

Seasonal water management for potatoes



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Introduction

Maintaining consistent soil moisture throughout the growing season is a key factor in producing high-yielding, quality potato crops.

This guide summarises the latest research findings and recommendations for efficient seasonal water management for potatoes, based on AHDB-funded research projects and work conducted at SPot Farms. The work was carried out by Dr Mark Stalham of NIAB CUF.

Seasonal water management for potatoes aims to:

- Improve marketable yield
- Maximise quality and reduce defects
- Increase water use efficiency
- Reduce nutrient (particularly nitrogen), soil and water loss

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

Overwatering can cause growth cracks, reduce yield and damage the environment.

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



Dr Mark Stalham
NIAB CUF

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

Early season water management

The main driver for early season irrigation in the UK has been tuber quality, and levels of tolerance for common scab in both the pre-pack and processing sectors have declined markedly. Common scab is caused by *Streptomyces scabiei* and other pathogenic *Streptomyces* species that are widely distributed in most soils.

“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

Soil texture	Varietal scheduling group			
	1. V. susceptible	2. Susceptible	3. Intermediate	4. Resistant
	Maris Piper (1) Maris Peer (5)	Charlotte (4) Desiree (4) Leontine Marabel Nectar (4) Red Fantasy Rooster (6) Safari (4) Saxon (5) Venezia (3) Vivaldi (5)	Bute (4) Estima (6) Exquisa Flair Juliette (7) King Edward (7) Melody (7) Soraya Sylvana (7)	Electra (8) Elfe Jelly (6) Lanorma (7) Orchestra (8) Perline Regina Vales Sovereign (7) Volare (5)
	Maximum soil moisture deficit (mm)†			
Sand	9.8	12.7	15.6	18.8
Loamy sand	12.0	15.9	19.3	23.1
Sandy loam	13.4	17.8	21.5	25.8
Sandy silt loam	14.4	19.0	23.0	27.7
Silt loam	16.3	21.5	26.2	31.4
Clay loam/clay‡	14.4	19.0	23.1	27.7

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

Notes: Values in brackets relate to common scab resistance in AHDB Potato Variety Database, where 1 = most susceptible and 8 = most resistant

†Soil moisture deficit for top 25cm of stone-free ridge profile

‡Excessively cloddy soils will need to be maintained at a smaller SMD

Common scab control: key points

Preparation

- Manage the seed planting depth and agronomy to ensure an even emergence. Often, poor scab control in irrigated fields is a result of incorrect timing (start date and frequency of irrigation) and variable emergence, which delays the end of scab control
- Avoid over-cultivating and compacting soils at planting. Excessively fine seedbeds can impede drainage and lead to increased risk of waterlogging and do not result in better control of scab
- Monitor SMD from immediately after planting. Use a recognised scheduling system and/or moisture probe
- Assess the soil type and know the variety susceptibility (Figure 1). Prioritise your plans to avoid falling behind schedule



Figure 2. Tuber initiation (TI) is defined as stolon ends swelling to twice the width of the stolon



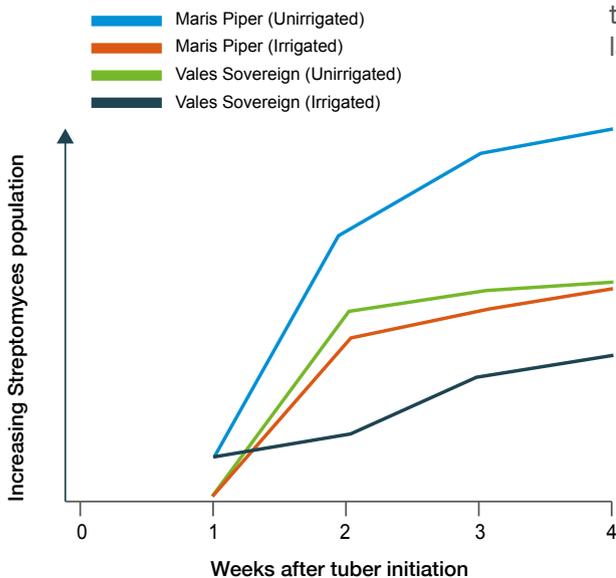
Figure 3. Common scab

Starting the control regime

- Assess earliest emerging plants for signs of tuber initiation (TI)
- If growing susceptible (Group 1; Figure 1) varieties, start irrigating when TI starts and aim to bring the ridge or bed back to field capacity
- For resistant (Group 4) varieties, a short delay (one week) can be tolerated
- Keep the top 25cm of soil moist during this period. Always check with a spade to ensure water is wetting the ridge or bed around all tubers. Repeat application may be needed within two to four days
- Refer to Figure 1 for maximum SMD for different soil types
- Apply water evenly and accurately; measure what you apply
- Pre-irrigation: infiltration is often poor when irrigation commences and watering should begin no more than one to two days before the initial irrigation is due
- If using drip irrigation, avoid watering for too long at each application and ensure the system is fully operational before TI
- The critical period for control is between one and three weeks after TI. This is useful for susceptible processing varieties and where irrigation capacity is limited

How long for?

- For Maris Piper, with a typical commercial emergence period, 31 days after start of TI
- Maintain the correct SMDs for varieties and soil types (see Figure 1) for three to four weeks after TI
- Potato varieties for the salad market are at risk from common scab infection for much longer owing to the small size of tubers. Scab control for six weeks is sufficient, even in susceptible Group 1/2 varieties such as Maris Peer or Charlotte and as short as four to five weeks in more resistant Group 3/4 varieties such as Perline, Regina or Juliette
- Ceasing irrigation two weeks after TI allows pathogens to multiply rapidly and can increase scab infection unless rain falls
- Avoid overwatering soils during the scab control period, particularly in the first week after TI. Excessive irrigation or soils kept above field capacity for substantial periods 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 and water use, and risks higher levels of scab. Good seed management, soil cultivation, planting depth and agronomy can all increase crop uniformity and improve scab control
- The allowable SMD during the scab control period can be increased to one suitable for preventing yield loss (eg 30mm in sands, 50mm in silty or clay soils) immediately after the period is over. Unless over-watered, there is little evidence that frequent irrigation makes the crop more susceptible to drought later in the season



Pathogenic *Streptomyces* populations increase rapidly between one and two weeks after TI but are suppressed by irrigation. There is less response to irrigation in resistant varieties (eg Vales Sovereign), compared with susceptible varieties (eg Maris Piper).

Figure 4. Effect of irrigation on pathogenic *Streptomyces* populations

Irrigation methods

Overhead rain guns are the main method of application and are cheap and versatile. They can be efficient, but are prone to uneven application, which can lead to over-watering in some areas. They need correct management of pressure, nozzle size and gun angle to account for variable application conditions.



Boom irrigation improves uniformity of water application, especially for scab control, but use 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 reduce the labour requirement during the season and offer improved uniformity and the ability to apply small doses frequently, but capital costs are higher. Sensitive soils are protected from structural damage.



Drip irrigation is more costly, but can be highly effective, applying water uniformly across large areas, if the pipe and emitter spacing are appropriate for the soil texture. Its operation needs careful management, including use of probes to measure soil water. It is possible to use less than one line per row with heavier soils, which can improve irrigation efficiency by up to 32 per cent.

Over-watering and waterlogging

Over-watering is applying more water than the soil will absorb or 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, poor distribution of water from equipment and bruising lead to an increased risk of over-watering.

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

"Applying too much water to crops can be just as detrimental as not enough. As well as risking crop damage such as cracking, there can be environmental impacts such as run-off and wasted valuable resource".

Over-watering

- 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 and wastes water

In some varieties where soils are kept very wet, or maintained above field capacity for different periods, tuber cracking can increase considerably (Figure 5).



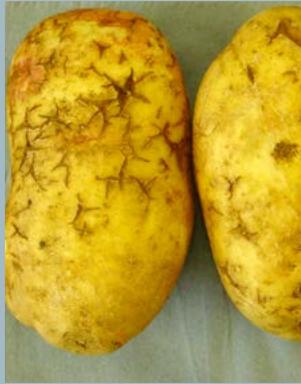
Andrew Francis
Senior Farm Manager
Elveden Farms Ltd



Linear cracking tends to be worse when watering in excess of field capacity at the start of TI and early in the scab control period. Tubers 'burst' owing to high turgidity and a weak periderm and cortex.



Superficial cracking, centred on lenticels, is increased the longer the period(s) of excessive soil moisture during the season.



Late over-watering (usually resulting from intense or prolonged late summer rainfall events rather than irrigation) generally has relatively little effect on crop growth and quality.



Group		
1. High risk	2. Moderate risk	3. Low risk
Safari	Electra	Charlotte
Estima	Flair	Desiree
Vales Sovereign	Jelly	Elfe
Bute	Juliette	Exquisa
Melody	King Edward	Leontine
Orchestra	Maris Peer	Marabel
Nectar	Rooster	Perline
Maris Piper	Saxon	Red Fantasy
Lanorma	Soraya	Regina
Sylvana	Volare	Venezia
		Vivaldi

Figure 5. Risk table for external tuber cracking resulting from over-watering. Group 1 listed by decreasing risk

Late-season water management

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 and increase the risk of bruising.

If soils are too wet, rotting diseases, lenticel eruption 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, but only where the crop is actively growing. Transpiration rates decline with an aging canopy.

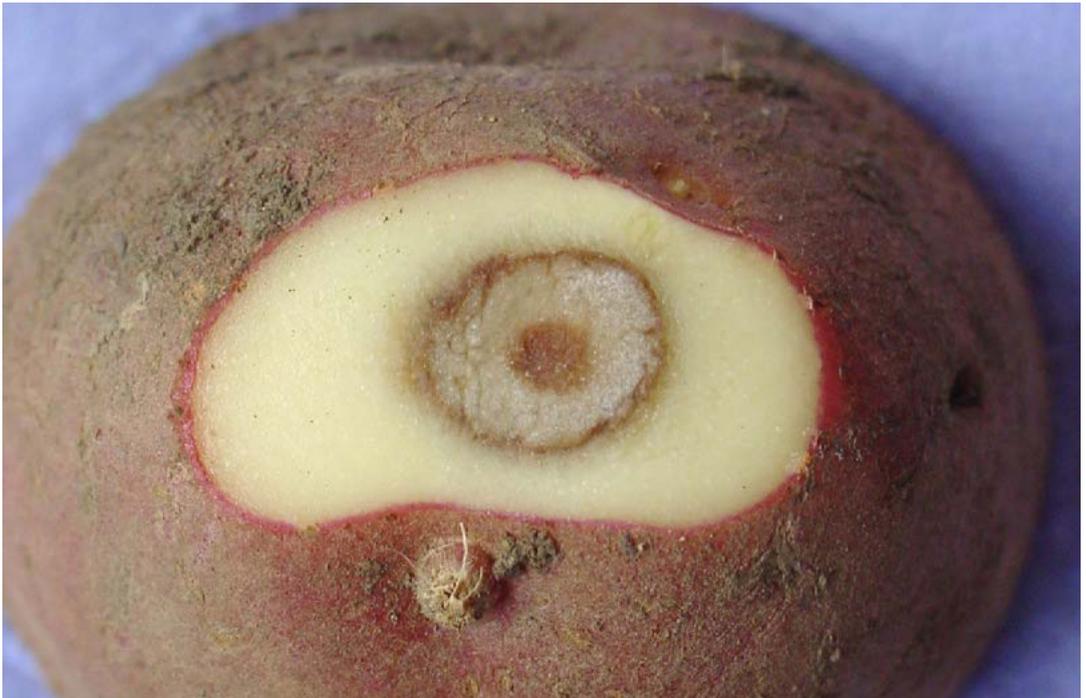
Growers should, therefore, focus on monitoring SMDs leading up to desiccation, rather than irrigating immediately prior to desiccation and/or lifting.

Water, combined with nitrogen management, plays an important role in skinset. 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

- Continue monitoring SMDs leading up to desiccation and harvest
- Maintain moderate SMDs during August, close to the limiting SMD for yield (eg 35mm for sand, 45mm for sandy loams, 55mm for silty loams)
- After crops have senesced to less than 50 per cent 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 where the crop is dead
- To reduce bruising, avoid desiccating or flailing following a hot or 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 increasing bruising, particularly if the crop has been previously irrigated and then allowed to dry out prior to defoliation



Further reading

The following full reports can all be found in the publications section on the AHDB Potatoes website:

R459 Improving cultivation practices in potatoes

potatoes.ahdb.org.uk/publications/r459-improving-cultivation-practices-potatoes

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

R406 Water use efficiency through soil and plant water balance

potatoes.ahdb.org.uk/publications/r406-water-use-efficiency-through-soil-and-plant-water-balance

R263 Management of tuber water status to reduce bruising

potatoes.ahdb.org.uk/publications/r263-management-tuber-water-status-reduce-bruising

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