

# Evaluation of conservation biological control innovation in winegrowing

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# Innovation and productivity growth

- New Zealand, slow rate of productivity increase
- Innovation in production systems key to increased productivity
- Considerable NZ investment in R&D including in agriculture
- Adoption and continuation of innovation essential to capitalise on R&D investment
- Little NZ research on adoption of innovation

# Winegrowing

- Grapes can be attacked by several pests and fungus including *Phylloxera vastatrix* (an aphid), *Botrytis cinerea* (grey mould), Grapevine Leafroll associated Virus type 3 (GLRaV-3)
- Crop losses due to leafroller – \$360/ha/yr
- \$500-\$1000 /ha/year of chemicals used to control pests, fungus in vineyards
- Potential cost reduction if use of chemicals can be avoided, plus marketing advantages of low chemical system

# Waipara Winegrowing Region

- $\approx 1500$  ha grapes
- 80 winegrowers
- Rapid growth in area
- $\approx 3.5\%$  NZ total grapes



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# Greening Waipara project

- Began 2005, includes 32 winegrowers, Hurunui District Council, LU and LCR researchers
- Goal is to make use of 'natures services' to improve winegrowing, increase use of native species, enhance profits
- Seven ecological innovations developed including:
  - Weed suppression by native ground cover plants,
  - Botrytis management through mulching,
  - Conservation Biological Control (CBC) to control leafrollers in vineyards



# Greening Waipara project

- Leafrollers (*Planotortrix* and *Ctenopseustis* genera ) damage grapevines and open them to *Botrytis cinerea* (grey mould)
- CBC aims to enhance natural predators to reduce threats to a commercial crop
- Inter-row planting of flowering plants - buckwheat, phacelia etc, attracts parasitoid wasps, a natural enemy of leafrollers into vineyards.

**Biodiversity Trails**  
**CBC**

Number of plants planted up to July 2008

18695

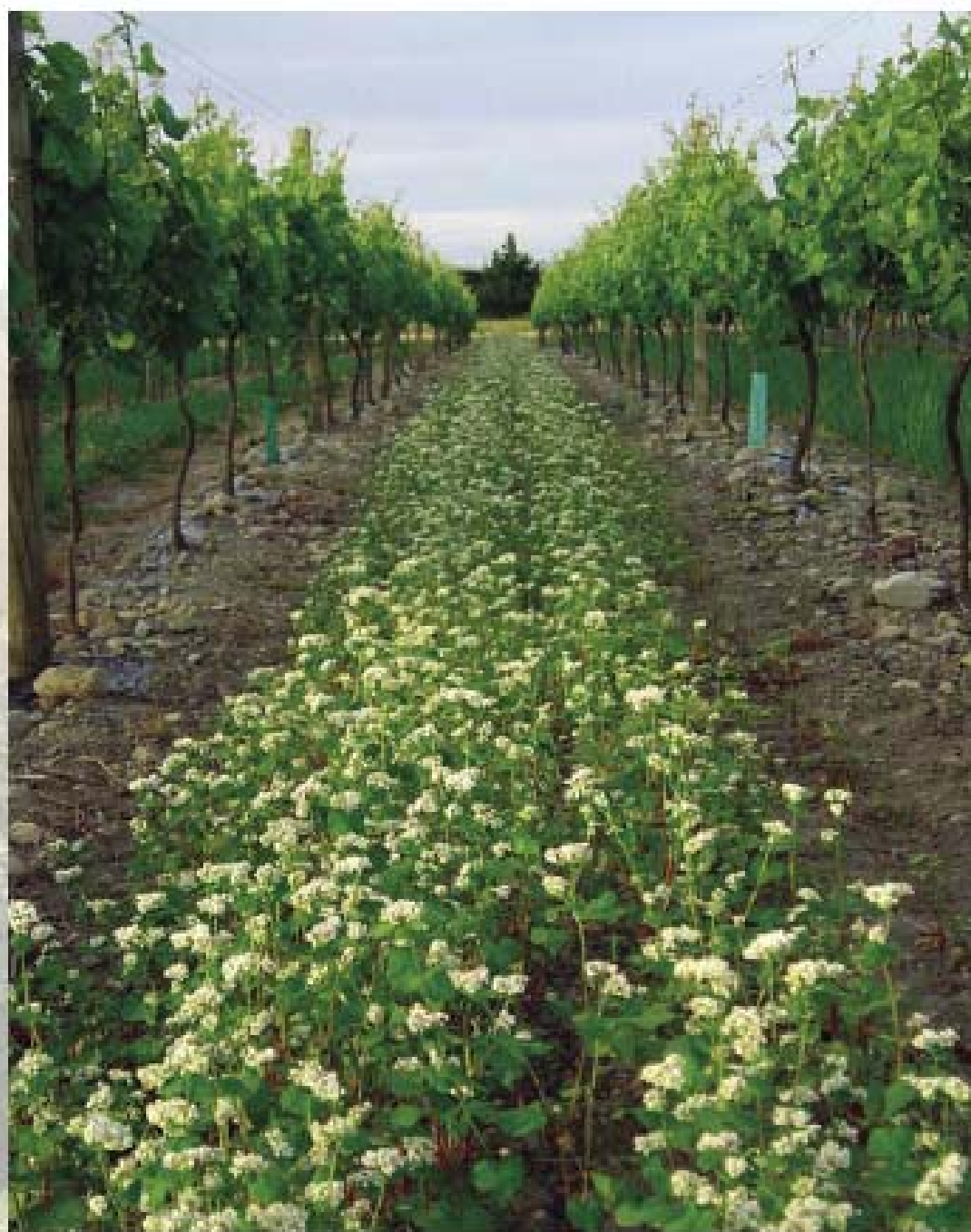
0 2.5km

The map displays the Waipara region with various vineyards and trails marked. Key locations include McKenzie Farm, Ball Estate, Ben and Viv Kepes, Pimlico Vineyard, Frog Rock, Waipara River Estate, Three Sisters, Weka River Vineyard, McKenzie Vineyard, Waipara Downs, Waipara School, Railway Station, Waipara Gardens, Cass View, Mt Cass, Concorde Vineyard, The Mud House, Camshorn, Pegasus Bay, Waiaata Estate, Dunstaffnage, Dickson Vineyard, The Mound, Waipara Terraces, Torlesse Wines, Graeme Allen Vineyard, Waipara Springs, Darryl Harris Farm, Glenview Farm, Claremont Luxury Estate, Mark Eder, Daniel Schuster Wines, Williams Hill Vineyard, Cabal Properties, Muddy Water, Greystone, Mountford, Ross Trowsdale, Artemis Estate, and Brent Knight. The map also shows major roads like SH 1, SH 11, and SH 12, and geographical features like Mt Cass (525m).

18695

0 2.5km





*Flowering buckwheat down the rows at Waipara Hills.*



# Minimising fungicide and insecticide costs through enhanced biocontrol

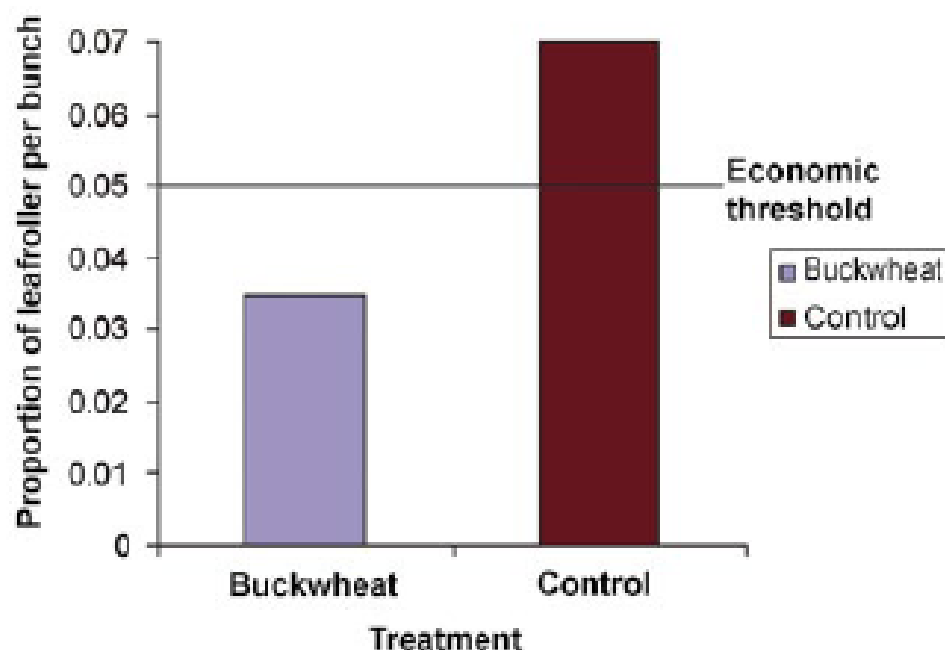


*The common earwig, is an important predator of the leafroller.*

New Zealand vineyards typically spend \$1000 per hectare per year on fungicides and insecticides. A typical ratio would be \$750 and \$250 on fungicides and insecticides respectively, but, of course, this will vary with the region. In Hawkes Bay, for instance, mealy bugs are an increasingly important problem so insecticide use there may be higher than average.

However, recent work at Lincoln University, funded by Technology

New Zealand, has delivered protocols for winegrowers that can reduce key pest and disease levels below economic spray thresholds. These methods involve simple habitat manipulation of vine inter-rows or of the below-vine area. Dr Samantha Scarratt showed how planting buckwheat at spacings



*Figure one: The proportion of grape bunches infested with leafrollers when buckwheat is used and under conventional practice.*

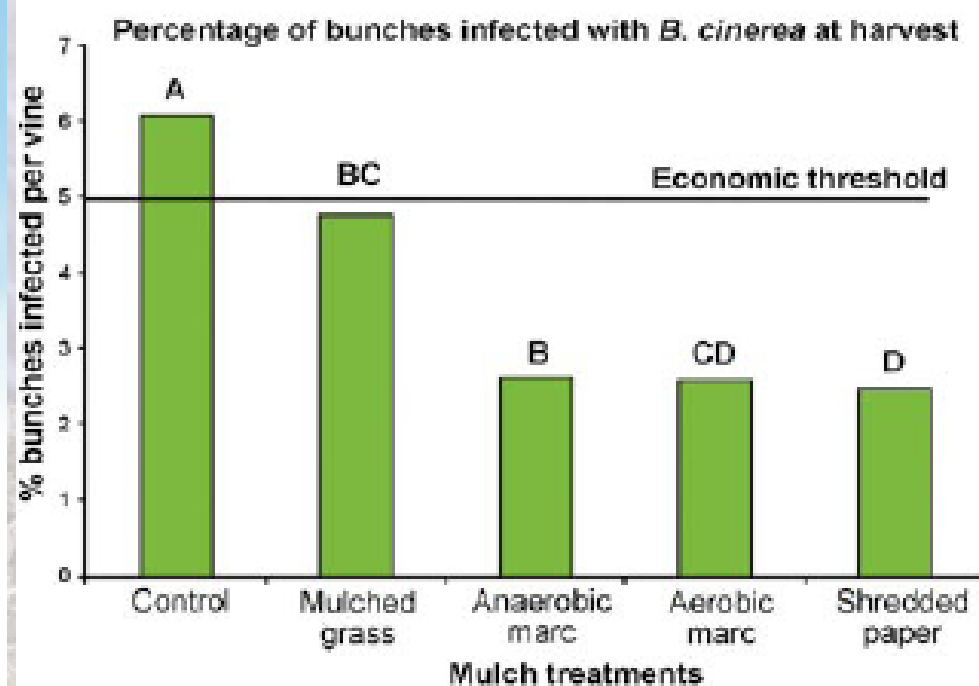


Figure two: The effects of under-vine mulches on botrytis levels on grapes at harvest.

of around one inter-row in 10 can improve the efficacy of the key parasitic wasp which kills leafrollers so that these pests no longer need to be sprayed (Figure one). For botrytis, Dr Marco Jacometti used a range of organic mulches (shredded office paper, marc and grass clippings) under the vines to accelerate decomposition of the vine pruning debris on which the botrytis disease overwinters. This practice led to botrytis levels on the grapes at harvest which were so low that fungicide applications were no longer necessary (Figure two).



# Buckwheat seeds available — cheap!!!!

From December, it will be worth your while to sow buckwheat seeds at a rate of around 40 kg/ha between one pair of vine rows in every ten pairs. Drill again in different rows at the same spacing in January and again in late February.

The research behind using floral resources such as buckwheat can be found on the Waipara winegrowers website ([www.waiparawine.co.nz](http://www.waiparawine.co.nz)) under the Research link.

Jean-Luc Dufour at Waipara Hills (formerly Canterbury House) has been using buckwheat like this for several years and says he has not had leafroller problems since.

Buckwheat seeds are available to Waipara growers at the ridiculously low price of 67 cents a kilo from:



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# Research questions

- What is the adoption rate of inter-row planting CBC to control leafroller in Waipara vineyards?
- What are the impacts of inter-row planting CBC on costs and revenue for Waipara vineyards?

## Previous research

- Much research on CBC effectiveness against insects, weeds, plant pathogens, vertebrates
- Griffiths et al., adoption of CBC is influenced by risk perceptions, efficacy of the innovation, can price premiums be gained?
- Cullen et al., CBC adoption related to: process of learning about innovation, relative advantage of innovation, ease of trialability of innovation

## NZ research

- Shadbolt, (2005) found labour costs and risks were factors limiting adoption of innovations for Waipara winegrowers, while potential for reduced costs, increased yields, and marketing benefits were motivating factors.
- Bewsell & Kaine (2005) found NZ dairy farmers adoption of sustainability practices depend upon farmer's perception of benefits that arise and these relate to commercial and practical realities.



# Economic benefits of CBC

- Measurement of economic benefits to farmers of CBC can be difficult to measure
- Increased yield, greater market share or reduced costs are direct effects, but secondary effects also may arise
- Rodenhouse et al., plant CBC help prevent soil erosion
- Fiedler et al., biodiversity conservation, ecological restoration
- Few examples of economic measurement of CBC, but
- Thomas et al., and Kellerman found CBC produced economic benefits to farmers
- Schmidt et al., alfalfa mulches in soybean crops attracts predators to control aphids, but yield fell by 25%

# Method

- Mail survey of all 32 winegrowers in Waipara region
  - 14 responses, 44%
  - Five were vineyards, without a winery
  - Eight with a winery and sales < 200,000 litres/year
  - Representative of NZ wine industry – most are small scale

Mail survey asked:

- General questions about winery or vineyard operation
- Have they introduced or plan to introduce a Biodiversity Trail?
- Which of 7 ecological innovations have they introduced
- Their effectiveness rated on a Likert scale
- What impact has each ecological innovation had on the business (labour costs, domestic sales, water use...)

**Table 1. Implementation of the CBC Innovation  
(number of responses)**

	Not implemented	Ineffective	Somewhat effective	Very effective	Unsure
Inter row planting	12	1	1		



# Business impact of Inter-row planting

	Inter-row plantings to prevent leaf rollers		
	Increase	No effect	Decrease
Cost of labour	1	1	
Cost of agrichemicals			2
Cost of vineyard floor management	1	1	
Cost to maintain implemented practices		2	
Wine price		2	
Customer demand		2	
Advertising / promotions expenditure		2	
Cellar door sales		2	
Domestic sales		2	
International sales		2	
Access into new domestic markets	1	1	
Access into new international markets	1	1	
Communication with Waipara wineries		2	
Communication with Waipara vineyards	1	1	
Need for vineyard bird control		2	
Need for vineyard pest control		1	1
Level of vineyard soil erosion	1	1	
Level of water use (irrigation)		2	
Grape quality		2	
Wine quality		2	
Yield per hectare		2	



## Two in depth interviews

- A small firm, annual sales < 200,000 litres, had not implemented CBC to control leafrollers
- A large firm, 450ha grapes, had implemented CBC to control leafrollers
- Large firm previously used insecticide to control leafrollers, but botrytis threat low as dry climate
- No longer sprays, & leafrollers not visible in vineyard
- Buckwheat between rows imposes labour costs, needs specialist machinery, is on a non-irrigated area and hence germination rates variable
- CBC cost/ha similar to spraying, trickier, reduces chemical use, but seed costs are increasing

## Two in depth interviews

- Small firm lacked specialist machinery, did not have labour available to manage inter-row CBC
- Insecticides are lower risk strategy than is CBC



# Impacts of CBC use

- Does reduce use of insecticides
- Does reduce incidence of leafrollers
- Increases labour & vineyard management costs
- No co-ordinated approach to gain marketing payoff via labelling
- No evidence of economic payoff to adopters (yield, quality, price, costs)
- One firm reported improved market access

# Conclusions

- CBC can bring several ecological benefits
- Inter-row planting CBC is not economically sustainable particularly for small vineyards
- Similar conclusions (not reported here) for 6 of the 7 Greening Waipara ecological innovations
- Adoption and continuation is essential to benefit from R&D