Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

ACE FACT SHEET

SARDI Soil Amendment Investigations

Background

SARDI's soil amendment experiment at the Almond Centre of Excellence (ACE) was established in 2018. It remains the only Australian experiment demonstrating almond response to both pre-plant and annual repeat applications of organic matter to orchard soils. It was established using industry standard and newly developed varieties planted at traditional density (7 x 4.5 m) and incorporates twelve different amendment treatments that test almond response to the rate, timing and method of applying compost. The trial also demonstrates drip versus sprinkler irrigation and the 'Super-Soil' concept, where organic matter (ryegrass) was grown in-situ and incorporated into tree mounds prior to planting. The experiment has enabled additional investigations into the implications of soil amendments for carbon accumulation and nutrient availability.

Aim

To assess pre- and post-planting soil amendments for their potential in reducing constraints to root growth and improving almond productivity in line with sustainable practices.

Trial design*

Six replicates of twelve treatments – 2,304 trees / 7.4 ha

Compost rate	0, 10 and 50 t/ha
Compost timing	Pre-plant vs annual repeat
Compost application (depth)	Rotary hoe (100 mm), Spader (300 mm), Slurry injection (450 mm)
Super-Soil	Ryegrass mounds
Irrigation	Dripper vs Sprinkler
Varieties	Nonpareil, Vela, Carmel, Carina (25% each)
Rootstock	Garnem
Density	7 x 4.5 m (317 trees/ha)
Planted	2018

**Full treatment descriptions and methodology described in* Hort Innovation | Advanced production for temperate nut crops (various projects) (horticulture.com.au)

Results so far

Mounded 'Super-Soil' treatments have failed at ACE

The two 'Super-Soil' mounded treatments were quickest to show favourable changes to soil metrics (soil fertility, water infiltration, microbial activity and soil strength) Figure 3. However, these treatments were also found to be the least commercially practical due to the long lead-time between application of soil amendment and planting (requiring at least one season). Super-Soil plots were highly susceptible to tree blow-outs and produced difficult weed management and inefficient harvest operations. Fifth leaf cumulative yields from these plots were approximately 20% lower than those of other treatments.

Compost amendments improved soil condition

Higher rates of compost application (10 t/ha annual applications or 50 t/ha pre-planting) and the Super-Soil treatments had positive effects on multiple soil metrics:

- Increased carbon
- Reduced soil strength (improved friability)
- Greater microbiological activity
- Enhanced water infiltration
- Improved fertility

Measures were collected in 2021 (3rd leaf almond at ACE). Repeat measures scheduled for 2025/26 (8th leaf almond at ACE).

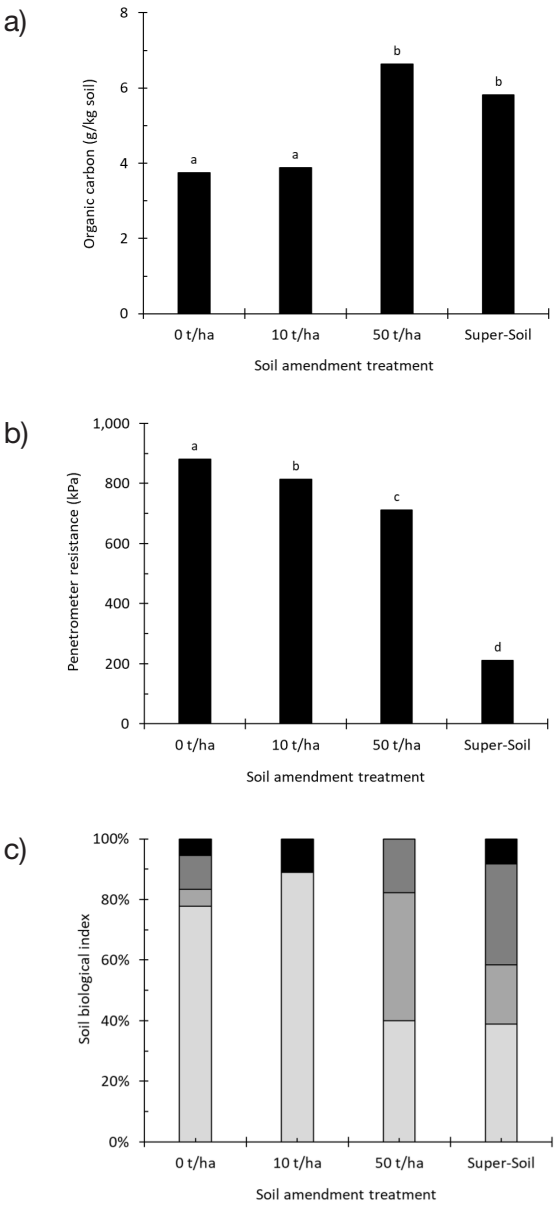


Figure 3 Impact of soil amendment on Soil Organic Carbon (a) Soil Strength (b) and oil Biological Health (c).

Compost amendments are yet to impact canopy size or yield

None of the compost application methods or application rates have produced consistently positive impacts upon canopy size or yield. To date (2023) the fifth leaf cumulative yields of all compost treatments have been equal to those of the zero-compost treatment (Table 1). Super-Soil plots have yielded approximately 20% lower than the zero-compost treatment. It is conceivable that early compost effects on yield have been overwhelmed by tree response to fertigation, and that positive yield effects may yet present through the coming years. Yield assessments will continue alongside soil and canopy measures through to 2026 (8th leaf) as part of Hort Innovation project AS22002.

Table 1 Effect of soil amendments on the cumulative kernel yields (t/ha) of fifth leaf almonds grafted to Garnem rootstock.

	Kernel yield (t/ha) – 5th leaf cumulative			
	Carmel	Nonpareil	Carina	Vela
Zero compost	Wind damaged (not measured)	4.3	7.7	9.9
Average of all compost treatments		4.4	8.2	9.4
Average of all Super-Soil treatments		3.6	6.2	7.8

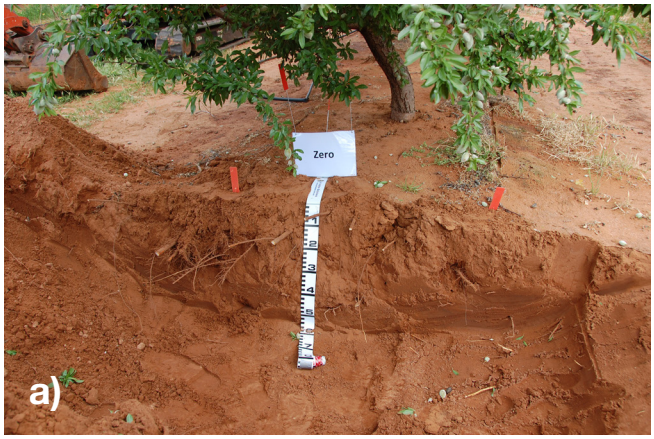
3rd leaf data was published in Hort Innovation | Advanced production for temperate nut crops (various projects) (horticulture.com.au)

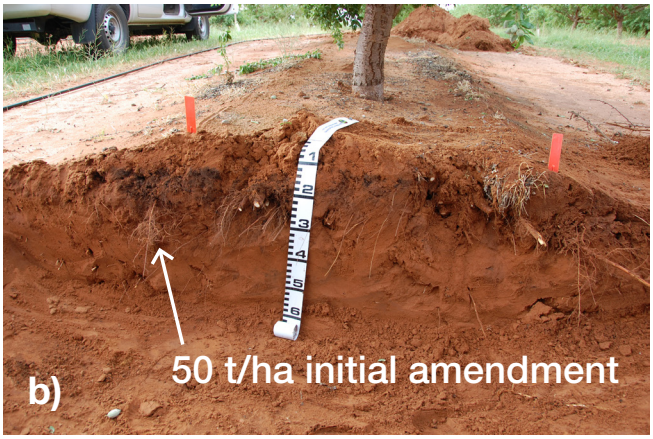
Ongoing investigations

Despite the apparent deficiencies of some treatments, all experimental units are being maintained through to season 2026 and include the annual repeat application of compost.

Together with ongoing yield assessments, the longer-term effects of compost on soil physical parameters such as moisture retention, bulk density and penetrometer resistance will be examined as a principal output of SARDI's current ACE project, AL21001.

Organic matter shown to improve soil health, but not yet translating to improved yields in high input growing system.





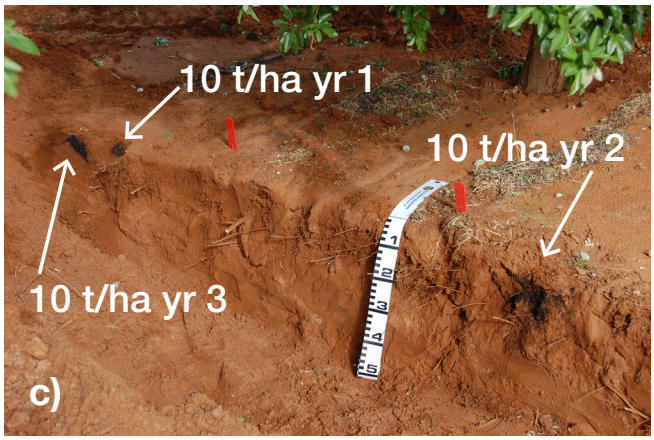


Figure 4. Soil profile under zero compost (a) 50 t/ha pre-planting (b) and repeat annual injections of 10 t/ha (c). Orange flags mark positions of dripline

Transforming almond waste from byproduct to soil enhancer – Agrifutures Video

Further information

SARDI Loxton – 08 8595 9100
mark.skewes@sa.gov.au

SARDI Waite – 08 8303 9400
nigel.fleming@sa.gov.au
tim.pitt@sa.gov.au

SARDI projects conducted at the ACE experimental orchard have been funded by Hort Innovation using the almond research and development levy and AgriFutures Australia, with co-investment from the South Australian Government and contributions from the Australian Government. For more information on these funds and strategic levy investments visit horticulture.com.au *and* agifutures.com.au.