

**Check for understanding of key terms from this article:**

- bumper year
- amelioration
- non-wetting sands
- break crops
- crop emergence
- topsoil
- hard pan
- hectare
- spading
- mouldboard ploughing
- power harrowing
- tillage
- deep ripper

**Watch the GRDC Mouldboard Ploughing video:**

<https://youtu.be/Xf52ZemlY20?si=tOJsAjhvg7oz1Ew7>

## Stock Journal

### How Pinery growers are getting yield gains of 50-100pc on non-wetting sands

<https://www.stockjournal.com.au/story/9231985/pinery-farmer-aaron-cliffords-big-yield-gains-from-soil-amelioration-program/>

By Quinton McCallum *Stock Journal* April 27 2026



*Inspecting the soil, previously non-wetting sand, after a mouldboard plough pass is Aaron Clifford, Glencairn, Pinery. Picture by Quinton McCallum*

Patches of poor crop in an otherwise bumper year back in 2022 was the final straw for Aaron Clifford to take the plunge into an extensive soil amelioration program, which is a more familiar sight in the west than in SA. Aaron operates a straight cropping enterprise, Glencairn, with his father Trevor at Pinery on the Adelaide Plains. The farm, with a 350 millimetre annual rainfall average, consists of sandy limestone flats, and sandy rises with troublesome areas of non-wetting sands.

The Cliffords are growing Tomahawk and Calibre wheat and Commodus barley, with canola, lentils and vetch hay as break crops. In what was a record grain production year in SA in 2022-23, Aaron became fed up with inconsistent crop emergence and growth throughout the season.

**Discussion point:** What problems can inconsistent crop emergence cause?

"In 2022, which was our best year, we reaped a pretty poor crop of wheat on that non-wetting sand ground, which is across nearly every hill on the farm," he said. "After that, I thought something just had to be done and I made it my pet project." The non-wetting sands were that bad that Aaron had previously found treated grain that had not germinated for the entire season, despite average rainfall. The gutless sands would often not 'wet up' even after a 25mm rain event.

**Discussion points:** what does non-wetting sand look like? What makes some sands "non-wetting"? What happens when rain lands on non-wetting sand?

**Activity:** using non-wetting sand, explore its hydrophobic properties by dropping water on to its surface. Record the time taken for water to penetrate. Compare this to other soil types.

**Note:** if you cannot access non-wetting sand, you can convert ordinary sand into non-wetting by spraying with a water-proof spray such as *Scotchguard* or vegetable oil spray. Do this ahead of the session in a well-ventilated area.

While spading was a consideration, Aaron landed on mouldboard ploughing after researching work done in WA. His plan, to flip the topsoil and bury the non-wetting sand before deep ripping several years later to crack the hard pan. Aaron oversaw the first run of mouldboard ploughing in late April of 2023, employing Gary Hill of G Hill Contracting, Macarthur, Vic, who has extensive experience of mouldboard ploughing in the west. They started off with 80 hectares and Aaron was pleased with the results - even germination and consistent crop growth across the entire paddock, with no telltale signs of the non-wetting sand area. Mr Hill has been back and was at Glencairn last week ploughing another 150ha, bringing the total to 300ha since 2023.

**Discussion point:** why didn't Aaron mouldboard plough his whole farm straight away?

**Activity:** conduct a germination and emergence trial under different soil types including non-wetting sand. Compare the number of plants that emerge, their vigour and distribution across the trial area.

He and his tractor pull a ten-furrow reversible Overum mouldboard plough, working at a depth of 250-280mm and a speed of 9-10km/hr, and roughly 3.5-4 ha/hr. Aaron estimates they have picked up yield gains of 50-100 per cent on the worst of the non-wetting areas, a tonne a hectare and more of barley, while the less severe areas have witnessed 0.5t/ha yield gains.



*A one season to the next comparison of crop emergence from non-wetting sandy rises to flats, after mouldboard ploughing and power harrowing at Glencairn. Pictures supplied*

**Discussion point:** what differences can be seen in the images from before and after mouldboard ploughing?

The recipe to success also includes power harrowing following the ploughing program. Aaron has enlisted Logan Contracting for that secondary tillage job, which levels the seed bed. "The ground is pretty rough and soft after mouldboarding," he said.

**Discussion point:** what problems arise from a rough and soft soil surface?

"The first year I ran over it with a stoneroller to compact it and sowed it with our normal airseeder bar, but trying to get an even depth was really hard. "You're looking to level the soil off, but not mix it because you have your non-wetting sand buried. The power harrow throws dirt left and right, levels it off with a packer roller and on the back is a full seeding system, so he now sows for me. "I'll generally do 100 kilograms of Commodus barley, and he can get 20 hectares out of that, sowing on a four-inch spacing. "That doubles my cost, but I think it puts the icing on the cake. "What used to be my worst two paddocks on the farm are close to, if not the best, two paddocks on the farm."

**Discussion point:** how does mouldboard ploughing fit in with minimum tillage or no-tillage systems?

Aaron has had vetch germinate on 4-6mm rain events, a far cry from the sands that wouldn't wet up on an inch. He says the keys to success are only doing the ploughing when there is good moisture, preferably in mid to late April before soils cool down, and ensuring the ploughed country is quickly sown to provide cover and avoid significant erosion risk. "You lay awake at night for a little while (after ploughing) because it's so bare and prone to erosion," he said.

**Discussion point:** why is erosion risk such a concern?

"I sow with Commodus barley, I did sow some to wheat but I found that was slower - a week to a week and a half - to cover than the barley."

**Activity:** run a germination trial comparing the time taken for germination and emergence of different crop types and/or varieties to determine which one would be best to get quick coverage and erosion protection.

While the primary aim has been to bury non-wetting sand, Aaron says there has been two bonus benefits - weed seed burial and better chemical efficiency.



*An aerial view of the mouldboard plough in action. Picture supplied*



*The power harrowing process, which prepares the seedbed and sows the crop days after the mouldboard plough has been over. Picture supplied*

"We've seen a definite reduction in our melons, caltrop, and three corner jacks," he said.

**Discussion points:** what type of weeds are melons, caltrop and three corner jacks? What are the advantages in reducing these three weeds?

"A lot of our pre-emergent chemicals are moisture-activated and my dirtiest country on the farm is non-wetting sand purely because by the time it has wet up in June or July we can't control the ryegrass then because it's in crop and I think our chemicals do little when they land on the non-wetting sand. "I've found that our chemical chemistry is working so much better, because there's moisture in that soil now."

The biggest risk factors in the process are the erosion risk and machinery movement across the ground post-ploughing.

**Discussion point:** what issues does "machinery movement across the ground" create?

**Activity:** design a demonstration of the impact of machinery movement on different soil types or soil under different tillage systems. Can students create a method to measure soil impacts?

As for the financial equation, Aaron believes he can get the ploughing and harrowing cost returned within one to three years. The total process of mouldboard ploughing and power harrowing, including fuel and freight, costs \$400-\$450/ha.

"If grain's say \$300 a tonne, I think it pays for itself within one to three years," Aaron said.

"If I'm picking up 1t/ha it's nearly paid for itself in the first year."

**Activity:** show each of the steps of the calculation required to determine how long it will take for Aaron to cover the costs of the mouldboarding per hectare.

Do some "what if" calculations such as:

- What if grain prices increase?
- What if diesel prices increase?
- What if there is a dry season after the mouldboarding has been done and yields are reduced?
- What if there is a really wet season after the mouldboarding has been done and yields increase?



Gary Hill, G Hill Contracting, Macarthur, Vic, pulls the ten-furrow plough at 9-10 kilometres an hour, estimating he works 3.5-4 hectares of country an hour. Picture by Quinton McCallum

As for the longevity of the amelioration, Mr Hill said he's got clients in WA who are still seeing the benefits of mouldboard ploughing country 15 years on, and don't require a re-plough just yet.

"My plan now is to mouldboard the top, then two years later deep rip it," Aaron said. "I've just bought an AgrowPlow deep ripper set up on nine, 600mm deep, straight shanks on 380mm spacings. "I'm hoping to get 15 years out of the mouldboard ploughing, and would imagine I'll be deep ripping every five years."

**Discussion points:** what is the purpose of deep ripping? What issues might arise if Aaron didn't follow up with a deep rip?

**Hint:**

Mouldboard ploughing fixes the *surface problem* → buries water-repellent sand

Deep ripping fixes the *subsurface problem* → breaks compaction layers (hardpans)

**Discussion point:** is Aaron Clifford a scientist? In what ways is his use of mouldboard ploughing a scientific investigation? In what ways is it different?

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