ARGOS

AGRICULTURE RESEARCH GROUP ON SUSTAINABILITY

ARGOS RESEARCH NOTE: NUMBER 24, NOVEMBER 2006

Shelterbelts in kiwifruit orchards

Introduction

Shelter is necessary for establishing and then maintaining high levels of fruit production and quality in kiwifruit (*Actinidia spp*) orchards. Unless kiwifruit vines are sheltered, high winds cause loss of replacement canes and growing points on young vines, defoliation and loss of flowers. Pollination efficiency, fruit set, plant size and fruit size can all be reduced. Excessive wind also causes fruit abrasion, increased water use of the crop, desiccation of vines, reduced opportunity to spray, unpleasant working conditions, and disruption of irrigation. Shelter probably also has a huge influence on orchard ecology and particularly, on its biodiversity. In view of its importance, it is therefore surprising that relatively little research has been reported about shelter management in kiwifruit orchards. ARGOS therefore decided to do a baseline survey of shelterbelts on its 36 study orchards in 2004 and will monitor changes over the coming years to identify optimum shelter management strategies for sustainability.

Characterisation of shelterbelts

We first mapped the position and orientation of 437 shelterbelts on the ARGOS orchards. The species composition, height, width and 'porosity' of each shelterbelt was determined and we surveyed the habitats and plant species growing under the shelter (see ARGOS Research Note 25 for these ecological results). We also talked to the orchard owners and managers about their visions and priorities for orchard management and report here their perceptions of shelter.

Figure 1. Shelterbelts in kiwifruit orchards – a conspicuous feature of the Bay of Plenty landscape.

Results and conclusions

Screens of wind-cloth are being used by some growers to retain shelter while increasing fruit dry matter content through retention of light. Although several growers referred to an increase of artificial shelter in recent years, overall only 3% of the shelterbelts in 2004 were artificial. Amongst the live shelterbelts, 26 different woody species were recorded, but Japanese cedar,

Table 1. Average proportions of shelterbelts on ARGOS orchards containing each of the different woody species. 424 live shelterbelts were surveyed in 36 orchards.

Shelter species	KiwiGreen Hort16A	KiwiGreen Hayward	Organic Hayward
Cryptomeria japonica (Japanese cedar)	40%	51%	39%
Casuarina spp (She-oak)	25%	11%	17%
Salix spp (Willow)	13%	16%	13%
Populus spp (Poplar)	6%	3%	4%
Other exotic	12%	11%	22%
Other native	6%	8%	5%
Total species (N = 26)	***15***	***15***	***20***

she-oak and willow were by far the most common (Table 1). External shelterbelts (ones around the perimeter of the orchard) were about the same height on average (9.3m) as internal shelterbelts (8.5m), but the external ones were much thicker (2.1m) and less porous near their base (29%) than internal shelterbelts (1.6m wide; porosity 41%). There was no evidence that the stature and porosity of shelterbelts differed between Organic Hayward, KiwiGreen Hayward, or KiwiGreen Hort16A orchards. Therefore shelter stature, and consequently shading and wind effects, are unlikely to be driving differences in mean fruit production, fruit quality and animal diversity and abundance between orchard systems.

Interviews with orchardists emphasised:

- Shelterbelts as an essential part of managing the orchard environment. There was an unquestioned consensus that external shelterbelts are indispensable. More crucial differences emerged in opinion over internal shelterbelt management. A trade-off is clear between increased space for vines through shelterbelt removal versus increased protection from wind and/or provision of refugia for biodiversity. There was no discernable difference in positioning relative to this trade-off between Organic and KiwiGreen.
- Shelterbelts also mitigate drift of chemical sprays to neighbouring orchards and houses. This is a particularly important safeguard for Organic orchardists and those orchards situated in peri-urban landscapes where the public are increasingly intolerant of chemical applications on working orchards.
- Many orchardists have been removing shelter in recent decades, especially internal shelterbelts, because of competition for light. This has increased risk to production from major storms.
- Recent pushes to increased fruit dry-matter lead to orchardists wanting to warm up their orchards, so they now want to increase shelter again.
- Costs of artificial shelter and delays in establishing live shelter are significant constraints to orchard management.

The ARGOS team will now research how shelterbelt composition and structure affect fruit quality and production as well as orchard pests and biodiversity. Geographic Information Systems and computer models will be used to link increasingly fine-grained information from orchards to variation in stature and type of surrounding shelter.

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