

IMPROVING PROFITS BY REDUCING SURFACE PONDING

“Crop loss due to surface ponding affects my profit and I want to do something about it.”

This sentiment is shared by many crop managers and growers who find that surface runoff arising from rainfall and irrigation is a universal issue affecting production. But just how big an issue can it be? And, what are some options for reducing the impact on your bottom line?

These are some of the questions the new industry-led ‘Holding It Together’ (HIT) project is addressing. This project sees Plant & Food Research and LandWISE working alongside growers to introduce management practices and technologies that have potential to reduce surface ponding, improve soil quality and make for better returns. The project is funded by MAF Sustainable Farming Fund, Fresh Vegetable Product Group, Potatoes NZ, Hawke’s Bay Regional Council, Horizons Regional Council, Auckland Regional Council, Environment Waikato and Ballance Agri-Nutrients.

Runoff is generated when the rate of water infiltration into the soil is slower than the application rate (of rain or irrigation). In some soils the natural rate of water infiltration is low due to texture, and in others it has been reduced due to frequent tillage or other management-induced constraints like compaction. Whatever the cause, runoff has to move somewhere, often into low-lying dips or to the edge of the field where it can pond for extended periods. It is this ponding that can be so damaging, as highlighted by observations last spring and summer in onion crops last in Horowhenua and Hawke’s Bay.

Working in four commercial fields, researchers identified areas where surface ponding was evident after rainfall and irrigation events. In each instance nearby areas of unponded row were also marked. At harvest, yield was determined in each area and the impact of ponding quantified. The results were alarming. Within a field, temporary ponding even for short periods suppressed crop growth and ultimately reduced onion yields. Yield loss in affected areas ranged from 60-80%, representing a substantial loss of productivity. In addition to lower total yields, ponding also reduced the proportion of yield that fell within the most profitable size range.

While the potential damage from localised ponding was clear, the overall impact on profitability was still heavily dependent on the cumulative area that was affected. However, the work showed that it doesn’t take much for the losses to stack up. For example, in one field there was a leaky pipe fitting that resulted in ponding damage during irrigation. This area was about 0.2 ha in size, and cost the grower \$1,700 in lost income. The cost of fixing the pipe was only about \$10.

In a separate field, a similar-sized area was affected by runoff and ponding during spring rainfall. The result was complete crop loss, totalling about \$3,500 in lost income.

While this work focused on the impact of surface ponding in onions, researcher Dr Paul Johnstone noted the results apply to other vegetable crops too. “Most crops do not like wet feet especially during germination, emergence and early growth. Surface ponding during these periods, often from heavy rain, can significantly affect establishment and final yield outcomes.”

In addition to loss of production and poor input efficiency, Dr Johnstone noted affected areas can be overrun with weeds and become ideal environments for soil-borne diseases to flourish. Also, readily mobile nutrients, such as nitrogen, are easily leached beyond shallow root



Surface ponding even for short periods can substantially reduce crop growth, and ultimately yield, at harvest.



In the worst scenario, there can be total crop loss in affected areas. Both areas cost the same to grow.



Soil quality is often poorer in areas that have ponded during the season. Aggregates are typically big and clumpy in these areas (left) compared to unponded areas (right).

zones, potentially resulting in deficiency. In the worst case, some crops require complete replanting which is costly and can result in supply delays.

In addition to crop impacts, the project also looked at the grower's greatest asset – their soil. Observations confirmed that soil condition in areas that have been subject to ponding is often poorer. In particular, aggregates tended to become big and clumpy, and soils heavily compacted. Often this was the result of the repeat and extreme wetting and drying cycles, and vehicle access for routine management before these areas had dried out sufficiently. Aggregate structure is central to a productive soil says Dr. Johnstone. When aggregation and structure collapse, soils become poorly drained and aerated, and access to nutrients and water restricted; all are counterproductive to high yielding crops. Good soil condition is difficult to restore so protecting what you've got is vitally important.

Nutrients and productive topsoil will also concentrate in ponded areas having moved with the surface runoff. For example, in ponded areas soil Olsen P levels were as much as 75% higher than adjacent unponded areas. Similarly, organic matter levels were higher too. This movement can contribute to significant variability and input inefficiency over time. All these issues complicate profitable and sustainable cropping.

Several growers have begun testing approaches to reduce surface runoff. One tool being tested is furrow diking. Small soil dikes, or dams, are formed in wheel tracks by equipment pulled behind a tractor. Controlling runoff largely eliminates the impacts of ponding on yield and on the soil. That means better returns on a per hectare basis.

Horowhenua grower John Clarke is among the testing group, along with others in Hawke's Bay and Pukekohe. He has seen firsthand just how effective the practice can be. In the past they've had ponding issues in low-lying areas of their fields. Crops in these affected areas look small and yield less. Where they tested the dikes last month there was no standing water after heavy rain, a major improvement.

Hawke's Bay grower Scott Lawson has been an advocate of diking for years. "There's a huge difference. It's part of our standard practice. We've found it eliminates our ponding damage and can reduce our disease incidence."

It's also possible growers will be able to harvest more rainfall with this approach.



Horowhenua grower John Clarke tests the furrow diking equipment at his Woodhaven Gardens operation (top). The outcome is a series of small soil dams in the wheel track that slow water movement (bottom).

The dikes hold water behind mini dams allowing a greater soaking time. This ensures more of the rainfall penetrates deeper into the soil. Harvesting rain is important in many regions, as there can be long periods between rains during the summer. While most crops are irrigated to some extent, making the most of what's free makes good economic sense.

But the project isn't confining its sights to mitigation approaches like diking. Longer-term initiatives that shift water more quickly away from the soil surface also have a central role to play. Scott Lawson notes that soils need to have good drainage: "It's the whole sustainability of farming operations we're trying to improve. This includes promoting good soil structure by building organic matter levels, reducing cultivation and working hard to eliminate compaction."

Field days will be held for growers where they can come together and discuss initiatives and ideas they have. Kathryn Davies, a rural officer with ARC says it's about finding solutions that

match challenges in each area. Councils are keen to support the industry to find solutions that offer win-win outcomes for growers and the environment.

Horticulture New Zealand Research & Innovation manager Dr Sonia Whiteman, who is directing the project, agrees it's about finding and adapting the right tool for the situation. "There is a real commitment within the industry to identify ways to improve the sustainability of current practices, including opportunities to increase the resilience and productivity of soils. This work is showing there is money to be made in controlling the controllable."

For more information on 'Holding It Together' projects or to be get involved in implementing some practices on-farm please contact Dr Sonia Whiteman, Research & Innovation manager, Horticulture New Zealand.

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