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EXPERIMENTS COMPARING THE USE OF KITES AND GAS BANGERS TO PROTECT CROPS FROM WOODPIGEON DAMAGE

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ABSTRACT

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Woodpigeon damage to spring cabbage on two farms in different years was greatly reduced when a large kite was flown over the fields. Protection continued for over 3 months with no sign of habituation to the kite by pigeons. Woodpigeons avoided flying or settling within 250 m of the kite. Damage in fields with a gas banger exceeded that in fields with a kite, especially in severe winter weather. "Humming line" proved ineffectual in reducing damage. On these lowland farms it was necessary to launch the kite on most mornings, but if such launching can be carried out, kites can be effective in reducing damage by woodpigeons.

INTRODUCTION

Woodpigeons (*Columba palumbus*) are important agricultural pests (Murton et al., 1974), especially on winter brassica crops (Jones, 1974), but no generally effective way of controlling the damage has yet been found. The most widespread control methods are shooting, which is economically unsatisfactory (Murton and Jones, 1973), netting the growing area, which is only suitable for small areas, and scaring methods. Propane gas bangers, electronically synthesised sounds, scarecrows, and model pigeons with spread wings can be effective in scaring pigeons off crops, but the birds habituate to all of these (Frings and Frings, 1967; Hunter, 1974; I.R. Inglis, 1984, personal communication). Murton (1970, 1974) mentions that a well-designed scarecrow, perhaps like those used by our ancestors, may be the best method. An anonymous report (Anon., 1980) indicated that a kite can be effective in scaring woodpigeons. Kites have

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existed for 25 centuries (Pelham, 1976) and their uses have been many and varied, but very little is known about their suitability for scaring birds. Kites, in association with loud hummers, were used in China for driving game. They were also used in France and England during the 19th century as aids to hunting game birds, particularly grouse and partridges, but due to habituation the method was not very effective (Hart, 1967).

In the experiments reported here, the effects of kites, gas bangers and "humming line" on woodpigeon damage to spring cabbage crops in Berkshire, England, were investigated. The kite was tested in one experiment in which the control and experimental periods were sequential in a single field, and in a second experiment in which kite, gas banger or no scarer were used simultaneously in a set of similar fields.

MATERIALS AND METHODS

Study areas

The three experiments were done in the winters of 1980—1981 and 1982 in two places about 8 km apart in Berkshire; the first and third at the University of Reading's Lane End Farm, Shinfield (Fig. 1a) and the second at Springalls Farm, Swallowfield (Fig. 1b). Each experiment involved fields of spring cabbage Myatts Offenham Compacta. In Experiment 1 at Lane End Farm, two experimental fields had been planted with spring cabbage. Field 1 measured 100 × 40 m, inside a larger area with onions, spinach, red cabbage and fallow ground, but no other spring cabbage. In the early part of this study, a field of about 0.25 ha of January King cabbage lay 100 m away from Field 1, but the cabbages were harvested a month after the start of the experiment. The other spring cabbage on the farm was 500 m away in the 90 × 60 m Field 2.

Experiment 2, at Springalls Farm in 1982, involved four fields planted with the same spring cabbage. In the 150 × 50 m, Field 1 (Fig. 1b), a kite was used and in the 225 × 50 m, Field 2, a gas banger. The other two spring cabbage fields were Field 3, 150 × 50 m, and Field 4, 150 × 30 m. In this farm there were fields of January King cabbage, red cabbage, leeks, onions and rye. In Experiment 3, at Lane End Farm in 1982, "humming line" was used on a field of spring cabbage close to Field 1 of 1980—1981.

On both farms isolated trees and woodland provided resting and roosting places for pigeons. The areas studied were subject to pigeon attack annually. In the early months of 1980, observations of woodpigeon behaviour at Lane End Farm showed that they attacked spring cabbage on this farm, and scaring devices, including bangers, were already in use. In the winter of 1979—1980, occasional shooting of woodpigeons occurred, but in the 1980—1981 winter there was no shooting. In 1980—1981, during visits

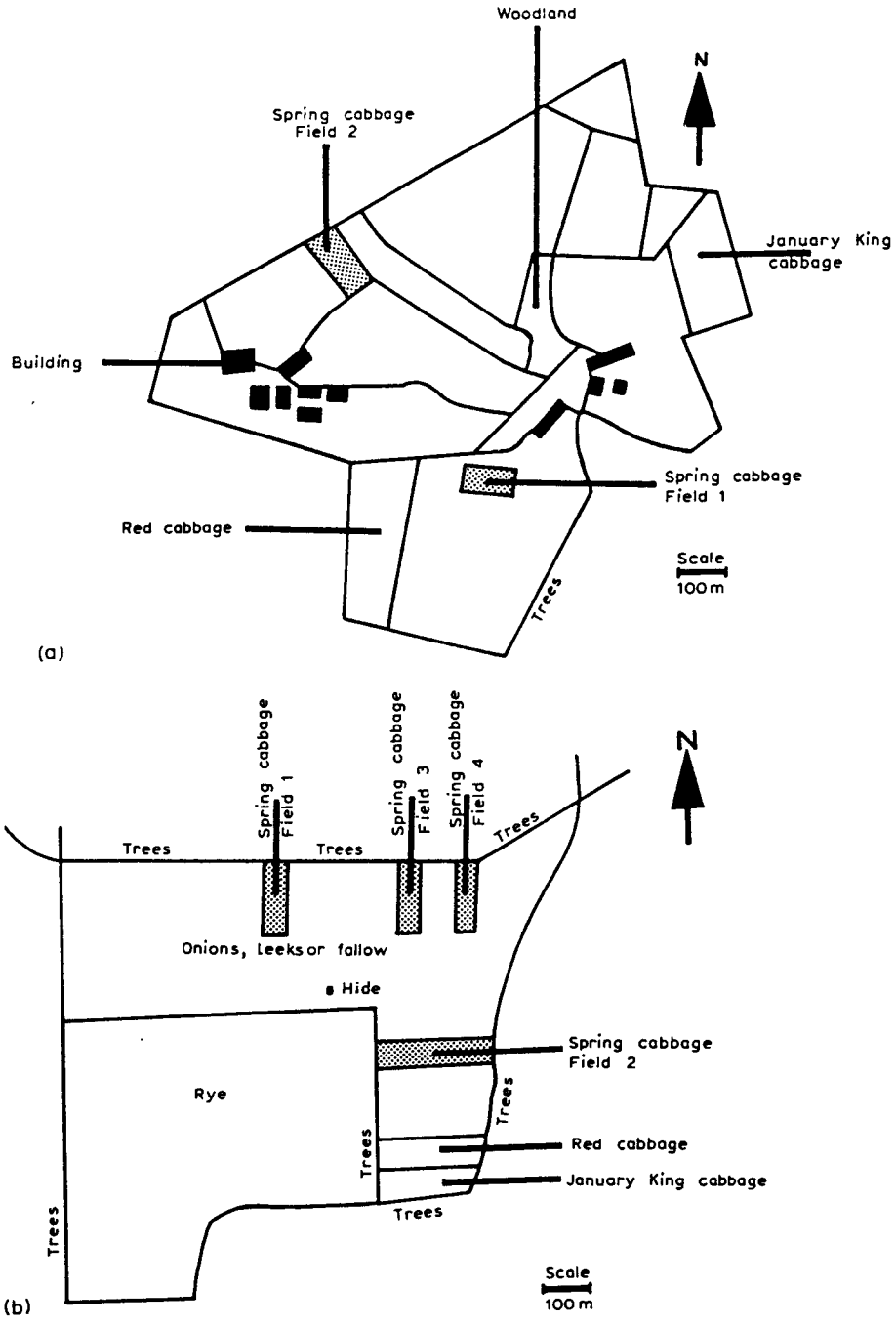

Fig. 1. (a) Lane End Farm, showing cabbage fields for Experiments 1 and 3, and (b) Springalls Farm, showing cabbage fields for Experiment 2. The surrounding land is farmland, arable or pasture with some woods and rows of trees.

to Springalls Farm, woodpigeons were observed feeding on spring cabbage. There were bangers and scarecrows to disturb them and some shooting took place each winter.

Damage assessment

In Experiment 1 the damage to cabbage plants in Field 1 was monitored on 9 December 1980 and weekly thereafter. One hundred plants were selected by choosing, in each row, the nearest healthy, undamaged plant to the two diagonal lines across the field from opposite corners. Since there were 51 rows, two plants per row were marked except in Rows 2 and 25 in which one plant was marked. The mark was a short length of pink polypropylene tied around the base of the plant. Damage was classified at the end of each week as follows: (1) undamaged; (2) medium damage, all leaves pecked but not stripped to the main veins; (3) severe damage, leaves stripped to the main veins. Plants in category (3) would be of no further use to the grower and those in (2) would be of little use. Undamaged plants were retained in the sample of 100 for following week. Damage in Field 2, which had been undamaged at the end of December, was assessed in the same way on 13 April 1981. A total of 389 plants was checked, taking plants systematically 0.5 m apart whilst walking twice diagonally across the field.

In Experiment 2 the damage assessment was similar to that in 1980—1981, a sample of undamaged plants being measured each week. A total of 214 plants, each 2 m apart, was marked from each row in a diagonal transect of Field 1, and 240 plants in Field 2. They were marked on 6 January but damage could not be assessed before 20 January due to heavy snowfall. Damage was assessed weekly after this date. In Field 1 (kite), checking continued until 14 April when the plants were ready to harvest. Field 2 (banger) was checked on 20 and 27 January, 3 and 10 February, whilst the banger was in use. In the last week of March 1982, damage was assessed extensively in all four spring cabbage fields. Each field was divided into four 20 m sections, each 20—40 m apart. In each section, 220 plants were checked. These were selected by dividing each of the 20 rows into ten equal lengths and taking the nearest plant to each of the 11 points thus produced.

In Experiment 3, 150 plants were marked, in the same way as in Experiments 1 and 2, on 16 December 1981. These were checked on 23 and 30 December 1981 and 7 January 1982.

Behaviour observations

In 1982, woodpigeons which came within a 500 m radius of Field 1 (kite) were observed from a hide, using binoculars and a telescope, for 106 h. Their behaviour was described as they passed over or settled in

three different areas: (1) within the kite field; (2) outside the kite field, but within a 250 m radius of the kite; and (3) outside a 250 m radius, but within a 500 m radius of the kite.

Scaring methods

In 1980—1981 a kite was flown over Field 1 during three experimental periods which were alternated with control periods when no bird-scaring device was in use. Damage was severe during control periods so these were necessarily briefer than experimental periods. Control periods were: 9—16 December 1980, 13—27 January 1981, and 24 February—3 March 1981; and experimental periods were: 16 December 1980—13 January 1981, 27 January—24 February 1981, and 10—17 March 1981. On several days during the week ending 10 March 1981 the kite was flown for part of the day only. A gas banger was used in Field 2 from December 1980 to April 1981. It operated from dawn to dusk and the interval between bangs was 10 min.

In 1982 the same kite was used continuously from 20 January to 14 April in Field 1, except for 5 days in the last week of February due to lack of wind and 4 days during the second week of March when a gale broke the line and blew away the kite. In Field 2 a human effigy scarecrow was present from January to April, and a propane gas banger producing bangs at 5 min intervals was used from dawn to dusk until 11 February. In Fields 3 and 4 there was intermittent use of a scarecrow and a banger, but long periods with no scaring device.

The kite was a Dunford Twin-keeled Delta kite supplied by Cochran of Oxford. It was flown continuously during the experimental periods at a height of approximately 55 m. It was necessary to fit a stronger, 20 kg braided nylon line to the kite before the experiment. The kite was red, with a span of 1.8 m. In flight the lateral vanes flapped up and down a little, the total movement of the kite being faster when the wind speed was faster and differed in pattern according to the frequency of change in wind speed and wind direction. There was sufficient wind to keep the kite aloft on most days during the experimental periods, but it came down to the ground on most nights. The kite was checked each morning by an experimenter and on these occasions, or at any time that farm staff passed the field during their routine work, the kite was launched. As a consequence, it flew throughout most of the daylight hours except for brief periods in early mornings and as noted in the previous paragraph.

A bird-scaring "humming line" supplied by Santark, Ltd., Reading, was used in Experiment 3. It was tied between stakes 5 m apart down the centre of the longitudinal axis of the field and 0.45 m above the ground. Strong wind produced a humming sound.

RESULTS

Figure 2 shows that in 1980—1981, much less damage occurred in Field 1 during experimental periods, when the kite was flying, than during control periods. The mean percentage of cabbage plants damaged during control periods was 30.0% per week, of which 14.7% were severely damaged. When the kite was flying, comparable figures were 2.8 and 0.6% per week. In Field 2 where a banger was in use, severe pigeon damage was 18.8% by April, with a mean of 1.3% per week between 31 December 1980 and 13 April 1981.

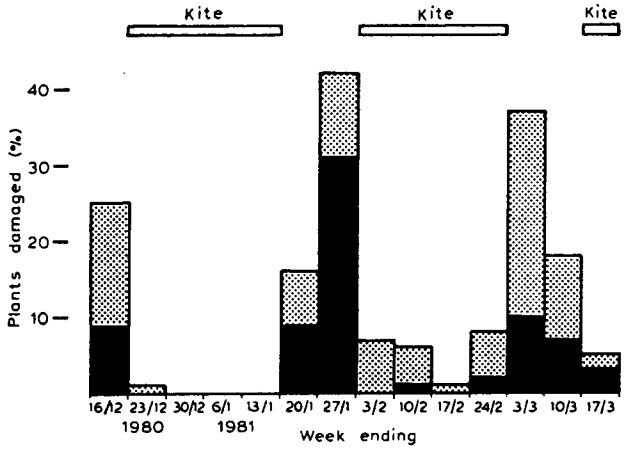

Fig. 2. The number of cabbage plants with severe damage (solid column) and medium damage (stippled) out of 100 examined is shown for each week of Experiment 1. Woodpigeon damage during weeks when the kite was flown continuously was much less than during control periods when no scaring method was used ($\chi^2 = 109.9$, $P < 0.001$ 2-tailed for severe damage).

The kite and banger were in use simultaneously in spring cabbage fields 500 m apart for 5 weeks during January and February 1982. The damage, measured weekly, was low in the kite field, being 5.3% per week in total, of which only 1.3% was severe. In the banger fields damage was greater, being 27.6% per week, of which 14.5% was severe (paired *t*-test on weekly values in kite field vs. banger field $P < 0.05$, 2-tailed). The kite gave better protection in these circumstances. For the remainder of the period from January to March the banger was replaced by a scarecrow, and, as in the other fields with scarecrows, substantial damage continued (Table I). The kite, however, reduced damage considerably.

Some results of behavioural observations of pigeons are shown in Table II. Fewer pigeons passed over or settled in the kite field. A chi-square test was used to compare the number of birds which passed over the kite field with the mean number passing over or landing in areas of the same size

TABLE I

Percentage of plants damaged by woodpigeons in four fields, January to March 1982, Experiment 2

Field No.	Method	Medium damage	Severe damage	Total damage
1	Kite	10.1	6.9	17.0
2	Banger for 5 weeks, then scarecrow	21.3	58.9	80.2
3	Scarecrow	19.6	49.9	69.5
4	Scarecrow	4.7	84.6	89.3

(Analysis of variance F-test $P < 0.001$ for severe damage, t-test $P < 0.01$ kite field vs. other three fields, P values 2-tailed).

TABLE II

Response to kite: woodpigeons passing or settling within 500 m

Response	In kite field	Outside kite field			
		250m	250—500m	χ^2	P (2-tailed)
Passed	19	277	954	372.1	< 0.001
Settled	72	238	10061	2717.9	< 0.001

up to 500 m away from the kite field. Since some of the many hundreds of birds visiting the area must have been observed on different occasions the χ^2 figure is for separate visits rather than for separate birds. The birds avoided flying near the kite and some were observed to divert their flight path sharply. During observations, only once did a pigeon feed under the kite, a single bird which flew in very low from a tree 200 m away from the kite field.

On five occasions when the kite was down, a total of 71 pigeons was observed feeding in the kite field. The damage during the experimental periods in both years might have occurred when the kite was on the ground. During the 13th week in 1980—1981, on one day when the kite could not be flown until 10 a.m., a flock of 100 pigeons fed in the field during the morning, causing severe damage to the cabbages. Similarly, in 1982 during the 1st, 6th and 9th week there was no protection as the kite could not be flown, and damage again occurred.

In Experiment 3, using the "humming line", damage was slight during the first week (Table III), perhaps because the woodpigeons were avoiding novelty. In the second week, more than half of 150 plants were damaged

and in the third week only seven plants out of a sample of 150 were undamaged and it was necessary to terminate the experiment. This is an unusually high rate of damage (e.g., see Fig. 1) so in these conditions the "humming line" clearly offers little protection against woodpigeon damage.

TABLE III

Woodpigeon damage to spring cabbage in field with "humming line", Experiment 3: percentage of plants damaged per week

Weeks	Medium damage	Severe damage	Total
1	4.6	2.6	7.2
2	40.6	19.5	60.1
3	30.7	64.7	95.4

DISCUSSION

The results show that a kite can be an effective means of scaring woodpigeons off spring cabbage. It must be kept aloft for as long as possible during daylight hours, especially during the peak period of damage in late winter and very cold weather. It should be emphasised that the kite used in these experiments was designed especially to fly continuously for long periods even in high wind. Neither scarecrows (Experiment 2) nor "humming line" (Experiment 3) protected crops against woodpigeon damage.

The reason that kites scare pigeons is of interest if more effective kites are to be designed. The kite flying over the field looked somewhat like a bird of prey, and it flapped and moved from one place to another due to changes in the wind. Hardenberg (1960) mentioned that a model of a goshawk (*Accipiter gentilis*) on a rotating mast kept starlings off nearby cherry trees in 1957, but not in 1958. It is likely, however, that the movement of our kite resulted in more of a scaring effect than did Hardenberg's model. Kenward (1978) found that woodpigeons feeding on brassicas were readily startled, both by a flying goshawk and by people, although their subsequent return was rapid, especially after hawk disturbance. Neff and Meanley (1975) suggested that habituation was slow when the object moved around. Inglis (1980) has suggested that frequent changes in the place and type of presentation of a stimulus might result in more effective and long-lasting bird scaring. A red kite was used in this study because Murton (1971) mentioned that pigeons avoided red objects, but blue kites seem to be equally effective (I.R. Inglis, 1984, personal communication).

We know of five farms where a kite was found to control pigeon damage, but habituation to the kite occurred after 2 weeks on another farm (I.R. Inglis, 1984, personal communication). Kites are usually easier to keep aloft

in hill or coastal areas than on lowland farms like those where these experiments were carried out. In high wind it is especially important that a strong line should be used or the kite may be blown away. Snow and lack of wind both make the kite fall to the ground. The repeated necessity to launch the kite would render it of little use in fields which are visited infrequently, but launching is easy and so kites can be used in lowland areas if the fields can be visited regularly, early on each morning. Kites can be hazardous to low-flying aircraft, however, so they should not be flown within 5 km of airports and the line should not be so long as to allow the kite to fly at a height of above 60 m, if so, it may impede air traffic (1980 Air Navigation Act in U.K.). The optimum height for pigeon scaring has not yet been found, but is likely to be much lower than that which might affect aircraft.

In 1980—1981, severe damage to cabbages was twice as high with a banger (1.3% per week) as with a kite (0.6% per week), but both methods reduced woodpigeon damage from the much higher control level (14.7%). In 1982 the severe damage was 1.3% with a kite, but 14.5% with a banger, almost as high as the control level (14.7%) in 1980—1981. This suggests that, during the 1982 winter, pigeons ignored the bangers, but not the kite. Murton et al. (1964) mentioned that during snow cover all pigeons were forced to feed on brassica, and Colquhoun (1951) suggested that they might feed on brassica in a cold winter when there is no snow cover. The difference between the 1982 results and those in 1981 might be due to heavy snowfall during the winter.

It might be argued that the present experiments were successful because the pigeons were not motivated to feed on the experimental fields. It is now an established fact, however, that woodpigeons damage spring cabbage, and extensive damage during our control periods with no scarer in 1980—1981 suggested that these fields were no less attractive to pigeons.

Unlike the banger, a kite does not cause a public nuisance, but cannot be used near trees, overhead wires, or airfields. Kites may be blown away and bangers sometimes fail to function; both are susceptible to theft. A kite is less expensive and there is normally no recurring expenditure.

Our extended trial in 1982 suggested that pigeons do not habituate to a kite over periods of at least 3 months and hence it seems that a kite can be a better means of controlling woodpigeon damage.

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