Case Study
VITICULTURE

Trialling undervine and mid-row cover crops

Undervine cocksfoot cover crop at Chris Dent's vineyard in Swan Hill, 2022

Introduction

This case study examines the use of undervine cover crops as a practical solution for addressing current challenges in the wine industry. The focus is on reducing herbicide use and the environmental impact of grape production. These changes are motivated by the need to meet international market requirements, avoid potential herbicide restrictions, and reduce greenhouse gas emissions to align with the wine industry's carbon neutrality goals. This investigation aimed to promote a more sustainable and environmentally responsible approach within the wine industry.

Key site characteristics

Soil description:	Red-clay-loam with gravelly limestone throughout
Soil pH:	8.4
Average annual rainfall (2009 – 2022):	357 mm
Average growing season rainfall (September – April, 2009 – 2022):	236 mm
Irrigation source:	Murray River

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AWRI Australian Wine Research Institute

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Background

Chris Dent's family has been growing wine-grapes in Swan Hill for more than 63 years. Growing wine-grapes in a warm, dry region where annual rainfall and soil moisture is predicted to decrease, temperatures and evaporation are predicted to increase by 2030, Chris has a deep understanding of the importance of good water management and increasing the resilience of his vineyard to climate change. Chris is also interested in looking at non-chemical alternatives for weed control, as he expects increased restrictions on herbicide use in the future.

Chris, like 85% of the winegrape growers in the Murray Valley, converted from furrow irrigation to drip irrigation in 1992. The conversion to drip irrigation significantly improved his water use efficiency but the combination of long-term drip irrigation, fertigation and chemical weed control can affect soil structure by increasing soil sodicity and reducing water infiltration.

The use of appropriate undervine covercrops has been shown to improve water infiltration through changes in soil physical characteristics generated through root development and associated improved soil biological activity. Research has also shown that cover crops can be used to manage weeds (Penfold and Collins 2012) and increase the capacity of the soil to store water through increased carbon, and improved structure (Penfold and Howie 2019).

In May 2021, a cover crop demonstration site was established in a two-hectare area of Chris's Gorton Drive vineyard. This case study explores Chris Dent's experience with the cover crop demonstration.

Method

Nine cover crop treatments were established to demonstrate the effective management of various species for specific outcomes. The selection of cover crop species took into account the site's soil type, climate, and water availability, as well as their adaptability to thrive in the mid-row or undervine areas of the vineyards. For detailed information on the chosen cover crop species, the Cover Crop Finder online tool (www.covercropfinder.com.au), developed by Wine Australia and the University of Adelaide, is a valuable resource.

To ensure optimal conditions for seeding, the demonstration areas underwent a pre-seeding process. This involved the application of a contact herbicide (Spray.Seed) and the use of a mechanical sweeper to clear the seed bed of weeds and surface debris. The specific details of each treatment in the trial can be found in Table 1. The cover crops were sown in May 2021, with seeding rates outlined in Table 2.

Table 1. Cover crop treatments trialled in Chris Dent's vineyard

Treatment	Undervine
Treatment 1	Herbicide control
Treatment 2	Cocksfoot
Treatment 3	Medic
Treatment 4	Lucerne
Treatment 5	Medic/Cocksfoot blend

Treatment	Mid row
Treatment 6	Volunteer sward
Treatment 7	Medic
Treatment 8	Cocksfoot
Treatment 9	Saltbush

Table 2. Cost and seeding rates of cover crops planted at Chris Dent's vineyard, May 2021. Note that all the medic seed was pre-treated with rhizobium bacteria to help ensure nodulation and nitrogen fixation.

Treatment	Species	Common name	Recommended rainfall range (mm)	Seeding rate (kg/ha)	Seed cost ($/kg)	Cost ($/sown ha)
Medic	*Medicago truncatulata*	Jester	250 - 400	6	$11.00	$264.50
	Medicago scutellata	Silver snail	300 - 700	7	$9.50	
	Medicago polymorpha	Scimitar	250 - 650	6	$11.00	
	Medicago littoralis	Seraph	250 - 650	6	$11.00	
Cocksfoot	*Dactylis glomerata*	Summadorm	400 – 550	7	$22.00	$154.00
Saltbush	*Atriplex semibaccata*	Creeping saltbush	250 - 900	6	$140.00	$840.00
Lucerne	*Medicago sativa*	Lucerne	250 - 800	5	$16.50	$82.50

All treatments were sown using a quad bike and six-row, 1.6 m wide Taege direct drill seeder (Figure 1). The mid-row treatments were sown with all rows of the seeder open (Figure 2A). The undervine covercrops were seeded in one row along each side of the vine row with one row of the seeder open (Figure 2C). The saltbush was seeded in one row along the centre of the mid-row with one row of the seeder open (Figure 2B).

Figure 2. Taege direct drill seeder

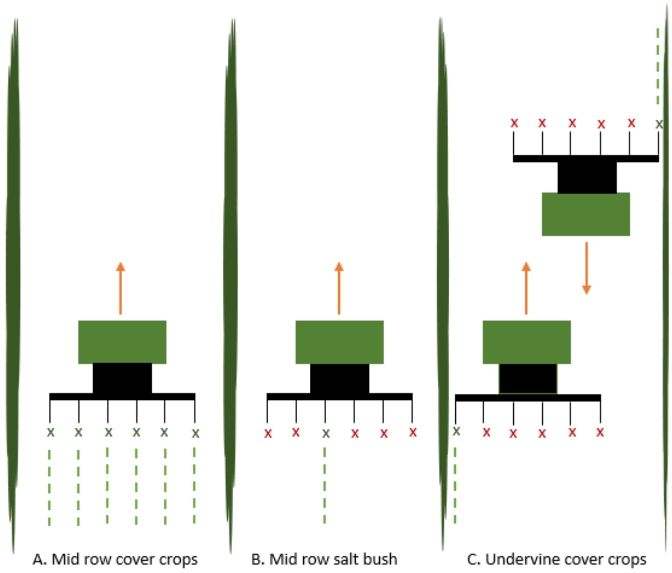

Figure 1. Seeder set-up for different treatments

Results

The demonstration treatments were all on the same irrigation valve and each treatment received the same amount of irrigation (6.4 ML/ha). Irrigation was applied to meet the needs of the vines with the highest irrigation demand.

The results of the mid-row cover crop treatments and undervine cover crop treatments, observed over the course of one year (May 2021 – May 2022), are presented in Tables 3 and 4. These tables provide insights into the effectiveness of various cover crop treatments in a vineyard setting.

Data collection from Chris Dent's vineyards for the second year of the demonstration was hindered by challenging weather conditions. However, the outcomes from the first year provide a solid foundation for understanding the initial impact of the cover crop treatments.

The assessment will continue into the third year of the demonstration, where additional data on yield, vine water stress, soil nutrition, and soil organic carbon will be gathered. This ongoing study aims to provide an understanding of the long-term effects of diverse cover crop treatments in the vineyard environment.

Table 3 Outcomes of mid row cover crop treatments after one year (May 2021 – May 2022)

Treatment	Establishment and coverage	Green mulch effect	Timing of senescence	Weed suppression
Medic	Good	Average	Spring	Average
Cocksfoot	Good	Good	Spring	Good
Saltbush	Sporadic	Poor	Remained active	Poor
Volunteer control	Good	Poor	Vegetation was always present	Poor

Table *4*. Outcomes of undervine cover crop treatments after one year (May 2021 – May 2022)

Treatment	Establishment and coverage	Green mulch effect	Timing of senescence	Weed suppression	Notes
Medic	Good	Good (5 cm thick)	Spring	Average	
Cocksfoot	Good	Good	Remained active	Excellent	Highest water demand
Lucerne	Slow to establish, patchy coverage	Poor	Remained active	Poor	
Volunteer control	Good	n/a	Vegetation always present	Poor	

Conclusions

The study of undervine and mid-row cover crops at Chris Dent's vineyard revealed their potential to address some of the pressing challenges in the wine industry, including reducing herbicide usage, minimising the ecological footprint, and contributing to carbon neutrality goals. Chris Dent's Swan Hill vineyard faces challenges such as decreasing rainfall and the need for improved water management due to a shift to drip irrigation in 1992, which introduced soil structure issues.

Results from the cover crop trial were promising. In mid-row treatments, medic and cocksfoot exhibited positive attributes, including good establishment, floor coverage, and green mulch effects. Saltbush had sporadic establishment and weak mulch effects, while volunteer swards showed good establishment but poor mulch effects and weed suppression.

For the undervine cover crop treatments, medic showed strong establishment, floor coverage, and moderate weed suppression, while cocksfoot demonstrated good establishment, strong mulch effects, and excellent weed suppression, albeit with higher water demands. Lucerne, however, struggled with establishment and weed suppression, and volunteer swards exhibited good establishment but lacked mulch effects and showed weak weed suppression.

These findings offer valuable insights into cover crop performance in the warm irrigated winegrowing regions of Australia, addressing wine industry challenges and promoting sustainable practices. Growers can reference this case study when considering the establishment of cover crops in their own vineyards.

Find out more

For more information and resources on irrigation monitoring and maintenance , including two 'how to' videos on under-vine cover crops, visit the AWRI's Sown undervine cover crop webpage.

Acknowledgement

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Reference and further reading

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Contact

For further information, please contact:

AWRI helpdesk

Phone 08 8313 6600 **Email** helpdesk@awri.com.au

Website www.awri.com.au

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064

Murray Valley Winegrowers

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