



Farm facts

Name: **Tony Reilly**

Location: **M & RG Levin, Tern Farm, nr Telford, Shropshire**

Farm size: **200ha**

Enterprise mix: **60ha potatoes, also carrots, winter wheat, winter oats, spring barley. Sugar beet dropped following closure of Allscott factory**

Soil type: **Loamy sand and sandy loam**

"On this sandy soil you get a better result from the Aqueel if it's used when the soil surface is slightly moist as it forms more stable reservoirs. We're learning that slowing down the planter speed also helps here." *Tony Reilly*

Background

- Sloping fields are prone to runoff and erosion
- Retaining water in sandy soil is a key problem, increasing the risk of common scab
- In the past compaction problems have been associated with late-lifted sugar beet – this may be less of a problem now
- This has also led to wet patches developing, which can result in rots
- Potatoes and carrots are irrigated with applications managed to minimise erosion and runoff



Previously Mr Reilly has tried tied ridging – using an implement that creates small dams in the furrow at planting – but he considers this has disadvantages:

- A separate field operation
- The tied ridges don't last long enough on the sandy soil to be properly effective but still leave bumps which interfere with harvesting
- The tied ridges are not good for scab control as they don't retain water where the tubers are

Observed benefits of the aqueel

- After very heavy rain there were a few small rills with some eroded sediment deposited at the bottom of the slope, but no major soil loss
- The Aqueel is fitted to the planter so does not require a separate operation
- This does not slow planting significantly, but better results are achieved when the machine is operating at slower speeds
- Soil stability benefits where straw is incorporated – the Aqueel reservoirs tend to hold together better

Comment

The sandy soils on the farm are prone to water erosion when worked, especially on fields with moderate to steep slopes. In these situations the Aqueel should be a win-win – it should help to reduce runoff and erosion by retaining water during heavy rain events in the reservoirs formed by the Aqueel. It will also aid water retention from rainfall and irrigation during the season with knock-on benefits for disease control. Sheila Royle (ADAS)

Current soil strategy

- An Aqueel – a specialised roller that creates indentations in the soil surface – is used, attached to the planter
- A hood on the planter ensures the ridges have flattened tops and a shallow central furrow, helping give better water retention and increased rooting area
- On the most sloping fields the tied ridger may be used in addition to the Aqueel
- In some fields some of the wheelings are also loosened with flatlift subsoiler tines, leaving a roughened surface which helps slow runoff as well as removing compaction
- In some seasons carrots are heavily strawed – the resulting boost in organic matter benefits the soil in following years





Better soils Better potatoes



Introduction

The soil strategy case study, featured on the reverse, is one of a series developed as part of the Applied Research Forum* (ARF), British Potato Council (BPC) led, Better Soil Management project. These case studies illustrate how producers from across the arable, horticultural and livestock sectors have tackled soil management issues they have experienced. The full series, covering a range of innovative techniques used to address soil issues, can be viewed on the ARF Soil Information Gateway (www.appliedresearchforum.org.uk/soils). The Soil Information Gateway provides central access to a comprehensive list of soil-related publications and organisations providing advice, training and events on soil management.

Five of the ARF soil strategy case studies featured in the Farmer's Weekly Soil Management Academy series. These can be viewed at www.fwi.co.uk/academy. BASIS points may be claimed following completion of a self-test questionnaire.

Soil management issues

Good soil management is essential for competitive potato production. However, a number of soil management issues are associated with potato production:

- Intensive seedbed cultivations can lead to the loss of organic matter
- Seedbed preparation and harvesting in less than ideal conditions can lead to compaction
- Compacted soils increase the risk of waterlogging and runoff
- Fine, clod-free tilths on sandy and light soils, particularly with rows or beds that run up and down the slope, are vulnerable to soil erosion, although all soils can be at risk in intense periods or rainfall or through poorly applied irrigation
- On light soils, such as peats and light sands, prior to the growth of crop canopy wind can erode drills and level furrows
- Fine seedbeds are at risk of slumping and capping particularly after heavy rainfall or poorly delivered irrigation, increasing the risk of runoff and erosion even on very gentle slopes.

The BPC is working with the industry to use existing knowledge and expertise on soil management to address potential issues, increase production benefits and meet cross compliance regulations through appropriate mitigation and remediation techniques.



Publications

A comprehensive list of soil-related publications, including best practice and policy guidance, generic and sector specific, can be found on the ARF Soil Information Gateway www.appliedresearchforum.org.uk/soils.

The following potato-specific publications can be viewed on the ARF website and BPC website www.potato.org.uk/soils or available from BPC publications 01865 782222 (24 hrs):

- *BPC research review – Soil compaction and potato crops*
- *BPC research review – Effects of soil compaction on potato growth and its removal by cultivation*
- *Policy report – Soil, water and other legislation: impacts on UK potato production (Cranfield University).*

***Applied Research Forum (ARF)**

To find out more, visit www.appliedresearchforum.org.uk

SOIL FACTOR: COMPACTION

SECTOR: POTATOES

Farm factsName: **Nick Baird**Location: **Basil Baird (Fareham) Ltd, New Barn, Chichester, W. Sussex**Farm size: **1,000ha**Enterprise mix: **344ha potatoes (on 80% rented land), outdoor pigs, combinable crops**Soil type: **Clay loam**

"We aim to get on the land as soon as the combine is out of the field. A GPS self steer system is used on the tractor that does the ridging, this helps achieve straight and precise lines and use 100% of the rented land. If not using GPS, even small inaccuracies, say a marker set 50 mm too wide, can equate to several hectares over the whole area of potatoes grown. Once the entire field has been planted then the final job looks something to be proud of." *Nick Baird*

Background

- On the clay loam soil, autumn or spring ploughing carried the risk of smearing and creating plough pans impeding potential root development
- Summer ploughing was not a viable alternative as experienced operators are busy on other machines at this time of year
- Capping from irrigation can also be an issue

**Observed benefits of no plough system**

- Sub-soiling in driest part of year aids shattering and produces natural soil fissures. Winter frosting helps break clods up
- With only headlands being ploughed, smearing and pans are less of an issue
- Not burying trash achieves better weed kill, minimises weed and volunteer populations in growing season and reduces slug problems.
- Ground that's sub-soiled (rather than ploughed) can be worked earlier in the spring and has better drainage

Comment

"The soil structure benefits at New Barn are apparent, the reduction in plough pans has provided a better rooting system for the pre-pack potato varieties grown. The result is improved yield and less quality variation in the M. Piper, Estima and Marfona crops."

Fraser Milne (consultant)

Current soil strategy

- Land is sub-soiled when it is taken on in June or post harvest. Only headlands are ploughed
- Following sub-soiling, land is ridged up and allowed to green up and then sprayed off in the autumn
- Weight of machinery addressed – all extra weights taken off
- Risk of soil capping is managed by using boom irrigation which is considered to give the most even application
- It is aimed to finish harvest by mid-October and to leave land in good condition to allow landlords to drill wheat



SOIL FACTOR: COMPACTION

SECTOR: POTATOES

Farm facts

Name: **James Grant**Location: **J&S Grant, Roskill, Munlochy, Ross-shire, Scotland**Farm size: **400ha**Enterprise mix: **Potatoes, winter and spring combinable crops**Soil type: **Sandy loam**

"Avoid over-cultivating soils – it causes slumping, soil disassociation, erosion and we've seen pockets of severe powdery scab where water has sat above layers of compaction. We've radically restructured the farm, but paid careful attention to detail when it came to ensuring the new machinery policy would address soil-related issues. It pays dividends." **James Grant**

Background

- The parent soil material is stony, coarse-textured moraine with 2-12% clay content and is imperfectly drained with an underlying friable yellow stony sandy loam, which is up to 40cm deep
- Below this an indurated layer exists – a naturally-occurring compacted pan in the subsoil – and can be found to be several centimetres thick but tends to gradually fade out with depth
- Prior to 2007, the 125hp tractors used on the farm were not powerful enough to subsoil to the desired depth. However, a subsoiler was used to pull up boulders ahead of stone separation, which it did very effectively
- A relatively narrow bed width led to frequent tyre compression damage on the side of the ridge
- Since water was unable to move vertically down the compacted soil profile it tended to be channelled along furrow bottoms, causing erosion on sloped areas of fields



Observed benefits of restructuring the machinery

- Lower costs – selling high grade seed at the same price for 26 years, but with growing costs spiralling upwards, meant the previous system was unsustainable
- The subsoiling has reduced compaction and noticeably helped rooting depth and improved drainage in the following potato crop
- The new, wider bed system has reduced tyre compression damage on the side of the ridge which in turn has reduced the amount of clod entering the harvester as well as reducing the number of green tubers

Comment

The potato crop can root to at least 70cm depth, but even a small amount of compaction can halve its vertical daily growth rate. Compaction decreases efficiency of use within the potato crop of soil water, which means more irrigation and fertiliser will be needed and there will be more surface run-off and soil erosion. This has consequences for loss of fertile top soil and loss of important nutrients including phosphate. Eroded soil particles become sediment particles that move from the land towards river systems. These fine grained sediments which are rich in organic carbon together with the 'active' fraction of soil organic matter are important for retaining structural stability in the soil. There are plenty of cases of businesses that have restructured to become more sustainable. Here the opportunity has also been taken to ensure the machinery is a better fit for the farm's soils. The result is a farming system that is more sustainable, with additional business benefits. Eric Anderson (Scottish Agronomy Ltd)

Current soil strategy

- Under a new contract farming agreement 170 and 190hp tractors are now used
- New machinery purchased under the agreement means bed width has been widened from 1.6m to 1.8m, allowing more space for the large radial tyres on the more powerful tractors
- A three-legged Kverneland subsoiler is now used after the preceding winter wheat crop to alleviate the indurated layer and/or compaction caused by previous machinery operations
- Ploughing takes place in late March when the ground is dry enough, followed by a pass with a Kverneland cultivator
- Deep ridging is done as soon as possible to 35cm while bed-tilling is only used when the soil has too high a clay content or when the operation is justified
- Headlands are left unplanted as this retains soil structure better and reduces tuber damage at harvest





Farm facts

Name: **Tim Pratt**

Location: **J H Kemball & Son, Wantisden Hall Farm, Woodbridge, Suffolk**

Farm size: **650ha + two rented farms**

Enterprise mix: **Potatoes, onions, carrots, barley, sweet corn, sugarbeet, triticale**

Soil type: **Fine sand/sandy loam/sandy clay loam**

"We've used nature to help tackle the wind erosion problem. This complements the farm's environmental programme. We aim to keep field sizes to 20-25 acres and have found hedges make valuable wind barriers – we have recently established nearly four miles of hedgerow." *Tim Pratt*

Background

- The farm has very fine sandy soil that can become airborne in the slightest wind if not stabilised
- Potato drills can be completely eroded and the furrows levelled off from wind-blown top soil
- Establishing onion crops from seed is difficult because wind erodes the seed bed – the slow rate of growth of onion seed means no crop cover for a long period of time
- It is common for roads in the area to be blocked by wind-blown soil
- The soil has a tendency to compact below plough depth and forms deeper pans at around 45cm
- The deeper pan is caused by iron pan formation – accumulation of iron compounds in a soil horizon due to water movements which form a chemical bond, alter soil structure and can impede water flow
- The texture of the soil results in very low water-holding capacity – any degree of compaction would significantly reduce water availability and crop growth
- The farm is in the Environmental Stewardship scheme, within a Nitrate Vulnerable Zone and contains a Site of Special Scientific Interest (SSSI)

Observed benefits of control measures

- Without the substantial measures taken to address wind erosion, many crops would fail, leading to further erosion
- Intermediate cover crops not only help reduce soil erosion from the wind, they also take up any remaining nutrients and increase organic matter
- The use of deep-ripper tines keeps both man-made compaction from machinery and naturally-occurring compaction from chemical bonding in check
- Ploughing is carried out with tractor wheels on-top of the soil surface rather than in the base of the furrow, this has further reduced compaction problems

Comment

The farm is managing the wind erosion problem well using natural controls which capitalise on the farm's environmental assets. These are combined with agronomic factors, such as fleece, floating plastic and using soil stickers, and protective crops planted when soils are most vulnerable. This approach of ensuring modern arable farming methods are in keeping with management of wildlife habitats is both progressive and sustainable. Fraser Milne (consultant)

Current soil strategy

- Field size is kept small to reduce large open areas – most fields are only 8 to 10ha
- Wind breaks have been planted so that every field is enclosed by trees and/or hedges
- Fields have grass margins and additional grassed areas along boundaries where the soil is not as suitable for cropping
- Establishing a cover crop on all ground ensures no land is left bare
 - Cover crops tried include buckwheat, mustard, phacelia, vetch, trefoil and sweet clover
 - Barley is sown between the carrot crop rows, which establishes quicker and stabilises the soil
 - Once the carrots are a reasonable size the barley is sprayed out
- Previous crop to potatoes is usually barley
- Straw from the barley crop is either chopped or converted to farmyard manure (FYM) to help increase organic matter
- The field is then subsoiled straight after harvest to a depth of 50-53cm
- Combined with the subsoiler is a soil-packer to close the ruptured surface and leave it level and consolidated to reduce wind-blown soil
- The stubble is then left over winter and ploughed just before planting
- After planting, the fields most vulnerable to erosion are covered with fleece
- When irrigation starts a central bed is uncovered to take the rain-gun trolley
- Soil stickers are used with some crops to help reduce soil wind erosion after sowing
- After potato harvest the fields are subsoiled to around 46cm
- A soil penetrometer is used to monitor soil compaction and understand where compaction is occurring. This allows mitigation and remedial cultivations to be planned
- Potatoes are harvested from mid-May to September, with most crops sold loose-skinned, which avoids the need for defoliation and soil left vulnerable to erosion
- Irrigation by rain gun is scheduled, with a strict policy of 15mm maximum application per pass to minimise erosion risk