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REVIEW OF RESEARCH ON CONTROL OF BIRD PESTS IN AUSTRALIA

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ABSTRACT: The most significant damage inflicted by birds in Australia is to germinating cereal and to ripening sunflower and fruit crops. The main pests are several native psittacine and corvid species, silvereyes (*Zosterops lateralis*) and European starlings (*Sturnus vulgaris*). The economic cost of damage is largely unquantified. While losses to industries as a whole are often low, losses to individual growers may be severe, and losses are distributed patchily in space and time. Shooting is the most widely practiced and most ineffective bird control technique used in Australia. Despite the high numbers of birds killed, damage persists, and disturbance caused by shooting and scare devices may actually increase damage. Trapping and export of native birds is frequently suggested as a solution but would be ineffective for damage control. Illegal poisoning is thought to have caused significant reductions in some parrot populations, but has not prevented crop damage. Decoy feeding shows promise for damage control in winter cereals. One site attracted 4,000 cockatoos for most of the seeding and germination phase. For sunflower, the main problem is rendering the main crop less attractive than the decoy. Netting is cost-effective even at moderate to low levels of bird damage for intensive growing systems with new varieties of high-yielding stonefruit. Research is needed on techniques to assess the cost of damage. The cost-effectiveness of damage control techniques can then be assessed. There is also a need for more studies on the biology of pest birds, in relation to the potential mitigation of crop damage by habitat modification or changes in crop growing practices.

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INTRODUCTION

Although birds cause significant agricultural losses in Australia, there has been little research that has ameliorated the problem. This review of bird pest research draws largely on papers presented at a Australian Bird Pest Workshop held in February 1990 (Fleming et al. 1990). Much Australian bird pest research has been short term and inconclusive. Research investigating the combination and integration of controls was identified as a priority at the Workshop.

An inability to accurately and consistently quantify and predict crop damage was also identified as a problem at the Workshop. Low-cost, repeatable damage assessment techniques are needed which can be used by growers. Without accurate estimates of the economic costs of bird damage, the economic justification of research funding is difficult. Researchers also need to know about the agronomics and marketing of crops being damaged to enable economic evaluations of proposed solutions. Another problem for research funding is that few research directions look promising in terms of delivering techniques for cost-effective reductions in damage in return for research dollars spent.

IMPACT

The most significant damage inflicted by birds in Australia is to dryland cereal and oilseed crops, irrigated rice and to fruit orchards (Table 1). In addition to direct losses from birds eating or damaging these crops, there are substantial opportunity costs where crops are not grown in otherwise suitable areas, due to the risk of bird damage.

Birds cause less significant damage to crops of commercial flowers and tree seedlings. They eat fish in aquaculture ponds, contaminate and eat livestock food at feedlots, eat bees from commercial hives, pose a risk of aeroplane strike, pollute and deface buildings, compete with native species for food and nest sites, and are a social nuisance where they roost in urban areas. They also pose a risk of spreading exotic diseases such as avian influenza and Newcastle disease.

While losses to industries as a whole are often relatively low, losses to individual growers may be severe (McKilligan 1978, Allan 1990, Emison 1990). For many crops, damage varies greatly between years, often in a fairly unpredictable manner (Davey and Roberts 1990, Halse 1990).

Table 1. The main problems caused by birds in Australia and the species involved.

Damage	Main species
Ripening sunflower crops	Galah *Cacatua roseicapilla* Sulphur-crested cockatoo *C. galerita*, Long-billed corella *C. tenuirostris*
Germinating wheat, oat and barley crops	Galah *C. roseicapilla*, Long-billed corella *C. tenuirostris*
Germinating rice crops	Pacific black duck *Anas superciliosa*, Grey teal *A. gibberifrons*
Stonefruit, apples, pears, citrus and tropical fruits	European starling *Sturnus vulgaris*, Silvereye *Zosterops lateralis* Native parrot species, Native crow species

The economic costs of damage inflicted by birds is largely unquantified. Growers perceptions of loss often greatly exceed estimates made by surveys of crop damage or estimates of bird food requirements (Noske 1980, Jarman 1990).

CONTROL

Behavior and Ecology

Long-term studies on the biology, behaviour, flocking and movement of the major pest species is needed as the basis for behaviour modification and damage control (Jarman 1990). If we know what there is about the bird's ecology that makes a particular crop vulnerable, possibly by comparing situations where damage does occur, to those where it does not, it may be possible to think of and test ways to alter circumstances to avoid or reduce damage.

There have been several studies on parrot ecology which may form the basis for future research on damage control (Easdown 1978, Jarman and McKenzie 1983, Jones 1983, Allan 1986, Alexander 1990, Emison 1990, Ford 1990). Parrots occupy a wide range of habitats and display a wide range of social behaviours in relation to habitat preference, flocking and nomadic behaviour and crop food preferences. Flock sizes are usually very variable, with the largest flocks forming when concentrated transitory food is available, such as germinating grain or ripening sunflower crops. Smaller flocks form in the breeding season.

The biology and ecology of the long-billed corella was studied for 5 years in south east Australia (Emison 1990). The bird has adopted to the loss of its native food by incorporating into its diet introduced plants such as cereal grains, onion grass corms and sunflower seeds, and they are heavily dependent on cultivated crops at certain times of the year (Alexander 1990). Most long billed corellas do not travel long distances—more than 85% of resightings of tagged birds were within 5 km of tag sight, and nearly half were within 1 km. Most movements were in relation to availability of cereal crops, particularly stubbles during late summer and early autumn (Emison 1990). In contrast, sulphur crested cockatoos and galahs are more mobile, travelling up to 50 km in search of food (Allan 1990).

Farm Management Practices

Sunflower is a highly attractive food to cockatoos, and its ripening coincides with fledging. Alternative foods in the form of native grasses and stubble fields are available, yet cockatoos and galahs prefer sunflower (Allen 1990). The most vulnerable sunflower crops are those grown near trees, especially where seed-heads vary in height due to terrain, irregular planting or germination (Ford 1990). Crops that offer birds visual vantage points, such as trees, fences and rises within the crop, are also at risk (Allan 1990). Careful location and timing of crops, together with suitable cultivation practices can reduce bird damage. Sunflowers planted to ripen at the hottest time of year have a minimum period when they are vulnerable to bird damage (Easdown 1978). In areas where severe bird damage is common, damage avoidance by crop substitution is a viable option. The economic return from sorghum, cotton or soybeans is competitive and bird damage is minimal.

Beeton (1977) assessed damage control by little corellas to irrigated grain sorghum. He recommended that ripening be timed to overlap the lowest density of the corellas annual population cycle to limit damage. He also recommended that the first bays to be planted should be the first bays to be crossed by the corella's regular flight paths. These crops would ripen first, and the birds would be encouraged to feed there rather than in other parts of the crop. Harvesting at 14% moisture and artificial drying reduced bird damage. The stubble would be slashed and the birds could feed on the waste grain rather than on unharvested parts of the crop.

Population Reduction

Shooting is probably the most universally practiced and most ineffective bird control technique used in Australia (Emison 1990, Ford 1990). The usual aim is to reduce the population in order to reduce the damage flocks of birds do to crops. The potential for cost-effective damage control by reductions in numbers is very limited because birds learn to avoid shooters, and it is expensive and time-consuming. (Fleming et al. 1990).

Two surveys comparing the distribution and abundance of long-billed corellas in South Australia in the late 1970s and in 1988 indicated that there had been a major decline in numbers over this period. The total number of white cockatoos (long-billed corellas, sulphur-crested cockatoos and little corellas) had decreased by 74% in South Australia, compared to only slight declines in other states (Alexander 1990). Long-billed corella numbers had declined by 90%. One of the main causes of mortality of long-billed corellas was thought to be shooting by farmers who are issued with destruction permits for damage control (Emison 1990), But the drastic reduction in numbers was also thought to be due to farmers instigating illegal poisoning (Alexander 1990). Drought may also have contributed to the decline in numbers. Despite the decline in numbers to a level where the long-billed corella is now considered endangered, there is still widespread concern among farmers over the level of damage caused by the species. Killing is clearly not providing a solution for these farmers.

Trapping and export of native birds is frequently suggested as a solution for bird damage to crops (de la Motte 1990). Removal of young birds from a population is unlikely to have any sustained effects on density because removals only replace high natural juvenile mortality rates. For example, 90% of galahs die from natural mortality before reaching breeding age. It is this 'doomed surplus' of young, inexperienced birds that are mainly caught by trappers (de la Motte 1990). Removal probably enhances the survival of the remaining birds.

Live trapping of cockatoos and corellas for export is also undesirable because wild caught cockatoos do not do well in cages. They screech and bite, and keeping a gregarious and strongly pair-bonded species in a small cage may be unacceptable on animal welfare grounds. The removal of baby cockatoos from nests will do even less to population dynamics than the removal of juveniles. Removal of eggs or nestlings will often induce adults to double clutch. The lifespan of a cockatoo in captivity has been recorded as >100 years. The pet replacement rate would therefore be extremely slow, and the market would soon be saturated and the current high prices drop (de la Motte 1990).

Local reduction in numbers around crop sites is unachievable because flocks of young birds are often extremely mobile, moving distances of more than 50 km from their breeding area to feed (de la Motte 1990). It is not cost effective to trap enough birds to reduce the population sufficiently in the long run to significantly reduce damage. However, unreplicated trials suggest trapping may disrupt large flocks of long-billed corellas (Emison 1990).

Decoy Crops

Decoy crops are a more effective and economical way to protect oilseed crops than shooting or scaring (Ford 1990). Decoy crops should be everything the main crop is not - irregular, early, close to trees and powerlines, and undisturbed. Unploughed wheat or barley stubble should also be left as birds will feed there if visibility is good. Growing crops specifically to be eaten by birds is hard for landholders to accept, and requires coordination on a regional basis for maximum effect (Ford 1990), but de la Motte's (1977) estimates of cost compare favourably with shooting. Several trials with decoy crops have been successful with sunflower (Broome et al. 1979, Allen 1984) and wheat (Jarman and

McKenzie 1983).

A decoy feeding study on winter cereal crops started in 1989 in south-eastern Australia. Major problems occurred at sowing and germination times when large flocks of up to 7,000 long-billed corellas were not uncommon. If the birds can be trained to feed in one location, then other management options may be more effective, and attempts to indiscriminately poison birds would become futile and the practice would stop.

The initial results were encouraging, with one site attracting 4,000 long-billed corellas for most of the seeding and germination phase of winter cereals. This was about a quarter of the estimated population of long-billed corellas in the region. The birds ate 20 tonnes of oats in 10 weeks. A second site failed to attract the birds but there was no major build up of long-billed corellas in the region. Taking into account cost of grain, labour and on-costs, savings in damage on dollars invested were estimated at 10-15 fold. Some additional savings could be expected in reduced costs for farmers in protecting their crops by other measures. There would also be a conservation advantage in using decoy feeding, in that reduced illegal poisoning would prevent population reductions of cockatoos and corellas and non-target species (Alexander 1990).

Decoy crops have had only mixed success in sunflower crops (Allen 1990). The main problem is rendering the main crop less attractive than the decoy (Allan 1990). Birds attack sunflower from shortly after flowering through until harvest (Allan 1990). Sorghum is attractive only in the doughy stage which lasts only 1-2 weeks. A sorghum decoy crop would only give protection for a week or two. Sulphur-crested cockatoos and galahs prefer to be fed above the ground, therefore spread grain is unlikely to be an attractive decoy. Oilseed sunflower, the preferred crop, is far more attractive to birds than birdseed sunflower (Jones 1983).

Screening

Crop screening, the establishment of a visual barrier of tall growing forage sorghum around the perimeter of the sunflower crop, developed from the observations of cockatoo feeding behaviour. By manipulating the visibility of feeding birds, the sunflower crop can be made unattractive to cockatoos and galahs, and reduce damage significantly (Allan 1990). Poor or incompletely developed screens fail to produce a visual barrier, and do not reduce damage. This happens when the sorghum is sown too late relative to the sunflower crop, does not grow fast enough, or is chemically or physically damaged. Screens are not suitable for protecting sunflower grown in sloping country.

Scaring

Several sound producing devices have been tested for their ability to repel birds from crops, but none have proved effective for damage control (Bomford and O'Brien 1990, Jaremovic 1990). Computer software tools are being used to inspect many calls quickly, and to rapidly and accurately modify calls in an attempt to develop synthetic calls with enhanced repellency, a wide species target range, or resistance to habituation (Nicholls 1990).

Shooting and use of scare devices may be counterproductive. For example, as cockatoos may break off sunflower heads and drop them uneaten when scared, this method may increase damage (Ford 1990). Similarly in fruit crops, birds return and damage more fruit than if they were left undisturbed (Fleming 1990).

Netting

Sinclair (1990) has investigated the use of nets to exclude birds from fruit crops. In the future it may be the only way of controlling birds in many situations given increasing concerns about the use of agricultural chemicals and animal welfare. Few chemicals are currently registered in Australia for bird control, and restrictions are increasing.

Throw-over nets give short term protection in the ripening season. Most are cheap, single use nets. Picking a crop through a net is slow and can increase costs significantly. Extruded nets also catch and strangle large numbers of birds. Few grape varieties have market values to make throw-over nets consistently cost-effective.

Cheap nets that can be mounted on light weight structures are also used. These have a high maintenance component and usually need to be replaced every 2-3 years. They are probably only cost effective if cheap labour is available.

A permanent structure with full exclusion is the most frequently adopted netting system for excluding birds from stonefruit. A pole and wire and cable structure supports roof and side netting. The structures are designed in panels, and loads that develop due to rain, hail or snow are transferred to anchors guying back the perimeter poles. Black nets have a life expectancy of >10 years, white nets of 5-8 years. There is no limit to size of area covered but there are economies of scale.

The decision on whether or not to net an area should be based on economics. Growers often consider netting is too expensive, but Sinclair (1990) found this is not accurate in terms of cost-benefit, if it is assumed that a grower borrows at 18% interest and pays it off over the 10 year life of the net, using a 10% discount rate. Netting becomes cost-effective in new, intensively grown cherry orchards with high-yielding fruit, even at moderate to low levels of bird damage. Netting is, however, difficult to erect over old orchards and is unlikely to be cost-effective.

Netting does not require much special expertise or sophisticated equipment. There are also side benefits associated with sugar content and fruit size due to increased temperature and humidity, though a potential downside is increased needs for fungicides. Netting has not been well accepted by traditional growers, but is gaining increasing acceptance for new orchards (Sinclair 1990).

Other Control Methods

Other approaches to bird damage control have been considered in Australia, but have not looked sufficiently promising to attract research. These include fertility control for population reduction (Bomford 1990), Chemical repellents (Temby 1990), and breeding plants for bird resistance (George 1990).

RESEARCH PRIORITIES

The cost of bird damage to affected industries needs to be evaluated. Simple cheap techniques growers can use to reliably estimate damage are required.

The cost-effectiveness of currently available control techniques needs to be assessed, particularly scare techniques, as these are the most popular with growers of broad-acre crops.

There is also a need for more studies on the biology of pest birds, in relation to the potential mitigation of crop damage by habitat modification or changes in crop growing practices.

An evaluation of the potential application of overseas bird pest control techniques to Australian bird pest problems is required. The role of chemical repellents on ripening fruit and germinating grain and at feedlots may have promise for use in Australia.

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