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## GREY SQUIRREL CONTROL USING MODIFIED HOPPERS, by Harry Pepper and Derek Stocker

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### Abstract

The recent introduction of hoppers modified to include a flap door has significantly reduced the amount of bait taken. As a result, there has been some concern that this was reducing the effectiveness of control. Occasional malfunction of flap doors has also been experienced. The consumption of bait from hoppers deployed in routine grey squirrel control in six forest areas was therefore measured over the 1991 control period. No difference was found in the amount of bait taken by grey squirrels from hoppers with or without flap doors, but 47% more bait was taken from hoppers without flap doors by non target animals. Using hoppers with doors ensures that the poison dispensed is only taken by grey squirrels. The number of squirrels killed can be estimated from bait-take and, therefore, the effectiveness of control operations assessed.

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### Background

1. The Grey Squirrels Warfarin (Order) 1973 specifies the dimensions of hoppers which must be used for squirrel control. The objective of this legislation is to prevent animals larger than grey squirrels gaining access to poisoned bait. The exclusion of non-target animals smaller than squirrels was a problem until 1989 when the hopper design was modified (Pepper, 1989). The modification involved fitting, into the tunnel entrance, a transparent flap door with a securing magnet. Only an animal with the strength and inquisitiveness of a grey squirrel could open the door to gain access to the poisoned bait.
2. The consequence of excluding non-target animals is that bait removal is reduced by 30–50%. This reduction has caused some rangers and forest managers using modified hoppers to surmise that the new design is discouraging grey squirrel feeding and is therefore less effective.
3. Experience with the modified hoppers also identified two other problems. Firstly, magnets became detached from the doors because of poor manufacture. Secondly, dropped wheat prevented the door from closing completely and the magnet from contacting the tunnel floor. As a consequence, there was some small animal feeding, and on occasions woodmice or bank voles became trapped behind the flap doors.
4. To obtain further objective information on the relationship between removal of bait and effectiveness of control, some routine poisoning operations were monitored throughout the 1991 control season to determine how well the modified hoppers were performing. Improved door designs were also tested, by monitoring poisoning operations in 1991 on three Forest Enterprise sites – at Forest of Dean, Dorset and Wiltshire & Avon – and in a National Trust woodland. All the areas have been subjected to squirrel control with warfarin in most years since 1973.

### Monitoring bait removal

5. Hoppers containing 2 kg of wheat bait were put down in all four areas during the first week of May and removed at the end of July. All were visited weekly, checked to ensure the flow of bait was not obstructed and, if necessary, topped up with 500 g of wheat. A record was kept of the amount of wheat dispensed into each hopper and, at the end of the control period, the amount of bait remaining was measured.

## Monitoring new door designs

6. Bait consumption in part of Wareham Forest (Dorset) was measured from four hopper types. These consisted of two with different door designs and two without doors. Hoppers with doors had either the current standard clear pvc door with magnet or a new solid heavy metal door. Both are designed to prevent small mammals and small birds, but not grey squirrels, from feeding from the hopper. Hoppers without doors had the entrance either completely open, to allow access to small birds and all small mammals including grey squirrels, or partially restricted with wire mesh, which allowed small mammals, such as mice and voles, and small birds through but not grey squirrels. In addition, bait consumption from hoppers with only the standard pvc and magnet door was measured in five separate forest areas.

## Results

### Bait removal

7. Table 1 shows the mean weight of poisoned bait taken from each hopper type. If the amount of bait taken by small mammals and birds from the restricted entrance hopper (D) is deducted from that taken by small mammals, birds and grey squirrels from open hoppers (C), the difference (1.690 kg per hopper) is the amount consumed by grey squirrels. This quantity, 1.690 kg, is not significantly different from the amount taken from hoppers with doors (A and B: mean, 1.722 kg); neither was the difference in take between hoppers with pvc doors plus magnet (A) and solid doors (B) significant.

Table 1 - Bait consumption from four hopper types (Wareham Forest, Dorset)

Hopper type	Average weight of bait taken in kg	Animals feeding
A. With pvc and magnet door	1.872	Grey squirrels
B. With solid door	1.572	Grey squirrels
Mean bait take $\frac{A+B}{2}$	1.722	Grey squirrels
C. Without door and open entrance	3.698	Small birds, mice, voles and grey squirrels
D. Without door and partially restricted entrance	2.008	Small birds, mice and voles

8. Because only grey squirrels take bait from doored hoppers it is possible to calculate from the quantity of bait consumed the level of kill obtained. It requires, on average, 250 g of warfarin treated bait to kill an adult squirrel (Rowe, 1975). Therefore the expected kill resulting from the 51.58 kg dispensed on the Dorset trial area was 206 squirrels (Table 2). The kill figure can be used as a measure of effectiveness by relating it to the area poisoned in terms of the number of squirrels killed per hectare. Grey squirrel population densities fluctuate from year to year and are, generally, between two and eight animals a hectare, but can reach as high as 16 a hectare in very favourable conditions (Gurnell, 1987).

9. Table 2 gives the kill figures for the six areas where hopper use was monitored.

**Table 2 - Measurement of control success on six forest areas**

Location	Bait removed in kg	No of squirrels killed	
		Total	Per ha
1. Wareham, Dorset	51.58	206	9
2. North Plumbly, Dorset	20.83	83	11
3. Dymock, Forest of Dean	21.24	84	4
4. Cake Wood, Wilts and Avon	51.12	204	11
5. Webbs Wood, Wilts and Avon	28.2	112	7
6. Sheepscombe (National Trust)	28.7	114	7

10. The results show clearly that squirrel populations are reduced by control operations while safeguarding non-target species.

#### ***New door designs***

11. No problems were experienced with the operation of the flap doors throughout the control period. Doors are now manufactured with improved security of the magnet. Only one woodmouse was found trapped behind a pvc and magnet flap door and none behind solid metal doors.

#### **Conclusions**

12. a. Grey squirrels are not deterred from feeding from hoppers with flap doors and the clear pvc door with magnet and solid metal door were equally effective.
- b. Generally 30–50% less bait is used.
- c. Small mammals and birds are protected.
- d. There is a risk that any bait dropped in the hopper entrance tunnel will prevent doors with magnets from closing onto the tunnel floor. This may enable mice and voles occasionally to relift the door and become trapped. Use of the heavy metal door eliminates this.
- e. The measurement of bait consumption from doored hoppers allows the effectiveness of poisoning operations to be supervised and assessed.
- f. All square tunnel entrance hoppers purchased before 1989 should be fitted with flap doors. Old round tunnel entrance hoppers are unsuitable for modification and should be replaced.
- g. Squirrel populations can be controlled by warfarin/hopper operations. See Research Information Note 180 for current recommended practice.

## References

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