

Brackish water for irrigation

“The salinity of soil water can affect the physical properties of soil.”

Roots Potato agronomy

Initial findings from a farm trial in Lincolnshire suggest there may be scope to irrigate potatoes with slightly saline (brackish) water without compromising yield or quality. CPM finds out more.

**By Paul Spackman
and Rob Jones**

An AHDB-funded Innovative Farmers (IF) project was set up last January after members of the Nene Potatoes grower group in the Holbeach Marsh area wanted more information about using brackish water to help alleviate pressure on limited freshwater supplies for irrigation.

In parts of South Lincolnshire, the only available irrigation water is from ditches which is slightly saline, even in winter, given the low-lying nature of the land. As sea levels rise, salinity poses an increasing risk to freshwater supplies in areas like this, which makes it doubly important to understand how brackish water affects potatoes along with any lasting effects it may have on soil.

“We know that applying saline water overhead can cause leaf scorch and impact on yields, but very little research has been done in the UK,” says the University of Lincoln’s Dr Iain Gould, who was research lead on the project alongside technical specialists, including Dr John Keer of Richard Austin Agriculture.

Salt accumulation

“We also know that salt accumulation in soils can cause structural damage over time. But most research into the effects of salinity has been conducted in arid countries where salt accumulates more readily, so we need to see if the UK’s higher rainfall has more of a ‘flushing effect’ that overcomes this,” adds Iain.

The IF Field Lab trial was hosted by GH Hoyles in South Lincolnshire on silty loam land that sits around 2m below sea level. Water of three different salinity contents was applied to replicated plots of Maris Piper, using a conventional drip irrigation system to avoid scorching the canopy.

Salt contents ranged from 950ppm in the ‘low’ salinity water, representative of the farm’s reservoir, through to 2000ppm in the mid-range, and 4000ppm in the highest salinity treatment. For comparison, tap water is around 380ppm, while seawater is nearer 35,000ppm.

Additionally, other plots received the low salinity water through an overhead irrigation

system and there were also unirrigated plots for comparison. Around 80mm of water was applied to the potato crop over the season.

Haulm vigour, yield, tuber quality, soil structure and soil biological respiration were all assessed, while soil probes monitored temperature, moisture and salinity at regular 10cm intervals through the profile.

Overall, the use of brackish water up to 4000ppm salinity had no significant effect on haulm vigour, yield or quality of potatoes grown in the trials last season, indicating that it could be a potential to supplement



Drip irrigation systems offer the potential to safely apply slightly saline water to potato crops, says John Keer.



Iain Gould says that more work needs to be done to make sure that structural damage doesn't occur to soils over time due to the salinity of irrigation water.

irrigation supplies in future seasons.

Drip irrigation systems offer the potential to safely apply this slightly saline water, which could help growers reduce future costs by extracting brackish water from ditches, believes John Keer.

"The past five years have seen some really dry winters where people haven't been able to fill reservoirs with good quality freshwater. These findings give us the confidence to top up reservoirs with slightly salty water without compromising scab control, yield or quality," he says.

In the Field Lab, common scab was controlled well in all the irrigated plots, with typically less than 3% of tuber surface area affected, compared with nearer 6% in the non-irrigated plots. There was no significant difference in black dot incidence or in skin brightness across the treatments.

Reduced infiltration

But Iain points out there were periods of heavy rain during the 2020 growing season which could have influenced results. There were also signs of reduced infiltration and slight compaction at depth (at around 35cm) in the higher salinity plots, although further soil assessments are planned this spring to determine if this is a lasting structural impact that needs rectifying with deep subsoiling or other measures.

More work is also needed to determine the longer-term impacts on soil microbiology as slight differences in soil respiration (an indication of soil biological activity) were observed between the low salinity overhead irrigation and the lowest salinity drip treatments.

John is keen to repeat the work in future seasons, potentially including water of even higher salinity applied through both drip and overhead systems to gauge the effect on crop growth and soil structure.

It would also be worth repeating the work



Overhead application of saline water can cause scorch to the foliage but this can be mitigated by laying drip irrigation.

in drier years where more irrigation water is required, to give a clearer picture for those considering changing practice, he believes.

"The salinity of soil water can affect the physical properties of soil by causing dispersion of soil aggregates, potentially resulting in reduced infiltration and tighter/compacted soil. Soils with weaker natural structure and fine particles are therefore at greater risk of developing salt-related structural issues," he explains.

Heavy clays tend to have a more resilient ►

Picking the right herbicide strategy

Despite several high-profile product withdrawals in recent years, excellent levels of early season weed control in potatoes can still be achieved by choosing the right mix of chemicals, says Agrovista agronomist Ross Barton.

Ross, who advises on over 500ha of potatoes across Shropshire, Staffordshire, Cheshire and North Wales, sees Soletto (metobromuron) and metribuzin as his key 'go to' residual herbicides, with the relative newcomer Emerger (aclonifen) proving to be an effective partner for fields with very high weed burdens.

"After analysing the weed spectrum, soil type and the variety being grown there is rarely a standard programme to cover all situations. The key is to utilise all the actives at your disposal and put crop safety and flexibility at the forefront of programmes. In Soletto and Emerger there are now two pre-emergence options that offer effective solutions. Both have no soil type or varietal restrictions so building programmes around them is a good starting point.

"Soletto is very active in soil and is an

excellent partner to other actives, such as metribuzin and prosulfocarb. Emerger is also an effective tank-mix partner offering additional control of polygonum weeds in tough situations," he comments.

Looking back to the dry spring last year, Ross believes that applying residual herbicides early and at high dose rates before a contact herbicide is applied is important when dealing with some of the unusual weather patterns the UK has experienced in recent years.

"With the potential for sudden and extreme weather fluctuations I advise getting residuals on as early as possible — normally 7-10 days after planting. Then wait as late as possible before applying a contact herbicide as a separate spray just before the ridges crack. Separating the two enables better overall risk management," he believes.

"The combination of Soletto and metribuzin worked extremely well in last year's dry conditions, but the varietal restrictions that come with metribuzin can be an issue and I wouldn't advise using it on coarse, sandy soils to avoid the potential for crop damage," he adds.

Ross sees Gozai (pyraflufen-ethyl) as a solid



Ross Barton emphasizes that residuals should be applied early – 7-10 days after planting.

choice for a contact herbicide — applied on its own at 0.4 l/ha, in no less than 200 l/ha of water with the addition of a methylated seed oil (MSO) to optimise results.

"If Gozai is applied at the right coverage levels with an MSO then there should be no requirement for a follow up, such as rimsulfuron, in over 80% of cases based on the extensive work I did with the active during 2019 and 2020," he comments.

► structure and higher cation exchange capacity (CEC), which gives more buffering capacity to any increases in salt content. However they are more prone to structural damage than free-draining sandy soils, which let salts wash through the profile more easily so prevents any

long-term build up, he explains. "The silty loam soil, where last season's trial was set up, was probably the highest risk scenario from a structural damage point of view. But it will be interesting to see if there's any lasting effect given that our winter rainfall should have a

significant flushing effect." Iain says increasing organic matter could help buffer soils against salinity by increasing the soil's CEC and by improving its structure, which in turn allows better natural drainage and increases the chances of salts washing out of the soil. www.innovativefarmers.org

Alternatives to metribuzin

Metribuzin has been a staple of potato weed control programmes and covers a broad spectrum of weeds. Scottish Agronomy's Eric Anderson says that achieving good weed control in situations where metribuzin can't be applied can be difficult and will almost certainly be more expensive.

Although there's some regulatory uncertainty hanging over metribuzin, the main concern is with variety sensitivity. While data on variety sensitivity is available, the role of soil texture in influencing its performance leaves some people apprehensive about its use, says Eric.

"Metribuzin tolerance, or lack of it, is often the first consideration when formulating a weed control programme. Without it, control is still achievable but is often more complex and potentially costly."

The loss of diquat ahead of the 2020 season forced a change in pre-em tactics. Eric explains that one of the issues was which contact herbicide to use — both carfentrazone-ethyl and pyraflufen-ethyl have limitations and product choices at the pre-em timing may also affect desiccation options later in the season.

"Some growers were unprepared for the necessity to bring herbicide applications forward. The first residual herbicide has to be made 7-10 days after planting — typically once ridges are settled. This can be sequenced with contact sprays, such as Gozai or Shark (carfentrazone-ethyl), which are restricted to no more than 10% crop emerged. Any later and crop growth will be seriously checked."

One consequence of this is to increase the pressure on the residual component of the herbicide programme, making it important to make the right herbicide choices. "The central issue is the weed spectrum to be controlled. Failure to understand the weeds present in the field will result in higher costs in the long-term," says Eric.

"On high organic matter skirt or fenland soils where the variety is approved for metribuzin, then it's a no-brainer. Metribuzin has a wide spectrum of activity including annual meadowgrass and many broadleaf weeds, so it should be incorporated into the top 10-15 cm of soil during the final cultivation with the rotary tiller (on this soil type).

"Applying Emerger pre-em will bolster control of small nettle, brassica weeds, fat-hen, orache, polygonum species, chickweed and black bindweed."

Soil moisture status is another consideration, he highlights. Emerger is a diphenyl-ether, which is taken up by the hypocotyls, cotyledons and coleoptiles of weeds. It's then translocated to the meristems causing bleaching and chlorosis of young shoot tissue as it develops. As such, it's less affected by dry soils than Defy (prosulfocarb) and this may influence application timing.

"Defy needs to go on later, typically as late as you dare and often as a standalone application. This has obvious cost implications and weed control in potatoes is already twice as expensive as it was two years ago," he adds.

In some situation Praxim (metobromuron) has a place in the programme but it may be more niche, believes Eric. "Emerger has the wider weed spectrum and is more cost effective, with better activity against fat hen, black-bindweed



Understanding the weeds likely to be present in fields and herbicide activity have become even more important to avoid unnecessary herbicide costs, says Eric Anderson.

and common field-speedwell, but both will require the addition of Defy (prosulfocarb) to bolster control of cleavers."

Pre-em herbicide performance

	Average weeds (per m ²)	Stomp Aqua (2 l/ha)	Defy (3 l/ha)	sencrox Flow (0.58 l/ha = 350g active/ha)	Gamit (0.15 l/ha)	Praxim (2.5 l/ha)	Artist (2 kg/ha)	Emerger (1.75 l/ha)		Emerger (1.75 l/ha) + Gamit (0.15 l/ha)	Emerger (1.75 l/ha) + Defy (3 l/ha)	Emerger (1.75 l/ha) + Praxim (2.5 l/ha)	Emerger (1.75 l/ha) + Stomp Aqua (2 l/ha)	Emerger (1.75 l/ha) + Artist (2 l/ha)
Spring Barley (2)	16	0	0	100	0	100	100	100		100	100	100	100	100
Cleavers	49	0	0	0	10	10	60	40		95	100	60	95	90
Redshank (2)	24	25	0	20	10	0	60	85		95	70	100	95	100
Black- Bindweed	5	20	20	50	0	0	50	90		90	100	100	100	100
Fat Hen	11	20	0	70	0	5	70	70		70	100	95	90	95
Cranesbill (2)	81	45	12	43	7	5	60	3		0	10	10	10	50
Poppy (2)	17	95	30	75	35	49	95	95		90	95	95	100	100
Chickweed	11	90	50	60	95	95	80	100		100	100	100	100	100
Creeping Thistle	30	10	0	70	0	5	80	80		90	90	90	90	98
Sow Thistle	34	20	0	40	30	20	50	20		70	80	95	20	95
Charlock (2)	28	10	5	63	5	55	84	83		90	80	90	70	90
Common F-Speedwell	70	100	85	100	80	0	100	90		80	90	98	95	100

]Trial conducted in dry conditions.
Source: NIAB-TAG weed screen, Cambs, 2020.