Corella, 2000, 24(4): 62–64

FEEDING PREFERENCES IN CAPTIVE CORELLAS FOR GREEN-DYED AND PLAIN OATS

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Received: 1 June, 2000

The common practice of including a green dye in baits used for pest animal control is thought to provide some protection to non-target birds because general avoidance of green coloured foods by some bird species has been documented. Captive Long-billed Corellas *Cacatua tenuirostris* offered a choice between green-dyed and plain whole oats showed a preference for the plain food on the first day. This preference was not evident on the second day of feeding, and by nine days there was a preference for the green food. These results are discussed in the context of current baiting practices. While the inclusion of green dye in oat baits may provide some initial protection to Corellas, this may not be a lasting effect in situations where birds have consecutive opportunities to feed.

INTRODUCTION

Food selection in birds seems primarily guided by visual cues. Many interacting factors including food colour, texture, shape and contrast with a background may affect whether an item is eaten (Goforth and Baskett 1971; Pank 1976). A general avoidance or decreased uptake of artificially coloured food by birds has been demonstrated (Caithness and Williams 1971; Pank 1976; Brunner and Coman 1983). Kalmbach and Welch (1946) suggested that the most pronounced avian aversion is to food dyed with colours near the centre of the spectrum visible to humans, in the green and yellow wavelengths.

It is clear that colour preference varies between bird species; for example, young anatids (not specified) were found by Kear (1964, cited in Brunner and Coman 1983) to prefer green coloured food. However, green colours have often been shown to be in the mid to low range of preference. Pigeons *Columba livia* were found to have colour preferences for blue, green and yellow respectively (Sahgal and Iversen 1975). In a study of a range of Australian native birds, Brunner and Coman (1983) concluded that an avoidance effect was generally highest for grain coloured blue or green and least for grain coloured yellow or red. Results obtained with newly hatched chicks *Gallus domesticus* found unlearned pecking preferences for orange or both orange and blue-violet coloured targets, with the least amount of pecking at green (541 nm) targets (Fischer *et al.* 1975). Other studies with the domestic hen show significant strain effects in their responses to novel red feed (Murphy 1977). A recent field study of North Island Robins *Petroica australis* in New Zealand showed two populations of this species to have similar colour preferences. The robins pecked more frequently at cake dyed red, yellow and green than at cake dyed medium blue, light blue or brown (Hartley *et al.* 1999). Colour preferences reported for weka *Gallirallus australis* (Hartley *et al.* 2000) were for pellets dyed red and yellow over pellets dyed green, blue or brown on the first day of being offered a choice between colours. While it is possible to generalize across a number of species that birds prefer colours other than green, it is nevertheless difficult to compare colour preference between species because of the differences in the colours offered, experimental settings and design and age and experience of the birds. General avoidance of green coloured food is thought to provide some protection to non-target bird species from poisonous baits commonly used for the control of mammalian pests (Rathore 1981). Oat baits are likely to be attractive to a wide range of Victorian birds, particularly parrot species. A green dye in oat bait products registered for use against rabbits *Oryctolagus cuniculus* has been recommended in Victoria to indicate the presence of poison to humans and also to deter birds from taking baits in field conditions (Natural Resources and Environment 1999).

Colour preference, or avoidance of coloured food, by birds is also likely to be influenced by previous experience (Slaby and Slaby 1977). It is possible that large scale or repeated baiting operations for the control of rabbits may provide opportunities for wild birds to learn to associate coloured baits with a food source. This may occur particularly where pre-baiting with non-poisoned feed provides a food reward. Captive Long-billed Corellas *Cacatua tenuirostris* were used as a 'model' common species that readily utilizes human resources as food and has been reported to exhibit a preference for oats in field conditions (Emison *et al.* 1984; Temby and Emison 1986; Environment and Natural Resources Committee 1995). This has also been confirmed in captivity (Waples *et al.*, in prep.), where hulled oats were preferred to whole oats, hulled sunflower seed and whole sunflower seed. The purpose of this trial was to investigate the effect of both green and non-coloured food on acceptance of that food by Long-billed Corellas.

METHODS

Long-billed Corellas captured from wild Victorian populations in February 1999 were purchased from a licensed controller. Ten corellas of unknown sex and age were housed at the Victorian Institute of Animal Science, Werribee for the duration of the trial. Birds were kept in individual pens 2.9 m (length) × 1.2 m (width) × 2.2 m (height), constructed of cockatoo-proof square mesh wire with a diameter of 1.3 mm on the front and 2.6 mm on one side wall and the back wall and aluminium siding on the fourth side. Each bird had visual and physical contact with one other bird through a mesh wall. The pens were contained within a shed allowing natural photoperiod and airflow through the upper half of the north and south-facing wall, which were covered in chicken wire. Plastic sheeting and an aluminium sheet on the upper half of part of the back wall of each pen formed a windbreak. Each pen contained a hanging perch and a perch angled from the ground to a side wall, made from eucalyptus or cypress, and had a cement floor covered in wood shavings.

Birds were allowed to acclimatize to the pens for one week during which time they were fed a commercial parrot seed mix (Salce Produce Merchants, Thornbury, Victoria, Australia) which included black and grey sunflower seeds, oats, wheat, sorghum, safflower and crushed and whole maize. Fresh water was provided *ad libitum* at all times. Feed trays were designed so that discarded seed and husks could be collected and weighed to measure food intake. A 600 ml bowl was bolted to a wire mesh grill (34 × 34 cm) which was set into a metal tray (34 × 34 cm). The trays were placed on the floor of each cage and raised on bricks. This method proved successful in trapping spilled and discarded food and in deterring rodents. Normal diet was retained prior to commencement of the colour preference trial. Green dyed and normal oats from the same batch were supplied by Animal Control Technologies (Somerton, Victoria, Australia) and used throughout the experiment.

Each corella (n = 10) was presented daily (between 0815–0830 h) with a dish containing 40 g oats (an amount in excess of daily requirements) and a dish containing 40 g green oats. Within each pen there were two feeding sites along a side wall that were visible from the hanging perches. The metal trays containing the feed bowls were separated by 10 cm and the location of the two feeds was randomized each day. The weight of food consumed by each bird was measured (0815–0830 h) each day for nine days. Normal maintenance diet was resumed at the end of the trial. The data were analysed by a split-plot analysis of variance for day and treatment effects using Genstat 5 statistical package (Lawes Agricultural Trust, Rothamsted, Experimental Station, UK). Values of least significant difference (LSD) between pairs of mean intakes of oats were calculated. The data were blocked on bird, which accounted for the use of the same birds during the experiment.

RESULTS

There was no overall treatment effect ($P = 0.07$), however there was an overall trend for birds to eat more green-dyed than plain whole oats (mean daily intakes were 10.3 and 8.9 g/day, respectively; $LSD_{(P = 0.05)} = 1.48$; Fig. 1). A significant interaction was found between treatment and day with a change in amount eaten over time. On day 1 birds ate less of the green-dyed oats (mean values were 0.1 *vs.* 7.5 g; $LSD_{(P = 0.05)} = 4.44$; $P < 0.01$), but the difference had disappeared by day 2 (mean values were 8.0 *vs.* 6.7 g; $P > 0.05$). From day 3 to 9, birds ate from 0.4 to 4.0 g/day more of the green-dyed oats, on day 9 this was significant with mean values of 15.2 *vs.* 10.2 g ($P < 0.05$).

DISCUSSION

The results showed an initial low uptake of the green-dyed oats in comparison to plain oats by Long-billed Corellas. After exposure to a choice between green-dyed and plain oats for one day there was no evidence of avoidance of green colour; in fact the data showed corellas to have a preference for this feed by the final day of the experiment (day 9). The gross energy content of the green dyed oats was 17.93 Mj/kg and the whole oats 18.02 Mj/kg and thus energy levels were not responsible for differences in uptake.

On day 1 of the experiment, while the intake of green-dyed oats was lower than for untreated oats, the intake of the untreated oats was lower than on subsequent days. A

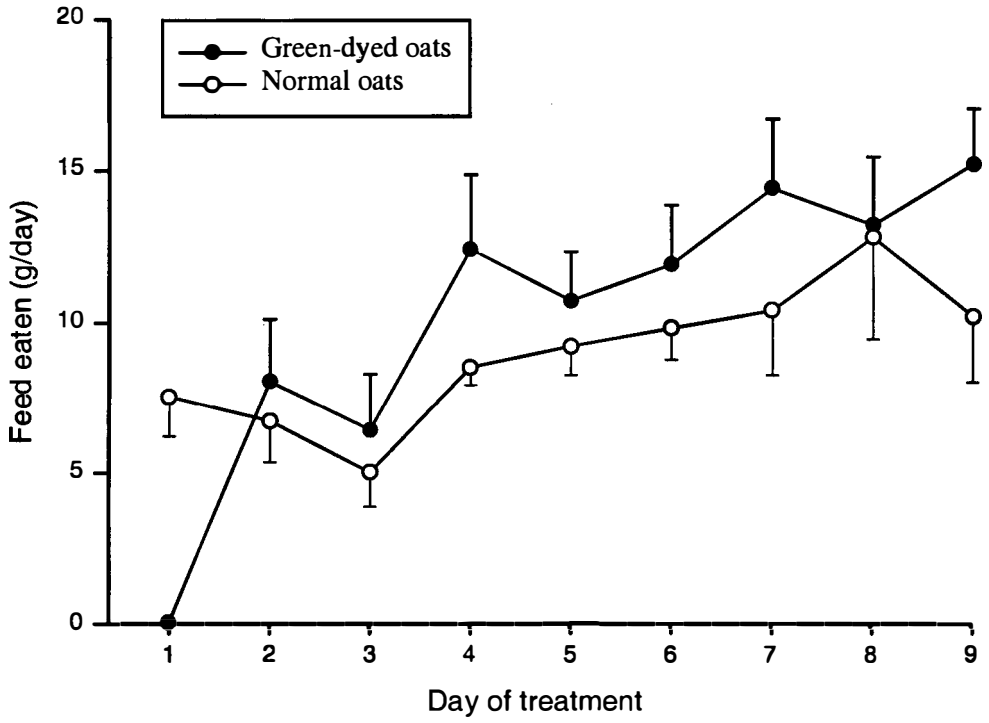

Figure 1. *Mean amount (± SE) of feed eaten (g/day) by birds given both normal and green-dyed oats.*

possible reason for this is that day 1 was the first day birds were offered only oats and in a choice situation of whole and hulled oats and whole and hulled sunflower seeds, whole oats was not the preferred feed (Waples *et al.*, in prep.). Other reasons could include the 'novelty' of the single oats and the change in the feeding environment by having two feeding sites.

Some birds can be trained to accept coloured food which they might normally be expected to avoid. Slaby and Slaby (1977) found that while Steller's Jays *Cyanocitta stelleri* showed a descending order of preference for food coloured red, yellow, blue and green, they could abandon this preference order in the short term if there was a reward (an increased availability of food) for doing so. Free-living Steller's Jays quickly learned to associate green coloration with a particular favoured food after five 'learning sessions', and reverted to their previous colour preference for red food within 48 hours of the last session. Flexibility in food colour preference was also found in Crimson Rosellas *Platycercus elegans* (Brunner and Coman 1983). Free-living Rosellas exposed to blue grain for three weeks before being presented with a range of artificially coloured and natural grain showed some preference for blue coloration. Wekas have an opportunistic and adaptable feeding habit, and were observed to increase their consumption of differently coloured pellets over a number of days, even of colours that they initially avoided (Hartley *et al.* 2000).

Results of this trial indicate that Long-billed Corellas can quickly learn to accept green coloured food. Initial encounters with green-dyed food seemed to deter the Corellas when natural coloured food was available, but the deterrent effect did not last more than 48 hours. If similar behaviour is present in wild populations of Long-billed Corellas and other cockatoo species, the degree of protection provided to birds by green coloration of poisonous oat baits may be less than currently thought. Conversely, if pest bird species are to be managed by poisoning, the effect of green coloured baits on uptake by non-target bird species should be further assessed in field conditions.

Significant bird uptake of oat baits laid for rabbits is obviously undesirable as it causes a reduction in the availability of baits to the target pest. Lethal poisoning or compromised fitness of birds from sublethal poisoning is undesirable if it occurs on a scale with implications for populations of birds, particularly threatened or endangered species. While the non-target risk to birds is difficult to assess, a practical approach is to minimize the likelihood that birds will be exposed to poison in the first instance. While whole oats are generally used in pest animal bait products, the characteristic 'husking' of whole grains by feeding parrots is thought to provide some protection when the baits are coated with poison. However, there are several bird species that will eat whole grains and also may be able to 'learn' to accept green-dyed oats in field conditions. It is also possible that birds husking sufficient quantities of whole oat bait over time may be exposed to poison.

This was a relatively small pen trial using experimental settings and birds which were not fully representative of field conditions. While the results obtained with captive Long-billed Corellas confirm previous observations of an initial avoidance of green coloured food by birds, this experiment also showed any deterrent effect of green coloration, using whole oats as a palatable food, to be quite short-lived. Field-based investigation seems warranted to further examine what this might mean in the context of current poisoning practices for target specific pest animal control. Field studies should examine more closely the likelihood of an initial deterrent effect of green coloration of baits being overcome by birds during consecutive exposures, such as might be available during a rabbit control operation using anticoagulant poisoned oat baits.

ACKNOWLEDGMENTS

This research was conducted with the support of the Victorian Department of Natural Resources and Environment (NRE). Corellas were held in captivity under Wildlife Permit No. 100000542. We thank Animal Control Technologies for supplying the treatment feeds used in the experiment. Professor Paul Hemsworth and Dr Kelly Waples kindly provided comments on the manuscript.

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