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EFFECTS OF FIELD BOUNDARY STRIP MANAGEMENT ON CROP PERFORMANCE, 1992-95

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Summary

The effects of five field boundary management systems were compared to assess their impact on crop performance and habitat. The strips 2 m wide and 16 m long were replicated five times along a relatively uniform north south field boundary. The strips, conventional cropping, Game Conservancy headland, cultivated fallow, mown grass strip and sown wild flower mix were established in Autumn 1991. The effects were monitored for four crop sequences of winter wheat and winter beans. Although there were differences in the flora of the different strips there was no consistent or significant difference in the yield of either wheat or beans.

Introduction

Increasing environmental awareness by farmers created interest in simple, but effective ways of managing wildlife resource on the farm. The field margin, providing as it does the interface between the crop and the hedge, fence or grass bank around the field, represents a habitat opportunity of which many farmers wish to take advantage. The area can also represent a threat to crop production, particularly when invasive weeds such as common couch (*Elymus repens*), barren brome (*Anisantha sterilis*) and occasionally creeping thistle (*Cirsium arvense*) are present within the hedge base.

These conflicting interests provide one of the foci for debate on the role of field margins in crop and environmental management. The limited information on management of field margins (Boatman and Sotherton, 1988) suggests that they have little effect on crop yield. This project was initiated to assess the potential impacts over a crop rotation and preliminary results have been reported by May *et al* (1994).

Method

The experiment was located on the western boundary of Clampe Close field at Morley Manor Farm. This comprised a grassy mound up to 1.0 m high, approximately 400 m long and running north to south with a few small (less than 2.0 m) trees. The bank separated a long term arable field from a public side road with some residential properties on the western side, away from the field. The boundary was selected because it represented the longest and most homogeneous boundary on the farm and comprised a non-turning headland. Soil type along the field margin was a sandy loam (Ashley series).

In October 1991, five different boundary strips, each of 2 m width from the base of the bank, and 16 m long, were established. In this report the boundary strip is defined as the area between the crop and the field boundary as summarised in Table 1 and as defined by Greaves and Marshall (1987). Each boundary strip was replicated five times. Adjacent to each strip, main plots each 16 m wide were established and a sequence of eight split plots 16 m long and 2 m wide were marked out into the field to provide opportunity for observations during the season and measurement of yield and quality at harvest. Details of the boundary strips compared, which were randomised in four blocks along the field boundary, are given in Table 2.

Table 1. *Summary of field margin terminology*

Field boundary	Physical barrier, eg, vegetation or ditch
Boundary Strip	Area between boundary and crop; may be bare ground or a grass strip
Crop margin	Usually crop headland

The wild flower and grass strips were established on 11 November 1991 and 2 April 1992 respectively, using the general purpose meadow mixture (EM1) seed mix (Emorsgate Seeds; Anon, 1992), from which the wildflowers were excluded for the grass strip.

Commercial crops were established within the field and plots using farm machinery. The plot where crop was adjacent to the field boundary was managed using Morley plot equipment and a two furrow plough, treatments being completed within a few days of the field operation to provide comparability of treatments. The field cropping, sowing and harvest dates are given in Table 3. The experiment was suspended in 1996, when the field was in sugar beet. All crops were grown according to standard commercial integrated crop management criteria used on the Morley farm.

Weeds were assessed by appropriate counts and in 1992 insects were monitored using pitfall traps as described by May *et al* (1994). Each year the crops were harvested using a modified Claas Compact combine harvester and the weight of grain on each plot recorded. Yields were corrected to 85% dry matter and subject to analysis of variance in each individual year. Grain quality was assessed as specific weight in 1994.

Table 2. *Boundary strips established to compare the effects of headland management regimes on crop yield and performance*

Headland treatment	Field margin treatment (0 to 2 m from base of bank)	Crop treatment (2 to 16 m from base of bank)
Conventional	Commercial crop. Farm inputs applied by hand	Commercial management
Game conservancy[1]	1 m next to bank - no treatment (to allow ingress of bank flora) m sterile strip	2 m to 8 m farm treatments except herbicides and insecticides 8 m to 16 m commercial farm management
Grass strip[2]	Sown grass strip mown in July	Commercial management
Sterile strip	Bare soil, rotovated in February and May	Commercial management
Wild flower[3]	Sown wildflower seed mix and no subsequent treatment	Commercial management

1 Established according to guidelines provided by the Game Conservancy Trust
2 Emorsgate EM1 (modified)
3 Emorsgate General Purpose Meadow mixture

Table 3. *Field cropping and crop management treatments used for comparison of field margin*

Harvest year	Crop	Sowing date	Harvest
1992	Wheat (Riband)*	24 Oct 91	1 Sep 92
1993	Beans (Punch)	13 Nov 92	1 Sep 93
1994	Wheat (Soissons)	8 Oct 93	9 Aug 94
1995	Wheat (Hussar)	6 Oct 94	7 Aug 95

* Second crop

Results

In each year satisfactory establishment provided acceptable crops in each of the main and split plots. There was, however, some crop unevenness owing to ploughing and cultivations, particularly close to plots where crop was grown up to the field boundary.

Vegetation surveys completed in 1992 and 1993 and the limited pitfall trapping completed in 1992 have been reported by May *et al* (1994) and are not repeated here. Further observations were made in 1994 and 1995. In general changes in plot flora and weed ingress to the crop

following the initial report were confined to invasion by creeping thistle, especially in the southern part of the study area.

Crop performance

Crop yield in the successive transects away from the field boundary was variable (Table 4). However, field boundary strip treatment did not appear to affect yield of either the wheat (Table 5) or the winter beans in 1993 (May *et al*, 1994). There was no effect of boundary treatment on specific weight for the Soissons wheat in 1994.

Table 4. *Yield of wheat in relation to distance from field boundary (t/ha)*

Distance from boundary (m)	1992	1994	1995
2-4	8.10	7.25	6.92
4-6	8.05	7.80	7.61
6-8	8.11	6.93	6.56
8-10	8.16	7.53	7.22
10-12	8.59	8.12	-
12-14	8.52	7.33	-
14-16	8.16	7.73	-
Mean	8.25	7.24	7.02

Table 5. *Comparative effect of boundary strip on wheat yield (t/ha)*

	1992	1994	1995	Mean
Crop	8.61	7.63	7.40	7.88
Game Conservancy	8.20	7.49	6.88	7.52
Grass strip	8.32	7.66	7.15	7.71
Sterile strip	7.93	7.55	7.38	7.62
Wild flower mix	8.19	7.34	6.99	7.51

Discussion

The experiment has provided some information on the impact of field boundary management on crop performance. The boundary strips established were only 2 m wide and subsequent set-aside regulations and Countryside Stewardship schemes have rendered this aspect of the work inappropriate. In addition, it is perhaps unfortunate, that at the time of writing, the field margin set aside option can only employ 20 m strips. To this extent the experiment shows one of the difficulties inherent in the practical and applied field experiments to assess the

economic and agronomic implications of statutory and environmental interactions in the commercial context of the Morley farm. The results do, however, have practical value.

They confirm the initial results by Boatman and Sotherton (1988) that, excluding the boundary strip, different management regimes on these strips are unlikely to differ in their effect on crop yield. These data do not take into account the reduction in total grain production in the 16 m of crop adjacent to the field boundary harvested. An estimate of these losses (as lost grain) is provided in Table 6 in an attempt to cost the various boundary treatments, based on proportional calculations. The estimate provides a basis for calculating the cost of providing a habitat resource between the field boundary and crop margin. In relation to the 2 m strips used in this experiment the loss equates to 12.0-15.8 kg per 100m of field boundary, which at current wheat prices (£85/t) represents a mean of just £8.50/100 m.

Table 6. *Mean yield for the 16 m of crop closest to the boundary (t/ha)*

	1992	1993	1995	Mean yield loss owing to boundary strip
Crop	8.61	7.33	6.96	-
Game Conservancy headland	8.20	6.55	5.50	0.88
Grass strip	8.32	6.70	5.72	0.72
Sterile strip	7.93	6.61	5.50	0.95
Wild flower mix	8.19	6.42	5.59	0.90
LSD	0.325			

The results showed an inconsistent variation in yield in successive sub-plots away from the boundary strip. There was an indication that the third sub-plot (6 to 8 m from the boundary strip) gave consistently lower yields in the 1994 and 1995 wheat crops. We believe that some of this fluctuation in yield is a result of attempts to unify treatment effects. The experiment included a set of plots where the crop provided one of the boundary strips. Yield on field headlands (crop margin) is notoriously variable, partly because of the impact of cultivations. Although the field margin used in this study was not used for turning the plough similar effects have probably been created by the wheelings produced while gaining access to the cropped boundary strip. This is likely to have created false tramlines within the crop and caused the slight yield variations recorded. In a commercial situation, where the boundary strip would be wider than the 2 m used in this work, the strip would be wide enough for farm machinery to operate. This would allow maintenance of a narrow sterile strip between the grass strip and the crop to prevent the weed invasion, which occurred in some plots of this study.

Field boundary strips provide a potentially valuable habitat resource which is not always fully exploited on most farms. The strips can be an important part of the Integrated Crop Management strategy on a farm. Certain pesticides are proscribed from the 6 m adjacent to water courses. One of the options open to farmers is to place this area in Countryside Stewardship, which would also provide some compensation for the loss of crop. The ensuing grass strip is managed either by an annual trim, to provide either a rough grass habitat or as short grass using more frequent mowing, to encourage barn owls and other predators that hunt

in short grass. There are other benefits, such as improved field access and reduced turning on field margins. These options are now being evaluated in further work at Morley, into which the results of the study reported here are being incorporated.

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