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**Preliminary estimates of rate of grain passage through the digestive tract of Mallards**by Robert G. Clark<sup>1</sup>, Hamilton Greenwood<sup>1</sup>, and Lawson G. Sugden<sup>2</sup>**Abstract**

Rate of grain passage through the digestive tract was assessed for nine captive Mallards. Mallards were fed mixed dyed and non-dyed durum wheat, and the number of faeces voided was then recorded for 23 h. The average amount of wheat eaten was similar to the weights of wheat found in the esophagi of wild Mallards during the fall in central Saskatchewan. Wheat was voided within 5.5 h of feeding, and this rate was only weakly related to the amount initially eaten. No wheat was found in their esophagi or gizzards when dissected 24 h post-feeding. Mallards can digest grain rapidly, and they probably feed twice daily if they are unable to feed efficiently in the morning or need additional grain to meet their energy demands.

**Introduction**

The preferences, rates of consumption, and amounts of grain eaten by Mallards (*Anas platyrhynchos*) have been well described (Bossenmaier and Marshall 1958; Hammond 1961; Sugden 1976; Greenwood *et al.*, unpubl.), but much less is known about the rate at which grain passes through their digestive tracts. Malone (1965) found that rates of passage of oats and corn through captive Mallards ranged from 1 to 6 h.

Mallards reportedly field-feed twice daily (Hochbaum 1955, Bossenmaier and Marshall 1958). In a study of field-feeding ducks in Manitoba, Ball (1983) found that, of 204 possible visits to grain fields, radio-equipped Mallards fed twice daily 77% of the time, whereas 13% and 10% of the visits occurred only in the morning and evening, respectively. Mallards that fed twice daily arrived earlier and stayed longer in grain fields than those that fed once, suggesting either that they had not met their daily energy demands (i.e. had not eaten sufficient grain in the morning), or that they were capable of digesting grain rapidly. For instance, a Mallard can travel to field-feed twice daily, but may not actually eat much grain unless there is room in its esophagus or if it has already met its energy needs. The Mallard's esophagus serves as a major food storage organ and may contain as much as, but usually *much less* than, 85 g of dry weight grain (Greenwood *et al.*, unpubl.). It was therefore of interest to learn whether Mallards can process grain quickly, and thereby to gain some additional information on the number of field-feeding flights a Mallard might be capable of making each day. Rapid digestion would enable them to make two efficient, daily trips to grain fields.

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**Methods**

Five male and four female Mallards, housed individually in poultry cages, were deprived of food for about 16 h. Further details regarding housing, food, and other feeding trials are available (Clark *et al.*, unpubl.). Twenty grams of dyed and 20 g of non-dyed durum wheat were mixed together, placed in a food tray, and presented to each duck for 15 min. The amount of grain and time allotted for eating were based on earlier observations of wild and captive Mallards. Sliding trays under the ducks were cleaned and covered with paper towels. At 1.5, 3.5, 4.5, 5.5, 6.5, and 23 h post-feeding, the paper was examined and the number of dyed and non-dyed faeces were counted. New droppings were marked and were excluded from subsequent counts. When the trial ended the ducks were sacrificed and dissected (as part of another study), and their esophagi and gizzards were examined for grain.

To learn how weight of grain eaten influences rate of grain passage, we divided the ducks into two groups depending on whether they ate more, or less, grain than the overall average amount eaten. We then compared these groups on the basis of the number of faeces voided during the measurement periods.

**Results and discussion**

Ducks ate an average of 21.6 g (SD = 15.6, range = 3.7-40) of durum wheat. This amount was very similar to weights of hard spring wheat eaten by wild Mallards in the fall in central Saskatchewan but was lower than the weight of barley eaten in mid to late fall (Greenwood *et al.*, unpubl.). Grain passed rapidly through the digestive tracts of the ducks (Fig. 1). Dyed grain appeared within 3.5 h after feeding, and reached a peak near 4 h. Much less dye was detected between 5.5 and 23 h after feeding. Apparently, grain passage was virtually complete 5.5 h after feeding. When the experiment ended and the ducks were dissected, no grain was found in their esophagi or gizzards.

Four ducks ate less grain, and five ate more, than the average amount eaten (21.6 g). We then compared the number of faeces voided by each group < 3.5, 4.5, and > 5.5 h post-feeding. The rate of appearance of dyed grain was independent of the amount of grain eaten (G-test,  $G = 1.4$ , 2 df,  $P > 0.05$ , Zar 1974) but, considering all faeces voided (Fig. 1), Mallards that ate less tended to void grain earlier ( $G = 9.9$ , 2 df,  $P < 0.05$ ). Both groups digested most grain within 5.5 h, when the number of faeces voided by each group was the same (below average,  $\bar{x} = 9.0$ , SD = 2.8; above average,  $\bar{x} = 10.0$ , SD = 4.2). Hungry captive Mallards excreted dye at maximum rates within 5.5 h post-feeding, suggesting that rates of digestion are very rapid. It is difficult to explain why non-dyed faeces were voided before dyed ones. Perhaps digested material in their intestines from the previous day's meal was voided after the Mallards had fed, or they may have eaten more non-dyed than dyed grain (but note that two ate all 40 g). We mixed non-dyed and dyed grain together

because our preliminary observations suggested that some of the ducks were reluctant to eat 100% dyed grain. Nevertheless, considering only dyed faeces that we know were produced from grain eaten during the feeding trial, most were voided within 5.5 h post-feeding (Fig. 1).

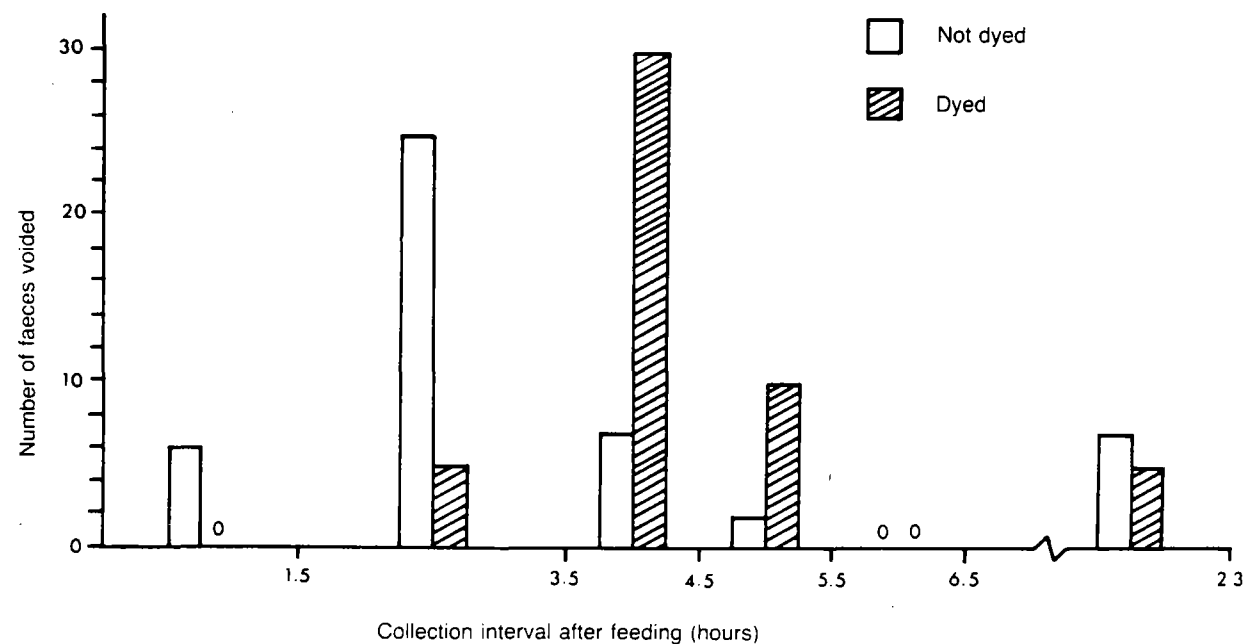
When Mallards field-feed twice daily, they are capable of eating 40 g of grain if the time between morning and evening flights exceeds about 6 h. This time interval between flights commonly occurs (pers. obs.), and shorter intervals are observed only when weather conditions are harsh, or occasionally in late fall. The difference between the amounts Mallards can potentially eat and actually ingest will be affected by such factors as: (1) their ability to locate good feeding sites, (2) the crop type selected, (3) the length of time they feed undisturbed, and (4) the success of their previous visit. In most situations, the decision to field-feed does not appear to be determined by an inability to empty their esophagi, but this may delay their afternoon departure to fields (Hochbaum 1955). It also remains to be determined whether a Mallard is capable of digesting 85 g of grain within 6 h. Given that the majority of Mallards returning from fields have eaten less than 40 g of grain (Greenwood *et al.*, unpubl.), we suggest that most of them will be both capable of field-feeding twice daily and in need of grain to meet daily energy demands.

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**Figure 1**

Number of dyed (hatched bars) and non-dyed (open bars) faeces voided by nine captive Mallard ducks in relation to the number of hours post-feeding. The total number voided in each time interval may be determined by summing the values of the two bars.



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