saw that growers would size their seed (minimal labour required – just putting through a shaker grader - early in the year to know what volume of different seed sized that they had) and then put boxes back in storage and grade for quality when preparing a specific order.
6. Most producers had no issue with warming seed up for a few days, grading, then cooling back down. Don't see big issue with shrink or physiological age, because they are generally trying to get more tubers/plant (unlike say North American russet varieties)
7. Ethylene has become pretty much standard for growers treating their own seed. Seen as cost effective. Provides sprout inhibition as well as breaking apical dominance. Not used for all varieties, but especially for varieties that can tend to be larger in tuber size or with low set numbers. Allows seed to be stored a little warmer (2 degrees higher). Requires separate compartment/storage with ventilation for ethylene. Growers would ship seed earlier to other local growers who wished control over the storage and handling of the seed that they intended to plant and perhaps treat themselves with ethylene.
8. Quality of seed storages is high.
9. Sizing seed into different size categories and then adjusting planting density to size is routine. Allows for more even emergence and crop profile.
10. Possible trend away from mineral oil (sometimes just reduced amounts) for multiple reasons, but still used. More investigation needed on adjuvants being used there.
11. Most people (whether Omnivent or Tolsma) run ventilation for shorter frequencies, computerized storage control very common.
12. Bacterial diseases in general, including Blackleg is a huge issue, but routine disinfection not as prevalent as we expected to see. Big reason for not cutting seed is risk of blackleg.

13. Some people use seed piece treatment for Rhizoc/silver scurf (aka Quadris), others go without.
14. Very intensive land use, as high land prices and high capital equipment costs necessitate high return crops. Definite interest in more cover cropping, alternative cropping.
15. With very little use of cut seed (and only single cut when used), average seed piece size is larger than Canadian average.
16. Overall hard to get a good feel for finances – land costs were very high as were labour costs (we heard up to 17euros/hour for manual labour and up to 26 euros/hour for equipment operators.) As well, capital costs must be quite high with high mechanization of farms that are a small size.
17. Very structured system with regard to seed.

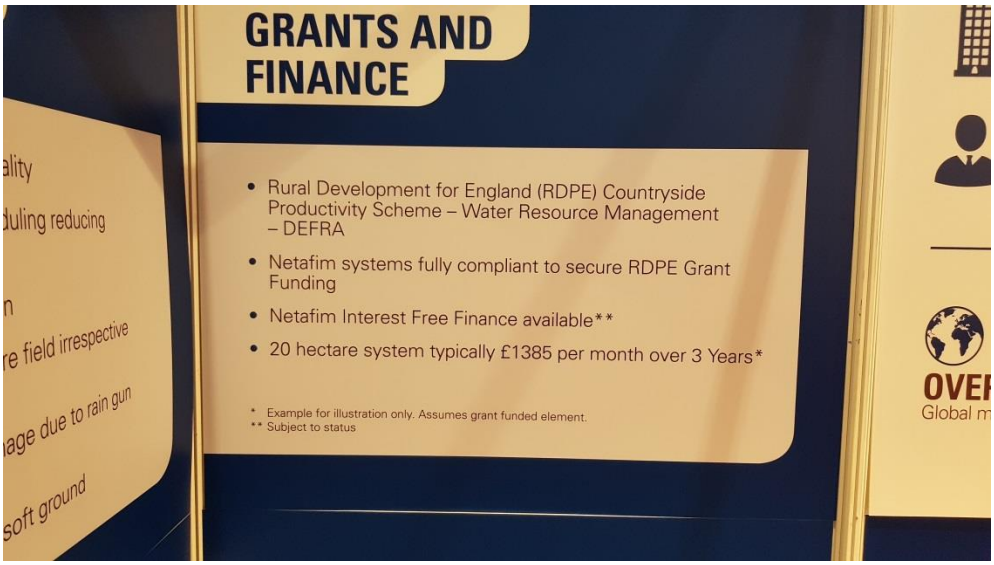
United Kingdom

BP2017

We flew from Amsterdam on Wednesday, Nov 22nd to Leeds, England and then continued on to the British Potato show in Harrogate in Yorkshire. This was a large potato show, with booths, equipment, and a seminar schedule over two full days. Some highlights from the show:

- Attended seminar on soil health. Facing a lot of the same issues as here in PEI, with reducing organic matter, soil erosion, and soil-borne pests…in their case, PCN. Three-quarters of British fields have serious compaction issues. Compaction can lead to between 10-20 T/ha difference in yield in the UK. Bare soil erodes at 100 times the rate as fully covered soils. Heavily compacted soils don't see a response to irrigation.
- www.terranimo.eu – Soil Compation model
- Wet winter will have more impact on compaction than a dry winter, especially with deep tillage
- Feedback from grower panel is that some fields are truly "knackered"…need longer rotations, diversity of crops, lighter equipment, less use of nematicide for PCN, less tillage.
- Found out about 12 year cover crop research done in Alberta. Got papers on this.
- Talked with growers and AHDB rep about wireworm. Growing problem in the UK, interest in what we're doing in PEI.
- AHDB – Successor to British Potato Council org largely responsible for organization. All conference presentations at ahdb.org.uk/BP2017
- AHDB has a **FarmBench** program that they are just now making available on-line – launching at the show – similar to our processing COP sudy info? – this will allow AHDB members to compare their costs against industry benchmarks that have been developed over the past several years.
- Spot Farms – on farm research trials with AHDB – Strategic Potato Farms – they work with AHDB and receive grants for doing on-farm research which also involves hosting tours to the sites through the season.
- NIAB CUF – Cambridge University Farm. Met with Mark Stalham to talk about soil compaction and having him speak in PEI. Has a wealth of knowledge about different topics, including irrigation, tillage, compaction, etc.

- Simon Smart at NIAB – research into seed size, planting density. Effect of large seed size, getting consistency of yield. Also effect of tuber dry matter on seed performance.
- NIAB Digital – niabnetwork.com – grower agronomy tools for mapping, data mgmt, weather, research data, etc.
- Rise P from Lallemand. Bacillus amyloliquefactans for making P more available. Improves P solubility, stimulates root growth, probiotic effect. Lallemand based in Quebec.
- Greenvale AP – full agronomy booklet from Produce Solutions.
- Oro Agri – Wetcit – adjuvant for better spray coverage
- Netafim – tube drip irrigation. 1 tube per 2 rows. Device for unrolling and for rolling back up. Useable for up to 10 seasons. Uses less water than conventional irrigation. Can set up 20 ha per day (50 acres)
- Levity Crop Science – foliar N product (Lono) which is amine-type N and promises significantly higher tuber count and yield. Worth follow-up.
- Downs seed cutter for single cut seed with "hot knife" at 350F, cauterize cut surface.
- Asked question of seed panel if in UK they were seeing pressure from buyers or processors to be selling Generation 3 (or E2) to commercial or end use growers. The replied saying that they have a seven generation system (as Canada) and are now selling G4, G5, and G6 (E3, E4 and F) and feel that is satisfactory quality so were not seeing a need. They also did not see that processors or table buyers were interested in paying the premium required to move up to an earlier generation.
- From Peter: We need a recipe for Bubble and Squeek (potato/leek dish).



Netafim info

Cultivator/hiller

Sykes Farm

On the morning on Thursday, Nov 23rd, we travelled to the Tadcaster area to visit with the Sykes brothers (Adam and Ben), processing growers for McCain Foods (Champion Growers in 2016). Growing 700-800 acres of potatoes all for processing. Some points of interest:

- Grow about 1400 acres of grains in rotation with potatoes. Also grow some sugar beets.
- Small contract of Lady Rosetta for chips and Amora for food service fresh cut
- For McCain, grow Shepody, Innovator, Russet Burbank, Fontane, and Pentland Dell
- Start planting in March. Start green harvest in July, harvest and ship direct to plant until October. Only store about half of their total crop.
- Seed is sourced through McCain, comes mostly from Scotland. 100% contracted with McCain
- Seed is collected in December and early January and is graded/stored on farm. Have a separate seed storage that has some non-gassed processing product in the fall before clearing it out to bring seed home. Grade/cut early and store for multiple months.
- Do some chitting of some varieties on chitting trays to accelerate emergence in the spring. Do a sizable quantity (600 T) – they were doing this more as a service for neighbours who were in the early market than for themselves. It was an activity that helped them to keep their fulltime staff busy during a slower time.
- Plant Shepody at 10 inch spacing, don't store any
- Have one cup planter and one belt planter. Cup more precise, belt is faster and a "population planter" especially for large size tubers (ie Innovator, Burbank)
- Yields of 18-22 T/acre across varieties. Royal variety higher yielding, but lower price and not used for MacDonald fries.
- Like Netherlands, blackleg a big concern. Again a big reason for limiting cutting. Only cut largest tubers, single cut.
- Don't use seed piece treatment, never cut and plant. Grade and cut early, put back into storage.

- Put a netting and then straw on top of storage piles. Prevents greening if lights are left on, and also absorbs water from roof condensation. A bit “old school” – something their father used to do - but still like to do it.
- About 40% irrigated, with low tech (gun)

Restrain Company – Greenvale AP

- Visited facility in Duns, Scottish Borders. Large fresh pack facility. Main seed facility in Perth
- Own Restrain
- Rent out generators…don’t sell them.
- Higher cost using for seed (application fee) as return is higher
- In UK, mostly use ethylene for sprout inhibition. Less for seed (unlike NL) and also used on seed that would be planted to produce creamer potatoes rather than seed for seed production.
- Because growers do not necessarily want to treat all their seed with ethylene they could ship seed to this facility for storage and treatment with ethylene and then sell or take back treated seed.
- Cost is substantial but return for seed
- Challenging to go through regular route for Canadian registration. May have to look at trying to go through minor use channel or OECD approval channel.
- Got contact for lobbying/regulatory rep
- They advocate using for 120 days before planting
- Ethylene takes 3 days to work into potatoes, 3 days to work out
- Would have about a 10 day window between remove from ethylene and planting before sprouting
- Seeing a lot of use in creamer varieties (Little Potato Co)
- Stops cell elongation while continually present.

- Receptive to working with us on research trials in Canada on multiple varieties. Have experience with lots of other varieties in the UK and NL and elsewhere.
- A growing market for them is ethylene used to assist with ripening of greenhouse grown tomatoes – potential to get registration support from Canadian greenhouse growers as well as potato industry.
- Restrain Co. rents out the generators and take them back in the off-season for servicing.

Mertoun Estates – Scottish Borders

- Estate farm owned by the Duke of Sutherland near Galashiels in Scottish Borders
- Potato manager Peter Shiells. Also farm manager (Jack Parsons)
- River Tweed runs through farm. Divides good land from marginal land
- Currently 1 in 6 rotation. Hoping to move to 1 in 8, especially on most marginal land
- 100% seed for potato production. (130 ha)
- Also grow wheat, rapeseed, oats, field peas, barley, forage crops/pasture
- Low pH soils like PEI, tight weather window as well
- Trade for manure as much as possible
- Plant in late April, harvest in October
- Grade throughout winter for stuff going to other growers. Own seed graded immediately before planting.
- Total of 3000 acres in hand and 2000 acres contract farmed
- Years are getting progressively wetter.
- Mostly Grimme potato equipment. Have big Great Plains tillage implement which is primary tillage operation. Also have to destone each potato year. Include belt planter.

- Have to sample all fields for PCN. Also sample for other nematodes
- Fertility rates of 90 kg N, 160 kg P, 200 kg K and 120 kg S per ha. Higher S due to less acid rain.
- K applied during winter, to leach Chlorine out of KCL
- N,P,S applied as liquid at planting. Some extra N topdress during season.
- Moved away from ploughing. Moving toward use of cover crops
- Huge number of varieties. Processing, fresh pack, chip…everything
- Forced ventilation at low storage temperature. Have a drying wall for 60-70 hrs before moving into long term storage.
- Storages refrigerated.

Take Home Messages from United Kingdom

1. Definitely a trend toward lengthening rotations, as land is getting worn out. Yields have been plateauing in many places and pest/disease levels are high.
2. In Scotland for seed production the required crop rotation is a minimum of six years (compared to three years in Holland – higher land cost?)
3. The seed system, as in Holland is very structured – companies like McCain and Agrico contract or make arrangements for their seed supply (often starting at minitubers and down through the generations) and are involved in the sale of this seed to commercial growers. Most seed comes through a supplying company (processor, Greenvale, etc). Not purchased directly.
4. Bacterial diseases including Blackleg are again a huge issue, but we saw little evidence of disinfection. Limit movement of product and track everything.
5. Virus is not a big issue in Scotland and they do not post-harvest test for viruses. They do spray with oil however.

6. Again, cutting seed is not common until seed is too large, mostly just processing.
7. PCN is a huge issue in commercial areas of UK, and big money spent on nematicide. All land to be used for seed production must be tested and found clear of PCN before planting.
8. Ethylene used more in fresh market for sprout inhibition and on seed for creamer potatoes and less in seed used for recertification.
9. Row width was higher in UK than in Holland – most people we spoke to were planting in two row increments with ridging and destoning prior to planting in 32, 34 or 36" rows.
10. Not much use of windrowing, but lots of destoning. Destoning can lead to compaction issues.
11. Most farms like to bring home/manage their seed early. Variation in times for grading, cutting if necessary.
12. Lots of interest in different cover cropping species/techniques.

Action Items we can explore further for use in PEI:

1. **Ethylene**:
    a. Registration Issues
    b. Impact on different varieties (Shepody, Prospect)
    c. Trials in PEI…either with or without registration. But need 90-120 treatment window.
2. **Whole Seed**
    a. It might be difficult to move entire industry to whole seed in a short time, but it would be feasible to move industry to more consistent, smaller average tuber size for seed
    b. Focus on creating more tubers per cwt and fewer large size potatoes that require cutting into multiple pieces.
    c. Average seed piece size in NL and UK would be larger than industry average in PEI.
3. **Sizing of seed**
    a. Obtain more uniform seed piece sizes
    b. Enable different plant spacings for different seed sizes
    c. Enable early planting of whole seed, single cut of some larger seed
4. **Netafim Irrigation**
    a. Have US distribution but not in Canada yet
    b. Investigate logistics and economics for use in PEI?
5. **Cover Crops**
    a. Explore more use of oilseed rape/oilseed radish as late season cover
6. **New Equipment**
    a. Shrink weighing technology from Tolsma
    b. Automatic grading/specific gravity evaluation equipment at HZPC – Cavendish Farms?