Pollination Aware

Cherry

This case study is the primary source of information on potential pollination services for the industry. It is based on data provided by industry, the ABS and other relevant sources. Therefore, information in this case study on potential hive requirements may differ to the tables in the Pollination Aware report (RIRDC Pub. No. 10/081) which are based on ABS (2008) *Agricultural Commodities Small Area Data, Australia 2005-06*.

Introduction

Cherries are classified under the genus *Prunus* and belong to the family Rosaceae (Bright and Marte 2004). There are two types of cherry, namely the sweet cherries and the sour cherries. Sweet cherries can be eaten right off the tree, whereas sour cherries are more commonly used in baking. As a general rule, sweet cherries need cross-pollination and most sour cherries are self-fruitful and do not need a polliniser.

The commercial sweet cherry is considered to be a native of the Caspian–Black Sea region, extending as far east as northern India. Today there are several species and hundreds of varieties which are cultivated around the world for their fruit, which may be consumed fresh.

Sweet cherries constitute an important fruit crop in southern Australia, and evidence has shown that cross-pollination is required to ensure a satisfactory crop of fruit, for which honey bee pollination services are often utilised. Somerville (1999) suggests that wind is not a factor in pollination of prunus species and honey bees constitute by far the majority of insect visitors to cherry blossom.

Cherry production in Australia

By national standards, the Australian cherry industry is a relatively small agricultural industry, with an estimated 701 growers spread across all states excluding the Northern Territory. The industry is concentrated in New South Wales, South Australia and Victoria and has smaller but important production areas in Tasmania and Western Australia (CGOA 2006). In the 2005/06 season, cherries were produced predominantly in New South Wales (36%), Victoria (24%) and Tasmania (22%) (Table 1). Key production areas within these states include the Young, Orange and Bathurst regions (NSW), the Dandenong Ranges (Vic), the Mount Lofty Ranges and the Riverland area (SA), the Huon Valley (TAS) and the Bridgetown and Mt Barker areas (WA) (Figure 1).

Cherry trees grow on most soil types except heavy clays provided that the soil is friable and well-drained, however, they do not tolerate water-logged soil ('wet feet'). As cherries blossom early, the fruit buds are sensitive to spring frosts just preceding and during the opening of flowers(Langridge and Goodman 1973).

The Australian cherry industry predominately focuses on the domestic market, particularly the mainland, with only 10–15%

of the national crop currently exported (CGOA 2006). The industry currently exports to more than 20 overseas markets with the main destinations including Hong Kong, China, Taiwan and South-east Asia. There is significant potential for growth in all export markets (CGOA 2006).

In 2002 the industry was worth $54.5 million to the Australian economy, with a total of over 700 growers distributed throughout the southern half of the country (Figure 1).

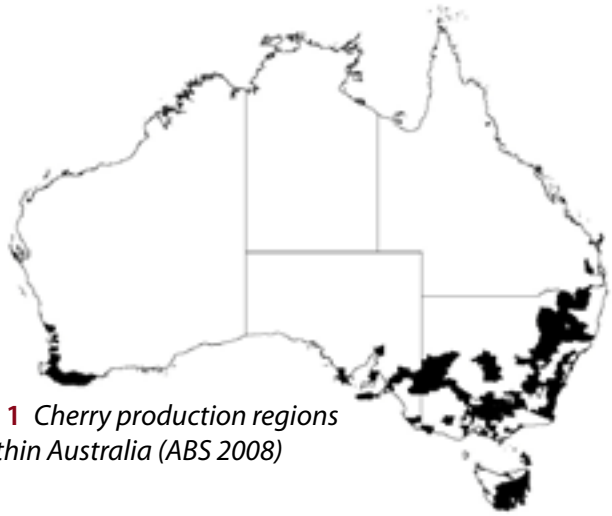

Figure 1 *Cherry production regions within Australia (ABS 2008)*

Table 1 **Cherry production by state across Australia (ABS 2008)**

	NSW	QLD	SA	TAS	VIC	WA	Total
Production (t)	4,407	18	846	985	3,389	134	**9,779**
Area (ha)	1,322	17	531	827	894	79	**3,670**

Pollination in cherries

Cherries constitute an important crop in southern Australia and evidence tends to show that cross-pollination is required to ensure a satisfactory crop of fruit (Langridge and Goodman 1973) with pollination by honey bees shown to increase yields (Free 1960). Cherries, like other stone fruits, require that only one viable pollen tube reaches the ovary to produce a fruit, but this pollen grain must, in most cases, arrive from another compatible blossom and at the right time (McGregor 1976).

Unsatisfactory crop yield from sweet cherries has been traced to insufficient or ineffective pollination (Somerville 1999). Most varieties of sweet cherries grown in Australia are self-sterile, while some varieties are cross-sterile with other varieties.

Several studies have shown increased fruit set and resultant production when using managed honey bee colonies for pollination services (Free 1960; Langridge and Goodman 1973; Somerville 1999). A study in Victoria demonstrated the importance of bees as the primary agent for pollinating cherries (Somerville 1999; Langridge and Goodman 1973). Trees caged from bees had a 2% fruit set, as compared to uncaged trees exposed to the activities of bees which had a 35.9% fruit set (Table 2). The yields were 1.9kg/tree for the caged trees and 35.2kg/tree for the uncaged trees (Table 2). It was found that 97% of the insects that visited the cherry flowers were honey bees (Langridge and Goodman 1973).

Whilst this evidence demonstrates that adequate pollination will help ensure adequate seed formation, which in turn results in better outcomes for the grower, it has been suggested that management to ensure good pollination often may not be given sufficient attention, especially during the busy spring season (Somerville 1999).

Table 2 **Effects of caging trees on fruit set in cherries (Langridge and Goodman 1973)**

Variable	Caged trees	Open trees	Significance
Set of fruit (%)	2	35.9	$P < 0.01$
Yield per tree (kg)	1.9	35.2	$P < 0.01$

Pollination management for cherries in Australia

There are a number of factors within the orchard which have a direct bearing on the pollination efficiency of honey bees:

Orchard layout

- *Tree and blossom density*: High-density plantings have recently become popular with tree-training systems allowing for tree heights of no greater than four metres. Tree density may range from 600 up to 1500 trees per hectare in high density plantings. Higher density plantings will thus require relatively higher numbers of honey bee colonies per hectare to ensure efficient cross-pollination.
- *Access*: From a beekeeper's point of view, all-weather truck access is highly desirable. Limited access may lead to an increased workload for the beekeeper, uneven placement of hives and thus inefficient pollination. Ensuring the beekeeper has good access will aid in placement of hives and be mutually beneficial to the grower (increased pollination efficiency) and the beekeeper (decreased labour effort).

Pollinisers

When selecting varieties or planting out new blocks, the issue of cross-pollination should be considered as unsatisfactory cropping of has often been traced back to insufficient or ineffective pollination (Bright and Marte 2004). Varieties of sweet cherries can be either self-fertile or cross-fertile. Because of this, all cross-fertile varieties should be planted together and with an arrangement made to obtain bees for pollination (Bright and Marte 2004). It is also important to ensure that varieties with similar flowering times are planted together to ensure adequate cross-pollination. Where pollinisers have not been planted or are insufficient in number, pollination can be achieved by grafting limbs of selected varieties onto trees throughout the block (Bright and Marte 2004).

Density of bees

A stocking rate of 2–3 hives per hectare is generally regarded as adequate to pollinate most crops. Some researchers contend that a higher stocking rate may occasionally be desirable (Somerville 1999).

Arrangement of hives

Hive placement within the orchard is a very important factor to consider. Locate bees away from competing sources if possible, to force bees to fly through the orchard; this will decrease 'drifting' and 'non-target' foraging. To ensure maximum bee activity, hives should also be located in an elevated position in a warm sunny area, and protected from prevailing winds. Recent research has indicated that groups of 20–30 hives located at a warm location in and around the orchard increases cross-pollination if correct strength colonies are used for the prevailing climate (Somerville 1999).

Timing

In general, the introduction of bees should be made when sufficient blossom is already in evidence to encourage bees to start working it straight away (Somerville 1999). Honey bees show a marked fidelity to the chosen species and may stay on the blossom for a considerable time (Somerville 1999). Placing bee on the orchard at or following 5% blossom will ensure that foraging honey bees will have access immediately to the fruit blossom.

Preparation of bees

For a hive to be able to adequately pollinate fruit blossom, it must be above certain strength in bee numbers. Hives left on orchards for 12-month periods seldom do a good job of pollination, primarily because of lack of management and the resulting small bee population at blossom time.

It is fundamentally difficult to build a population of honey bees during cool conditions, particularly if there are no naturally occurring sources of pollen and nectar. Thus having healthy bees during mid-spring for cherry blossom is very important in order to gain optimal fruit set.

Attractiveness, nutritional value of pollen and nectar

Sugar concentrations as high as 55% in sweet cherry nectar have been recorded which makes the blossom very attractive to bees. Competition for bees may come from other species of flora, however, if there are equally or more attractive species in the vicinity, thus reducing the foraging level on cherry blossom (Bright and Marte 2004). Little can be done about flowering trees or shrubs on the outskirts of orchards, but the main cause of bees drifting from cherry and plum blossom is ground flora. Species such as capeweed, Paterson's curse and white clover are often in flower at the same time as *Prunus* spp. and in some cases they will be far more attractive to bees.

Availability of bees for pollination

Cherry blossom coincides with a number of nectar-producing winter-flowering eucalypt species that have the potential to provide alternative economic gains for the beekeeper in the form of honey crops. Thus monetary incentives may be needed for beekeepers to provide pollination services in cherry orchards.

Feral bees

Orchardists relying on feral bees for part or all of their pollination services should be similarly aware first, that feral colonies are unlikely to be at full strength at the time that cherries flower and, second, that even if they were, foraging by these bees is unlikely to be sufficiently intense to achieve the level of pollination required for optimal production especially if there are alternative floral resources available to the bees in the same vicinity.

Risks

Pesticides: One of the biggest drawbacks of placing bees near any agricultural crop is the possibility of colonies or field bees being affected by pesticides. Pesticides should be kept to a minimum while hives remain on the property. Most poisoning occurs when pesticides are applied to flowering crops, pastures and weeds.

It is strongly recommended that growers take the following steps to prevent or reduce bee losses:

- follow the warnings on pesticide container labels
- select the least harmful insecticide for bees and spray late in the afternoon or at night
- do not spray in conditions where spray might drift onto adjacent fields supporting foraging bees
- dispose of waste chemical or used containers correctly
- always warn nearby beekeepers of your intention to spray in time for steps to be taken to protect the bees; give at least two days' notice
- always advise nearby farmers.

Weather

Temperature and rainfall have a marked effect on honey bee activity. Bee activity is very limited below temperatures of 13°C, with activity increasing up to around 19°C, above which activity tends to remain at a relatively high level. Decreases in both numbers of bees visiting blossoms and the distance from the hive at which bees forage occur with a decrease in temperature.

Opportunities for improvement

Species such as capeweed, Paterson's curse and white clover are often in flower at the same time as *Prunus* spp. In some cases these will be far more attractive to bees. Thus every effort should be taken to reduce this problem by slashing between rows and other areas of significant blossom before introducing bees into the orchard (Somerville 1999).

Potential pollination service requirement for cherries in Australia

Optimal use of managed pollination services in all cherry orchards in Australia would require a service capacity as indicated in Table 3 below.

Table 3 Potential pollination service requirement for cherries in Australia

State	Peak month	Area (ha) total	Average hive density (h/ha)*	Estimated number of hives required
VIC	October	894	3	2,682
NSW	October	1,322	3	3,966
QLD	October	17	3	51
WA	October	79	3	237
TAS	November	827	3	2,481
SA	October	531	3	1,593
Total		**3,670**		**11,010**

Notes: * Area sourced from ABS (2008) *Agricultural Commodities Small Area Data, Australia 2005-06*, flowering times and average hive density from Somerville (1999).

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This case study was prepared as part of *Pollination Aware – The Real Value of Pollination in Australia*, by RC Keogh, APW Robinson and IJ Mullins, which consolidates the available information on pollination in Australia at a number of different levels: commodity/industry; regional/state; and national. Pollination Aware and the accompanying case studies provide a base for more detailed decision making on the management of pollination across a broad range of commodities.

The full report and 35 individual case studies are available at www.rirdc.gov.au.

Notes

Australian Government

Rural Industries Research and Development Corporation

HAL

Know-how for Horticulture™

This project is part of the Pollination Program – a jointly funded partnership with the Rural Industries Research and Development Corporation (RIRDC), Horticulture Australia Limited (HAL) and the Australian Government Department of Agriculture, Fisheries and Forestry. The Pollination Program is managed by RIRDC and aims to secure the pollination of Australia's horticultural and agricultural crops into the future on a sustainable and profitable basis. Research and development in this program is conducted to raise awareness that will help protect pollination in Australia.

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