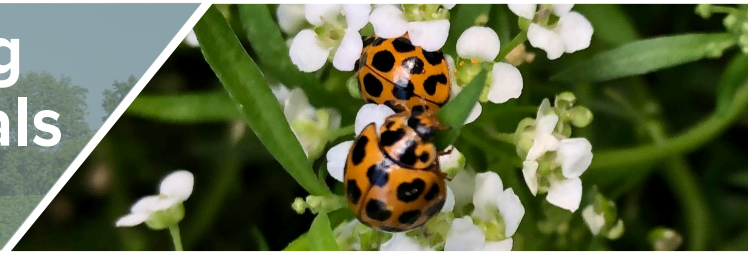




How does the surrounding landscape affect beneficials on your farm?



Beneficial insects and other invertebrates ('beneficials') include pollinators, nutrient cyclers and predators or parasitoids of plant pests. The role that predators and parasitoids play in pest suppression on farms is becoming increasingly evident.

Research led by Charles Sturt University demonstrates that the type of landscape surrounding a vegetable farm is an important influencer of beneficial numbers within crops. In turn, the surrounding landscape can influence in-crop pest pressure.

Landscapes are typically a mix of cropland, shelterbelts, roads, pastures, riparian zones, and dams.

Using extensive farm survey results and geospatial analyses, this fact sheet shares evidence-based actions to guide optimal placement of vegetable crops in relation to landscape features and, in the longer term, to manage landscapes to support beneficials and suppress pests.

General actions to support beneficials in your landscape

- 1** Preserve uncultivated areas on farm, including woody vegetation and shelterbelts, as these can support beneficials and help suppress crop pests.
- 2** Exercise effective control of weeds, especially those that are related to your crop (e.g. brassica weeds close to brassica vegetables). This includes weeds within areas of woody vegetation.

Use the decision-aid tables in this guide to:

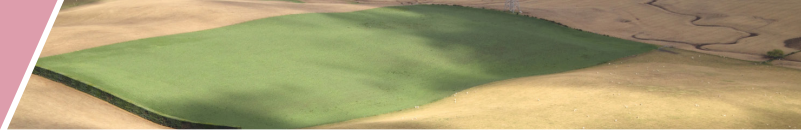
- 3** Consider what crop types are planted adjacent to one another, and if the planting pattern may promote greater pest numbers.
- 4** Determine what crop types would most benefit from proximity to riparian vegetation and shelterbelts.
- 5** Consider what crop pest is of greatest concern for your locality and, if possible, position the crop accordingly.

Beneficial insects and other invertebrates provide a range of ecosystem services, including pest control.



Aphid parasitoid (*Aphidius* sp.) laying an egg into an aphid nymph

The science behind the actions



The research investigated the influence of the following on beneficial and pest numbers:

1. Land use immediately adjacent to a crop, and
2. The wider landscape (up to 5 km from a crop).

Pest and beneficial numbers were recorded in 491 vegetable growing paddocks across Australia. Surveyed paddocks were: brassica vegetable crops (246), sweetcorn (69), lettuce (71), capsicum (39), carrot (44), and bean (22).

Geospatial mapping allowed the research team to characterise landscape features surrounding each

survey site (e.g. the proportion of crops or woody vegetation).

Insect numbers in the centre of each crop were set as a baseline abundance. This baseline was compared with numbers of pests or beneficials at the edges of the crop and the influence of adjacent land use was determined.

Results for several crop types, land uses, key pest species and beneficial species are shared in this fact sheet.



What was found?

Effects of adjacent land use

Across all crop types surveyed, beneficial numbers were significantly greater in areas of crop adjacent to shelterbelts and riparian vegetation. In addition, crop areas adjacent to these land uses had lower pest numbers than the crop centre.



Adjacent shelterbelts and riparian vegetation can influence pest and beneficial numbers

Decision-aid tools for crop positioning

To aid in making planting decisions, growers can refer to the crop specific decision-aid tables provided in this section.

Brassica

Pests	Weeds	Shelterbelt	Road	Riparian veg	Pasture	Dam	Brassicas
Cabbage aphid		***		*		***	**
Green peach aphid			***				
Thrips	***	***		***	***	***	***
Whitefly	***	***	**		***		
Rutherglen bug				***	***	**	***
Diamondback moth		***		***	**		
Cabbage white butterfly				**			*

Beneficials	Weeds	Shelterbelt	Road	Riparian veg	Pasture	Dam	Brassicas
Ladybird beetle		***			***		***
Spider	*	*	***				
Brown lacewing	*	***	***	**	***		
Parasitoid wasps		***	*		*		**
Aphid mummies		***	***			**	***

Key

Green = Desirable effect (more beneficials, fewer pests)

Red = Undesirable effect (fewer beneficials and more pests)

Shading intensity = strength of the effect. The darker the shading, the greater the effect.

Cell characters = Statistical confidence (*= 95% confidence, ** = 99% confidence, *** = 99.9% confidence).

Grey = 'no effect'

Key insights for brassica growers

- Numbers of diamondback moth are reduced in the crop adjacent to riparian vegetation and shelterbelts.
- Where possible, situate the most vulnerable or highest value plantings adjacent to riparian vegetation or shelterbelts. This also assists with the suppression of other major caterpillar pests, cabbage white butterfly as well as Rutherglen bug, and thrips.
- Protect and expand woody vegetation over the longer term as these actions are likely to bring economic benefits linked to enhancement of beneficial insects such as parasitoid wasps (that cause 'aphid mummies', i.e. parasitised aphids that do not feed), ladybird beetles and spiders.
- Weedy areas (including pastures with brassica weeds) tend to promote pests and should be managed or avoided.
- Shelterbelt vegetation is associated with higher numbers of cabbage aphid (which feed only on brassica family plants), reinforcing the necessity to control weeds in shelterbelts and, where possible, avoid siting crops close to areas with brassica weeds.

Sweetcorn

Pests	Weeds	Shelterbelt	Road	Riparian veg	Pasture	Lettuce	Sweetcorn
Thrips	***		***	**	*		
Rutherglen bug		***	***				***
Corn earworm	*		**	**	**		
Jassid		*			*		
Corn rootworm	**			**	*		
Corn aphid	***	**		***			

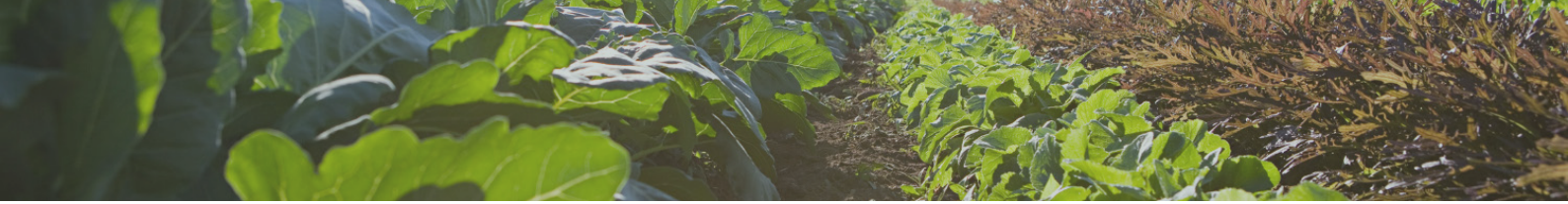
Beneficials	Weeds	Shelterbelt	Road	Riparian veg	Pasture	Lettuce	Sweetcorn
Ladybird beetle	***	***		**			***
Red and blue beetle	***	***	**	***			
<i>Orius</i> species	**	***	***	*			
Green lacewing			***				***
Soldier beetle		*			***		**

Key

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Key insights for sweetcorn growers

- In most districts, corn earworm is the pest of greatest concern. Crops adjacent to riparian vegetation tend to have low numbers of this pest. Riparian vegetation also assists with thrips.
- Sweetcorn should be planted adjacent to riparian vegetation, specifically if corn earworm is the main concern, however corn aphid may be promoted so care should be taken if these are of concern in your district.
- Shelterbelts reduce the density of Rutherglen bug.
- Decreases in pest numbers are associated with enhancement of beneficial insects such as ladybird beetles, red and blue beetles and *Orius* spp.
- Pasture (mainly lucerne) tends to promote thrips, jassids and corn rootworm so vigilance is recommended when planting sweetcorn adjacent to this land use.
- Roads, which are bordered by undisturbed vegetation and often with trees, significantly reduce the numbers of thrips, Rutherglen bugs and corn earworm, likely reflecting the shelter and food resources provided by roadside vegetation. This reinforces the necessity of undisturbed habitats (e.g. trees).
- Protect riparian vegetation and expand woody vegetation over the longer term as these actions are likely to bring economic benefits via pest suppression.



Lettuce

Pests	Weeds	Shelterbelt	Road	Riparian veg	Brassicas	Lettuce
Thrips	***	***		***	***	***
Whitefly	*	*	*	***	***	
Rutherglen bug	***		**	**	*	***

Beneficials	Weeds	Shelterbelt	Road	Riparian veg	Pasture	Dam	Brassicas
Ladybird beetle		***			***		***
Spider	*	*	***				
Brown lacewing	*	***	***	**	***		
Parasitoid wasps		***	*		*		**
Aphid mummies		***	***			**	***

Key insights for lettuce growers

- Recommendations for lettuce strongly depend on which pest types are of primary concern in the district where the crop is grown.
- Shelterbelt and riparian vegetation tend to give lower numbers of whiteflies but promote thrips.
- Planting lettuce adjacent to other lettuce crops has neutral or positive effects on pests.

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Capsicum

Pests	Weeds	Road	Sorghum	Capsicum
Rutherglen bug				**

Beneficials	Weeds	Road	Sorghum	Capsicum
Green lacewing		***	***	*

Key insights for capsicum growers

- Rutherglen bug is increased in crop areas adjacent to other capsicum crops.
- Sorghum is associated with higher numbers of green lacewings.



Carrot

Pests		Weeds	Sweetcorn	Shelterbelt	Road	Pasture	Dam	Brassicas	Bean	Carrot
Thrips					*	**		***		
Whitefly			***			*				*
Rutherglen bug	***			***	***	***	***			***
Jassid						*				*
Mirid bug	**						*			

Beneficials		Weeds	Sweetcorn	Shelterbelt	Road	Pasture	Dam	Brassicas	Bean	Carrot
Ladybird beetle				***						
Spider						**				
Parasitoid wasps	*					**				

Key insights for carrot growers

- Jassid, thrips, whitefly and Rutherglen bug numbers are reduced in carrot crops planted adjacent to pastures.
- Numbers of parasitoid wasps are enhanced by adjacent pasture.
- Shelterbelts are associated with higher numbers of ladybird beetles.
- Shelterbelts support beneficials but also tend to increase whiteflies so care should be taken if these are of concern in your district.

French bean

Pests		Weeds	Shelterbelt	Road	Pasture	Bean
Thrips	*			***	**	
Whitefly				*		**
Tobacco cutworm				***		**

Beneficials		Weeds	Shelterbelt	Road	Pasture	Bean
Ladybird beetle					**	
Spider					**	

Key insights for bean growers

- Tobacco cutworm (*Spodoptera litura*) numbers are increased when bean fields are planted adjacent to each other.
- Beans fields adjacent to pasture have higher numbers of ladybird beetles and spiders, and fewer pest thrips.
- Roads that are bordered by undisturbed vegetation and often with trees, significantly reduce the numbers of thrips and Tobacco cutworm, likely reflecting the shelter and food resources provided by roadside vegetation.

Key

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Effects of the wider landscape

The effect of the wider landscape (up to 5 km from the crop) was studied using brassica survey sites. Brassica vegetable crops in landscapes with more woody vegetation and fewer crops within 1 km tended to have higher numbers of cabbage aphid and green peach aphid.

Since neither aphid can survive on most native Australian plants, control of exotic weeds (especially brassica weeds) in woody areas such as shelterbelts is recommended.

Bringing it all together

When growers have flexibility in relation to positioning a high value or vulnerable brassica crop, they should consider the type of pest of most concern in their district and adopt the most appropriate planting tactic.

To suppress diamondback moth in brassica crops

- Plant adjacent to woodland or shelterbelts; this is most effective when the wider landscape (up to 5 km distant) contains woodland.
- Plant adjacent to pastures; this is most effective when the nearby landscape (0.5 -1.0 km distant) contains non-crop uses such as dams, woodland and pasture.

To suppress diamondback moth and cabbage aphid in brassica crops

Plant adjacent to non-brassica crops; this is most

effective when the nearby landscape (1 km distant) contains non-crop uses including dams, woodland and pasture and if crop areas are present in patches rather than as contiguous plantings.

To enhance predatory ladybird beetle numbers in brassica crops

Ladybird beetles attack a wide range of soft bodied prey, and therefore, potentially provide protection against aphids and caterpillar pests.

To exploit this, plant brassicas adjacent to woody vegetation; the beneficial effect is especially marked in landscapes where crop areas are present in patches rather than as contiguous plantings, where woodland is contiguous rather than patchy, and where dams are present.



A ladybird beetle feeding on cabbage aphid