Seasonal Water Management for Potatoes
Introduction

This document summarises the latest research findings and recommendations for efficient seasonal water management for potatoes based on AHDB-funded research projects (R448, R445, R406 and R263). The work was carried out by Dr Mark Stalham and the team at NIAB CUF. The full reports and technical briefings can be found at potatoes.ahdb.org.uk.

Early-season irrigation is an effective control measure against common scab.

Over-watering can cause growth cracks, reduce yield and could damage the environment.

Late-season irrigation management can reduce bruising and secondary growth.

Maintaining the correct and consistent soil moisture throughout the growing season is a key factor in producing high-yielding, quality potato crops. Water-stressed plants are much more susceptible to disease and pest problems than plants that have a consistent supply.

This document covers early and late-season water management along with the damaging effects of over-watering. Use it to improve your business’ profitability and compliance with evolving environmental regulation by:

• Improving marketable yield;
• Increasing water use efficiency;
• Reducing nutrient (particularly nitrogen), soil and water loss.

Background

Climate change, pressure for sustainable production and changes to the water abstraction licensing system makes efficient water management increasingly important. Most potatoes are grown on lighter sandy and loamy soils and potatoes currently account for 54% of the irrigation volume applied in England and Wales.1
Common irrigation methods

“In the UK, well-timed and evenly-distributed water applied at 3 to 7-day intervals is as beneficial to the crop as daily irrigation and offers potential water savings and reduced drainage losses.”

DR MARK STALHAM
NIAB CUF

Overhead rain guns

These are the main method of application and are cheap and versatile. 76% of irrigated water by volume is applied with a hose reel and rain gun. They can be efficient but are prone to uneven application. This can lead to over-watering in some areas, so ensure water gets to all parts of the field.

Boom irrigation

Improves uniformity of water application, especially for scab control, boom irrigation can be restricted due to topography, layout, ‘field furniture’ and soil type. High application rates can lead to run-off, soil slumping and ridge erosion.

Sprinkler systems

Ideal for reducing the labour requirement during the season offering improved uniformity and the ability to apply small doses frequently, but capital costs are higher.

Drip irrigation

A more costly option but it can be highly effective, applying water uniformly across large areas, if the pipe and emitter spacing are appropriate and the soil conditions are right. Its operation needs careful management, including use of probes to measure soil water.
Early-season water management and common scab

Common scab is caused by *Streptomyces scabiei* and other pathogenic *Streptomyces* species that are widely distributed in most soils. Infection with common scab leads to rejection causing significant reduction in value, particularly in crops where skin appearance is important. Research has determined the optimum soil moisture deficit to control common scab in different varieties (see below).

**Table 1. Maximum soil moisture deficit (SMD, mm) for common scab control in different groups of varieties**

<table>
<thead>
<tr>
<th>Group</th>
<th>1. Susceptible</th>
<th>2. Intermediate</th>
<th>3. Resistant</th>
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<table>
<thead>
<tr>
<th>Soil texture</th>
<th>Maximum Soil Moisture Deficit (mm)</th>
</tr>
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<tbody>
<tr>
<td>Sand</td>
<td>9.8</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>12.0</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>13.4</td>
</tr>
<tr>
<td>Sandy Silt Loam</td>
<td>14.4</td>
</tr>
<tr>
<td>Silt Loam</td>
<td>16.3</td>
</tr>
<tr>
<td>Clay Loam/Clay‡</td>
<td>14.3</td>
</tr>
</tbody>
</table>

**Notes:**
- Soil moisture deficit for top 25cm of ridge within a stone-free ridge profile
- †Marabel and Safari: tentative
- ‡Excessively cloddy soils may need to be maintained at a smaller SMD
Seasonal Water Management for Potatoes

Getting ready
- Carefully manage seed preplanting as well as planting depth and agronomy to ensure an even emergence.
- Avoid over-cultivating and compacting soils at planting.
- Monitor SMD from immediately after planting. Use a recognised scheduling system and/or moisture probes. But always check the ridge with a spade to ensure water is penetrating the whole ridge profile.
- Assess the soil type and know the variety susceptibility. Prioritise your plans to avoid falling behind schedule.

Starting the control regime
- Assess earliest emerging plants for signs of tuber initiation (TI). (Picture below left).
- If growing Maris Piper then start irrigating as soon as TI is observed.
- For other less susceptible varieties then a short delay (1 week) can be tolerated.
- Keep the top 25 cm of soil moist during this period. But not all varieties or soil types have the same requirement. Refer to Table 1.
- Apply water evenly and accurately. Measure what you apply.
- In situations where scab control is less critical (processing crops for example) the critical phase for disease control is during weeks 2 and 3 after tuber initiation.

How long for?
- For Maris Piper, with a typical commercial emergence period irrigate for 31 days after start of TI at the appropriate SMDs from Table 1.
- Maintain moderate soil moisture deficits [19mm (sand) to 31mm (silt loam)] for 3-4 weeks after TI in scab-resistant main crop varieties.
- Potato varieties for the salad market are at risk from common scab infection for much longer than main crops owing to the small size of tubers. Six weeks’ scab control is sufficient, even in varieties such as Maris Peer or Charlotte and, as short as four to five weeks in more resistant varieties like Perline or Regina.
- Avoid over-watering soils during the scab control period, particularly in the first week after TI. Excessive irrigation, or soils kept above field capacity for substantial periods during the control phase, can aggravate other disease problems and impede root growth, leaving the crop more susceptible to drought later in the season.
- Uneven or protracted emergence lengthens the control period required. This increases costs, water use and risks higher levels of scab. Seed management, soil cultivation, planting and agronomy can all increase crop uniformity and improve scab control.

Common scab control: Key points

Effect of irrigation regime on common scab severity in Maris Piper

<table>
<thead>
<tr>
<th>Unirrigated</th>
<th>Irrigated every 4-6 days for 4 weeks post - TI</th>
<th>Irrigated daily for 4 weeks post - TI</th>
</tr>
</thead>
</table>

Tuber initiation (TI) where stolon ends swell to twice the width of the stolon (circled)

Picture courtesy of Dr. Mark Stalham

DR PHILIP BURGESS, AHDB POTATOES
Over-watering and waterlogging

Over-watering is applying more water than the crop needs and can be highly detrimental to quality and yield, slowing plant growth through lack of oxygen supply for root respiration. Fear of common scab and increased irrigation to compensate, along with poor distribution of water by equipment, leads to an increased risk of over-watering.

AHDB Potatoes project R448 has shown that the longer soil remains above field capacity (as a result of too frequent watering, poor drainage or irrigation run-off to low lying areas) generally the worse the incidence of cracking.

In some varieties where soils are kept very wet, or maintained above field capacity for prolonged periods, tuber cracking can increase considerably. Plants with an active rooting system can take up extra water, making tubers very turgid and susceptible to cracking.

"Applying too much water can result in growth cracks, lenticel eruption, internal rust spot as well as tuber diseases, such as blackleg and powdery scab. Over-watering may also cause environmental problems such as nitrogen leaching and run-off."

JENNY BASHFORD, AHDB POTATOES

Table 2: Risk table for external tuber cracking resulting from over-watering. Varieties in Group 1 are ranked by decreasing risk. Groups 2 and 3 in alphabetical order. Safari is the greatest risk.

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<thead>
<tr>
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<tbody>
<tr>
<td>Safari</td>
<td>Estima</td>
<td>Vales Sovereign</td>
<td>Melody</td>
</tr>
<tr>
<td>Orchestra</td>
<td>Nectar</td>
<td>Maris Peer</td>
<td>Volare</td>
</tr>
<tr>
<td>Desiree</td>
<td>Elfe</td>
<td>Exquisa</td>
<td>Marabel</td>
</tr>
<tr>
<td>Perline</td>
<td>Regina</td>
<td>Venezia</td>
<td>Vivaldi</td>
</tr>
</tbody>
</table>

Over-watering

Avoid over-watering and maintaining the soil above field capacity through too frequent watering, poor drainage or irrigation run-off to low lying areas, because it:

- Increases the incidence of tuber cracking and rotting diseases.
- Reduces nitrogen uptake.
- Promotes early senescence and yield loss in some varieties.
- Increases the risk of run-off.
- Wastes water.
Late-season water management
For control of bruising, secondary growth and skinset

Late-season water management, as the crop begins to senesce, is the essential final phase in an efficient irrigation regime. Yield, bruising susceptibility and secondary growth can all be affected at this time.

The objective late in the season is to keep the tubers turgid, maintain full yield potential and provide some insurance against wet weather late in the season. Crops allowed to accumulate high SMDs prior to defoliation can cause tubers to become dehydrated. The damage this may cause to cell structures can increase the risk of bruising.

If soils are too wet rotting diseases, lenticel disruption and reduced dry matter accumulation can result. However, switching off irrigation leaving the crop to survive on soil reserves alone during dry periods can be equally detrimental.

Irrigating late in the growing season can reduce the risk of bruising only when the crop is actively growing. Transpiration rates decline with an aging canopy. Growers should therefore focus on monitoring SMDs leading up to desiccation not just irrigating immediately prior to lifting.

Skinset: Water, combined with nitrogen management, plays an important role. Correct nitrogen management should result in late season irrigation having little effect, but for crops defoliated prior to active senescence, water can still be taken up and this may slow skinset.

Late-season irrigation, desiccation and harvest

• Moderate SMDs close to the limiting deficit for yield (e.g. 34mm for sand, 45mm for sandy loams and 55mm for silt loam) should be maintained during August.

• After crops have senesced to less than 50% ground cover, there is little benefit (in yield or quality) in continuing irrigation. However, if senescence is variable in the field, best practice would be to irrigate the whole field to reduce the risk of bruising and accept some over-watering of areas where the crop is dead.

• To avoid bruising, avoid desiccating or flailing following a hot, dry period unless soil has been maintained in a wet status. Following very hot days, it is better to defoliate on the following morning.

• Rapid defoliation (mechanical) of actively growing canopies can result in significantly increased bruising, particularly if the crop has been previously irrigated and then allowed to dry out prior to defoliation.
Bruising and skinset

“Water is an increasingly expensive resource and we must all ensure we make best use of what is available. Understanding specific variety requirements to optimise marketable yield and quality is essential which firstly requires accurate and effective irrigation scheduling.”

TONY BAMBRIDGE, MANAGING DIRECTOR, B & C FARMING LTD

“Irrigation is often applied immediately prior to harvest during dry conditions to soften clods and ridges or improve soil cushioning. But there is little evidence to support the view that a single irrigation event immediately prior to defoliation reduces bruising susceptibility.”

DR MARK STALHAM

Further Reading

R448. Common Scab Control. potatoes.ahdb.org.uk/publications/r448-common-scab-control

R445. Late Season Water Management. potatoes.ahdb.org.uk/publications/r445-late-season-water-management


R263. Management of Tuber Water Status to Reduce Bruising. potatoes.ahdb.org.uk/publications/r263-management-tuber-water-status-reduce-bruising

Technical Notes:

• Over-watering
• Early season irrigation technical note

Best practice: Irrigation and water use best practice guide for potatoes.
Can all be found at: http://potatoes.ahdb.org.uk/agronomy/water

References


For more information contact:

Jenny Bashford
Technical Executive
jenny.bashford@ahdb.org.uk
07500 100 715

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