2.
Management Options

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FIELD MARGINS, A FARMER'S VIEW ON MANAGEMENT

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INTRODUCTION

Crop husbandry techniques during the past 15 years have changed substantially, with the result that one effect on wildlife has been to exchange a deciduous 'woodland' with rides and clearings (3.75 tonnes per ha of spring barley) for an evergreen 'forest' with narrow rides allowing little light to the forest floor (10 tonnes per ha of winter wheat or barley, or a heavy crop of oilseed rape with tramlines). This has changed the environment for many species of flora and fauna, and has highlighted the need to manage the corridors (hedges, walls, ditches, grass tracks) and reservoirs (woods, spinneys, old ponds, field corners) positively for the benefit of nature. It is often forgotten that indigenous species such as docks, nettles, thorn bushes, old tufted grass, bramble and scrub, are more valuable to wildlife than neat looking avenues of trees with mown grass.

I would like to concentrate on the management of the division between the crop and the field boundary. The crop must be looked after to the best economic effect for the farmer so that he has money to manage what is left for the benefit of nature (and his sport), and the beauty of the countryside. We must all remember that none of us "<u>own</u>" land, but are at best "tenants for life" and will have to pass it on to those who follow. I will also comment on the excellent work done by the "Cereals and Gamebirds Research Project" of which I am a keen member. I will leave management of the boundary itself to those that follow over topics like: how often to use the hedge chomper; what species to plant if you are planting; or even whether dividing a field with a grass track would be helpful in some large arable areas.

FIELD EDGES AND STERILE STRIPS

The invasion of many hedge bottoms, wall bases and ditch banks by annual species such as brome and cleavers has been encouraged over recent years by the "hedge chomper" leaving a mulch to encourage germination; and by "greed farming", namely tractor drivers getting too close to the edge with cultivations or defoliating sprays, thus killing-out competing perennial species and leaving room for annuals to germinate and flourish.

Our objective must be to reverse this trend by positive management:

i. To separate managed field edges from the crop. eg creation of a "sterile strip".

ii. To encourage perennials to re-establish themselves on the field edges.

Sterile strip objectives

i. To segregate crop and nature so that both can be managed to best effect.

ii. To eliminate the re-introduction of weed seeds to the crop area.

iii. To ease first-round combining and crop inspection.

iv. To give a dusting area for pheasant and partridge chicks, and to save them from drowning in heavy, wet crops and inundated hedges in June.

v. To look tidy.

Method. There are two suggested ways of managing a sterile strip:

i. Monthly rotovating: this is expensive in time and in the area taken, but is effective for reclaiming bad headlands.
ii. Spraying once with residual herbicide as used in forestry: this is cheap and very effective if done well.

Fixing up the Sprayer. Make a short spray line about 75 cm long with 3 or 4 large jets in it. Fix this behind the sprayer on the hedge side about 30 cm from the ground, so that it follows the outside wheel of the tractor plus extra width against the hedge. Place a skirt about 1 m square round the boom (a 15 cwt fertiliser bag is ideal) to touch the ground and extend at least 25 cm above the boom. Drift MUST be stopped.

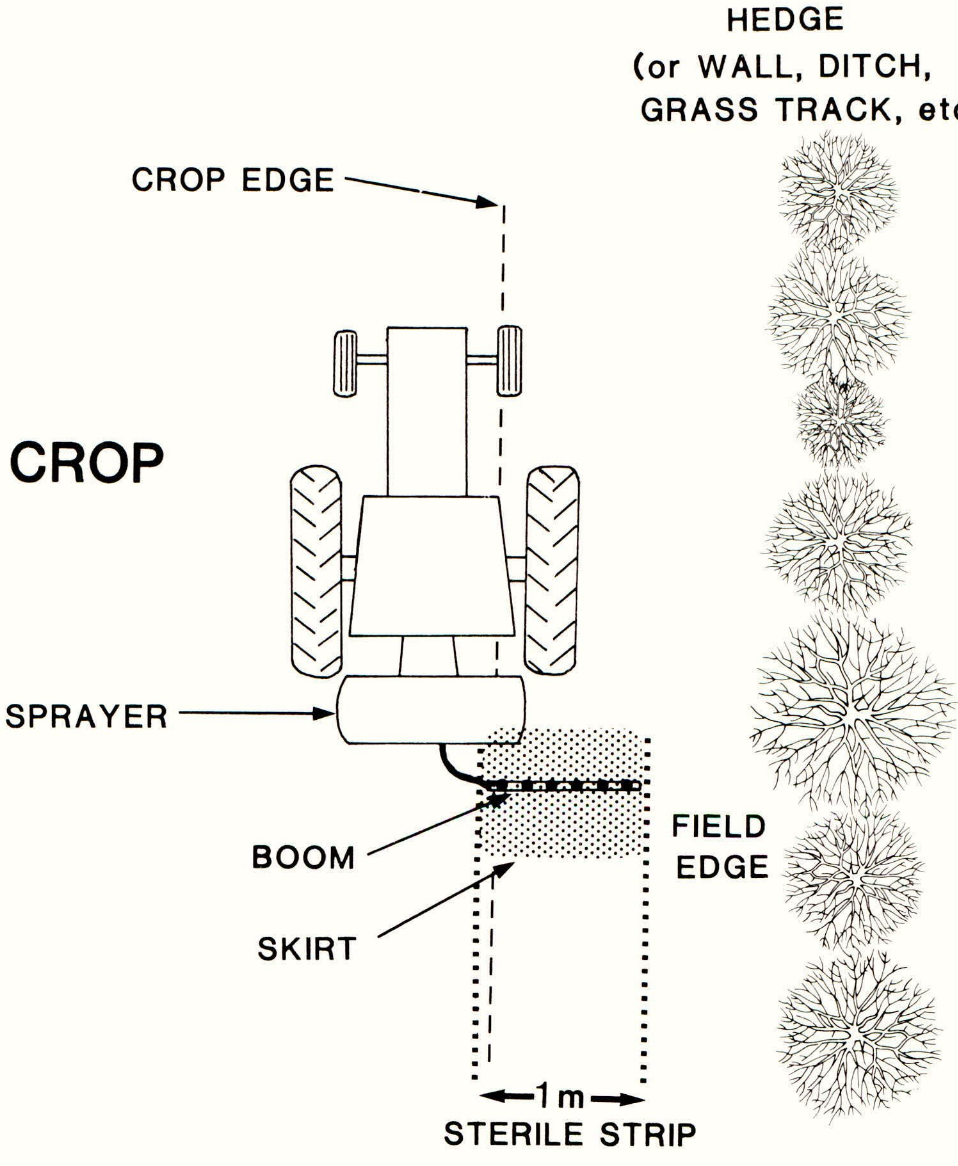
Pressurise to approx 0.7 bar so that jets JUST make a fan with NO small droplets. It will probably be necessary to take a second pipe into the top of the sprayer to re-circulate in order to reduce pressure enough.

Drive with inside edge of the front wheel against the final crop (Fig 1). It is advisable to take out 2 or 3 rows of crop to ensure an overlap between the sterile strip and the area of weed control in the crop. DO NOT GET TOO CLOSE TO THE EDGE OF THE FIELD, and drive in exactly the same place each year. Remember that the effect can last for more than one crop.

Calibrating. Drive round a 6 - 8 ha field using water only, and measure how much you use.

Chemicals. Between November to March an application of atrazine @ 1 litre for every 4 ha of field size, costing 50p per ha, is sufficient. As the plants get larger in April/May, either add 0.25 litre glyphosate or 0.5 litre paraquat to mix, costing an additional 75p per ha. Thus, for a 7.25 ha field use 1.8 litre atrazine per water rate determined after calibrating (see above), + 0.4 litre glyphosate (or 0.9 litre paraquat) if required. This amount of chemical is similar to that used in forestry, and lasts about 6 months, killing annual weeds and reducing the vigour of perennials.

FIGURE 1 Application of herbicide at the edge of a field to create a sterile strip.



Occasionally, aggressive perennial species can invade the sterile area. These are good for game, but if they become a nuisance a 'herbi' applicator with glyphosate or 2,4-D in June can help; possibly on a bike?

Re-establishing good field edges.

This is a far more difficult objective to achieve than sterile strip management. Nature will, eventually, after 4 or 5 years, start a trend of re-establishing desirable perennial species on undisturbed ground in place of the dominant annuals, who are encouraged by bare ground to germinate in. We must experiment with "speeding up" this process on a limited scale. Selective chemicals to reduce brome and cleavers without harming the hedge or perennial species should be tried.

Ideas. There are various possible ways of establishing perennial vegetation at the edges of fields:

i. Spraying ethofumesate during the winter to hedge bottoms when hedges are dormant. This should damage brome and cleavers, but is unlikely to damage perennial grasses and herbs, or hedges.

ii. Spraying 4.0 litres per ha of mecoprop in winter to hedge bottoms whilst hedges are dormant to kill seedling cleavers.

iii. Be very careful not to use high rates of hormone herbicides when the hedge is active. Never use glyphosate or paraquat.

iv. Any other ideas?

THE CEREALS AND GAMEBIRDS RESEARCH PROJECT

This project is proving to be of enormous value to farmers, game conservationists and naturalists alike, in that it is finding out what really matters to game and wildlife and also what is less important. We must keep the whole in balance, and I would like to make a few comments on the results that I have so far gleaned from the work. I must admit to being one of those who enjoy standing or walking in sleet, snow, gale or rain waiting for birds that may fly or beasts that may run. Daft, but of enormous spin-off value to the whole of conservation. The results have shown enormous benefit from the sterile strips on our farm, and thus far I am in agreement. I am not over-concerned about the problem of leaving-out insecticides, fungicides, or growth-regulators, for the end section of the sprayer boom against worthwhile field boundaries, provided that the farmer also reduces the amount of nitrogen used. Herbicides are a different problem, and need deeper consideration. It is vital that the area does not get heavily infected with dominant weeds such as brome, cleavers, blackgrass and wild-oats. If this happens then the combine will re-contaminate the whole farm, however careful the driver is, and this will add enormously to future costs.

We have been examining ways of eliminating the need for spring hormone weed killers by using a mixture of the broad-spectrum autumn applied materials now available to us and rotational spring spraying as required. Last year we were particularly successful, and only had to overspray approx 10% of 20,000 acres of autumn crop. In areas where polygonous weeds are present we found that they remained dwarfed in the bottom of the crop. Cleavers are a more difficult problem, but we have now found that the late use of fluroxypyr when the cleavers are first climbing on top of the crop, and are therefore a good target, growing actively on a warm day, will reduce heavy populations to one plant every 20m in one season. It has proved important NOT to merely stunt cleavers in April but to kill them. An effective sterile strip is, of course, also vital.

RESEARCH

We have been asked to suggest areas where research would be helpful. I believe that the reduction of brome and cleavers in our hedge bottoms, and their replacement with low seed viability perennials such as couch and cocksfoot, would be of enormous benefit both to wildlife and the farmer. Nature on her own is too slow, and we must give some chemical assistance. It is also difficult to be selective, and not to damage those species that you are trying to encourage. I have put up some ideas, but others could well have better ones. It is also vital that we have an educational programme directed particularly at tractor drivers as well as farmers, showing them the folly of their ways. I have even seen glyphosate being used by a farmer, thinking that he was doing good!

MANAGEMENT OPTIONS FOR FIELD MARGINS - AN AGRICULTURAL ADVISOR'S VIEW

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INTRODUCTION

Crop headlands and field margins are often problem areas from the perspective of the agricultural advisor. The crop here may be poor due to additional weeds, pests and diseases, often interacting with different soil conditions from the rest of the field. On the other hand the benefits of shelter and organic matter from hedges and trees can sometimes lead to better crops on the headland than elsewhere. These areas require special management to reduce the risk of yield loss and at the same time minimise harmful effects on the local environment.

HEADLAND CHARACTERISTICS

Headlands are often dismissed as an insignificant part of the field as a whole, but this is not so, particularly with small or awkwardly shaped fields. Assuming a simple situation with rectangular fields and a 12 metre wide headland (1 sprayer width), calculation (Table 1) shows that the proportion of the field classified as headland varies greatly depending on field size.

TABLE 1

Headland areas as a proportion of total field area for fields of different dimensions.

Field Dimensions (m)	Total Area of Field (ha)	Total Headland* (ha)	Percentage of Field as Headland
500 x 300	15.0	2.19	14.6
500 x 200	10.0	1.62	16.2
300 x 100	3.0	0.90	30.0

* Assuming headlands 12 m wide.

The proportion of headland increases as field size declines. In the case of the 3 ha field described it becomes 30% of the total, and headland problems become increasingly significant.

CROP RESIDUES

The method used to dispose of crop residues on and around headlands is likely to affect the performance of subsequent crops. In cereals and combinable crops the management options available have been reduced following the introduction of bye-laws and a code of practice to regulate straw burning. These require that a firebreak be created around areas to be burnt to contain the fire and protect hedges, trees and other features at risk from damage.

The majority of farmers prefer to remove straw from the headland firebreak by windrowing it further into the field or by baling and removing it. If the latter option is chosen the straw bales must be disposed of, and the obvious method is to dump them in the middle of the field. This can create two problems. Firstly unopened bales burn slowly and emit a good deal of smoke (Larkin et al 1985), which involves longer periods of supervision for fields in which bales are burnt. Secondly these bales often burn incompletely and any weed seeds brought from the headland and contained therein are liable to survive. To overcome such problems the bales should be opened out and spread as much as is reasonably possible once they have been carted to the field centre. Alternatively the straw can be chopped and ploughed-in on the headland, if local bye-laws allow.

Windrowing straw into the field also risks seed dispersal and although the large windrow itself will usually burn fully, the area of stubble outside it often does not, with seeds shedding in this area as the straw is moved over it. Unfortunately few data are available on the extent to which baling and windrowing facilitate weed seed dispersal and any recommendations given can be tentative only.

In situations where residues are not being burnt loose straw is often ploughed in, in situ on the headlands. Such straw would need to be chopped (probably by a combine mounted chopper) before ploughing can commence. Trashboards are commonly fitted to ploughs used for straw incorporation to improve the degree of mixing of straw and soil, but perhaps on the headland these are best not used and instead the straw buried to as near as possible full ploughing depth. This is desirable to ensure deep burial of weed seeds, such as black-grass (Alopecurus myosuroides), and barren brome (Bromus sterilis) (Moss 1984). Additionally, straw burial would be difficult with trashboards on curving or awkwardly angled field margins.

CULTIVATIONS

Ploughing is the commonest method of primary cultivation on headlands. The furrow is best turned outwards towards the field centre to give a sharp cut-off at the field margin, and eliminate the development of a low furrow a few metres in from the field margin, which can sometimes be affected by waterlogging and soil erosion. Where the plough is used to create a firebreak the operation may be carried out 8 or more weeks before drilling. If a dry period occurs then the ploughed soil will bake and become dry, cloddy and difficult to work. Such conditions are detrimental to good crop establishment, and to the efficacy of residual herbicides and therefore this situation must be avoided. Ploughing in dry conditions should therefore be followed promptly by a suitable form of secondary cultivation; usually discs or rolls to reduce the clod size and help prevent moisture loss. In wet soil conditions however, these implements will lead to smearing and compaction and should not be used. Tined cultivation provides an alternative but tends to pull trash to the surface, and if the weather is wet the safest option may be to dispense with secondary cultivations until just before drilling is due. Various powered cultivators can be used for secondary cultivations on headlands but require a relatively trash free surface for good results.

There is a temptation to plough as close to the field margin as possible, which is undesirable because cultivation may then physically spread weeds or their seeds into the field. The exact location of the field margin may also vary from year to year as a result of ploughing closer to or further from the hedge. This should be avoided as cropped land left uncultivated in subsequent years may well be colonised by the more competitive weed species and become a problem area for the future.

In practice there are three main causes for poor seedbed quality on headlands. Firstly there is the need to plough early to produce firebreaks; secondly machines tend not to perform well on field corners and other awkwardly shaped areas; thirdly, excessive wheeling of the headlands year after year can create a long term problem with soil structure.

SOWING THE CROP

If a satisfactory seedbed can be created without moisture loss the sowing of headlands should not present special problems. Seedbeds are often of inferior quality however due to clodiness, dryness and the presence of surface trash. One answer is to increase the seed rate by 10 to 20%. Unfortunately no information is available on whether this proves beneficial, or by how much seed rates should be raised. As well as providing a plant population sufficient for optimum yield, increasing seed rates should provide a denser crop more able to compete with headland weeds. On the debit side however, excessive plant density can increase the spread and severity of certain cereal diseases e.g. eyespot (*Pseudocercosporella herpotrichoides*).

Differential sowing dates between headlands and the remainder of the crop are not usually a practical proposition due to wheeling problems and reduced work rates.

WEEDS

Weed populations on headlands could increase for several reasons. Firstly there is a risk of ingress from uncropped areas; secondly herbicide performance may be impaired by clods and trash; thirdly, thin or patchy crops offer poor competition for weeds.

Black-Grass (*Alopecurus myosuroides*)

A. myosuroides is a common grass weed in winter-sown cereals, particularly on heavy soils and where there is a high proportion of winter cereals in the rotation. It is particularly favoured by minimal tillage and early sowing of the crop. On a short term basis 30-50 *A. myosuroides* plants per m^2 constitutes a reasonable economic treatment threshold, but when seed return over a number of years is taken into account the threshold may be as low as 7.5 plants per m^2 or less (Cousens *et al* 1985).

Traditionally, burning of cereal straw has been found to kill many A. myosuroides seeds, but this is not permissible on headlands. Recently, however, most headlands have been ploughed, which is likely to help check populations of this weed. The net result of these changes in field margin management is unknown and the long-term implications for headland A. myosuroides populations need to be quantified.

Heavy infestations may require a higher level of herbicide input in the form of additional or more expensive headland sprays. More commonly, poor quality headland seedbeds affect herbicide timing by delaying emergence of both crop and weed. Similarly, the presence of many clods will reduce the efficacy of autumn applied residual herbicides. Where clods are severe these sprays should be delayed until the spring by which time at least some clods will have broken down. Despite the logistical problems of the extra operation and the larger weed size, spring applications have generally provided superior weed control in these situations.

Wild-oat (Avena fatua), Winter Wild-oat (A. ludoviciana)

The two wild-oat species A. fatua and A. ludoviciana are, like Alopecurus myosuroides, geographically widespread and not confined to field margins. Intensive herbicide use over the last 15 years or so has, however, reduced populations to fairly low levels on many farms. Headlands can act as a reservoir for these species where the seeds are safe from burning whilst at the same time they are not adversely affected by ploughing.

Good chemical control can be achieved using a range of herbicides listed in various Agricultural Development and Advisory Service (ADAS) publications. For low populations, particularly those confined to headlands, hand roguing is a possibility provided that sufficient labour can be obtained. When hand roguing, weeds growing on the field margin should also be removed; this is not possible with sprayer applied herbicides. There is a temptation to dump rogued Avena spp at various places on the field margin where they can shed viable seeds. Instead they should be removed completely from the field and destroyed. Herbicide gloves can be used for hand roguing; this method allows the treated Avena spp to be left in situ.

Barren Brome (Bromus sterilis), Meadow Brome (B. commutatus), Soft Brome (B. hordeaceus)

B. sterilis is the commonest of the agriculturally important brome species, but B. commutatus and B. hordeaceus can be locally important headland weeds. Over the past decade the bromes have increased in frequency, although unlike A. myosuroides and Avena spp they are still largely headland problems only. Occasionally they have been able to spread further towards the centre of fields.

Straw burning has been beneficial in checking the spread of B. sterilis but an alternative strategy is necessary for headlands. Furthermore, straw windrowed into the field or baled and carted in for burning has been suspected as a source of weedy patches away from the headland. Even if contaminated headland straw is baled and used for livestock bedding, seed could still be returned to the field in the form of farmyard manure. There is a need to establish whether or not these operations offer genuine opportunities for seed dispersal and if so how important they are.

Cultural control can be achieved by ploughing as long as good furrow inversion takes place burying the seed to 12 cm depth or more. B. sterilis emerging between the harvest of one crop and sowing of the next can be controlled by the use of glyphosate or paraquat, which will also control most other emerged weeds on the headland. Selective herbicides for use in winter cereals can give moderate levels of control, but alone may not be sufficient to control a serious infestation. To date the best results can be expected from tri-allate, chlortoluron, isoproturon and metoxuron, particularly if tri-allate is used in sequence with one of the other three. Tri-allate should be applied pre-emergence and one of the other herbicides later when B. sterilis is at the 1 - 3 leaf stage. Post-emergence sprays work best under humid conditions and when active weed growth is taking place. Metoxuron and chlortoluron can be used on specified cereal varieties only. Trials of cyanazine followed in sequence by cyanazine tank-mixed with isoproturon show promise. B. sterilis actually growing in the field margin cannot be controlled by any of the treatments listed above, because of the resulting damage to other plant species.

A change from winter to spring cropping is a radical alternative control method where B.sterilis is very severe. Alternatively, winter oilseed rape or field beans would give good opportunities, because of the range of graminicides available for these crops. Such options must however be considered as a last resort unless justified for other reasons. Growing these crops around the field margin where B. sterilis is often worst, and winter cereals in the remainder of the field, cannot generally be recommended because of the resulting management problems.

Cleavers (Galium aparine)

G. aparine is probably the only dicotyledonous weed species which has become serious and widespread on field margins, although Indian Balsam (Impatiens glandulifera) has become a local problem in parts of northern and western England. Work at the Weed Research Organisation (WRO) (Froud-Williams 1984) has suggested that hedgerow populations do not pose a major threat to arable crops, but despite this G. aparine is widespread both on headlands and elsewhere, especially in winter cereals. It is very competitive and populations as low as 5-10 plants per m^2 can adversely affect yields making chemical control economically worthwhile. Lower levels than this may still be worth controlling to prevent combining difficulties and contamination of harvested crops. G. aparine therefore requires a high standard of control even at low population levels.

Cultural methods are of limited value on or near field margins, since straw burning is not permissible and ploughing does not appear to be particularly effective.

Fortunately, a range of herbicides is available for use in winter cereals. Autumn germinating G. aparine is most commonly controlled whilst small by using products containing mecoprop, although graminicides such as pendimethalin provide an alternative with residual activity. In the spring mecoprop is again widely used, often in combination with ioxynil/bromoxynil or bifenox to control larger weeds. More recently fluroxypyr has also given good control of large G. aparine plants and can be used on its own in winter cereals until the flag leaf has emerged. The best yield benefits can however be expected where G. aparine is removed early, and a sequential programme of autumn and spring herbicide applications can often be justified for this weed which has a prolonged germination period. Removal of weeds soon after emergence may also allow lower doses of less expensive herbicides to be used with consequential economic benefits.

PESTS

Soil-borne pest problems are not generally more common on field margins than elsewhere in the crop, unless the headland is very cloddy. Sometimes the reverse is true and healthy headlands and wheelings commonly occur in crops which have been otherwise severely damaged by slugs, wireworms and other soil pests. This happens because the compact soil in these heavily wheeled areas prevents free movement of these pests and thereby reduces their feeding.

Certain pests of non-cereal crops are known to be either largely confined to the headland or at least more serious on it. Brassica pod midge (Dasineura brassicae) lays its eggs in the pods of oilseed rape, usually through the feeding and egg-laying punctures made by seed weevil (Ceutorhynchis assimilis), and the larvae feed within the developing pods. Those affected are yellowish in colour, swollen and misshapen, and they also shatter prematurely so that all of the seeds are lost. Sometimes attacks extend through the entire crop but more frequently economic levels of damage are confined to the headland. Where the latter situation occurs regularly a headland-only spray would be recommended. Triazophos must be applied post-flowering to prevent harm to bees, but phosalone (or pyrethroid insecticides which are still under limited commercial clearance) can be applied at the end of flowering of the main raceme.

The pea and bean weevil (Sitona lineatus) is a pest of peas and spring field beans, although it can also be found on winter beans. Damage is most severe on newly emerged or backward crops. Adults make U-shaped notches in the leaves and larvae feed on roots hollowing the nodules.

The adults spend the winter in hedges and ditches and from there spread onto the headlands of suitable host crops in spring. Although they may eventually spread throughout the crop, damage is often noticed first and most severely on the headland.

Economic damage does not usually result from adult feeding, but post-emergence foliar insecticides are recommended where weevils are attacking the growing points of backward or poorly growing crops of peas or spring field beans. A range of insecticides carry approval and label recommendations for this purpose. On peas granular insecticides applied at drilling can only be justified where there is also a history of pea cyst nematode, or pea early browning virus. On spring beans, in-furrow application of phorate granules has sometimes given worthwhile control of adult and larval damage. Until the economics of controlling this pest are better known it is difficult to foresee whether or not separate headland treatments can be justified.

The black bean aphid (Aphis fabae) overwinters on spindle trees (Euonymus europaeus) and spreads into field beans, sugar beet and a range of horticultural crops in the late spring. Fortunately severe attacks can be forecast by ADAS and preventive treatment carried out with granules of insecticides such as disulfoton or phorate just before flowering if the risk of damage is high. In the midlands where attacks begin later than in southern England or East Anglia, serious damage may be confined to headlands, particularly those facing south-west. In these cases headland only treatments can be recommended, with an application of one sprayer width around the perimeter of the field being sufficient.

Where prophylactic treatments have not been applied and economic damage occurs unexpectedly, eradicant treatments of primicarb, demeton-S-methyl, oxydemeton-methyl and thiometon may be used. Pirimicarb, disulfoton or phorate granules are less harmful to pollinating insects that other treatments. These are usually applied whilst the field bean crop is flowering and due regard must always be given to the presence of any non-target species. Eradicant measures may also be confined to the headland if this is the only area where aphids are present.

In the case of sugar beet, insecticides are applied with the intention of controlling the peach potato aphid (Myzus persicae) as well as black bean aphids, and separate treatment of headlands is unlikely to be justifiable.

Stem nematode (Ditylenchus dipsaci) occurs as a number of races attacking a wide range of crops. In most areas damaging attacks are uncommon. Stem nematode can be seed borne, but also breeds in many weed species which can be particularly common on headlands, such as common chickweed (Stellaria media), G. aparine, Avena fatua and A. ludoviciana.

Birds and mammals can also damage headlands, and the grazing of cereals by rabbits (Oryctolagus cuniculus) is a frequent problem. On a more localised basis the brown rat (Rattus norvegicus) can cause damage; as can pheasants (Phasianus colchicus), adjacent to releasing pens. Where a pond adjoins the headland, moorhens (Gallinula chloropus) and coots (Fulica atra) may also pose a potential threat.

DISEASES

Many headlands carry more surface trash than adjacent areas and where successive crops of cereals are grown disease innoculum can spread via trash from one crop to the next. Examples of diseases transmitted in this way include common eyespot (Pseudocercosporella herpotrichoides) in cereals, Septoria spp in winter wheat and net blotch (Pyrenophora teres). However, in experiments comparing different methods of straw disposal, levels of plant diseases have generally remained similar regardless of whether or not surface trash was present, with the possible exception of net blotch (Hubbard 1984). Separate headland sprays cannot therefore be recommended.

Levels of take-all (Gaeumannomyces graminis) are often different on headlands than those elsewhere in the crop, as a result of variable soil physical conditions. For example, on heavier soils where headlands have become over-compacted, root growth is poor causing the effects of

G. graminis to be worse, but on loose soils G. graminis can spread more quickly than on nearby headlands where the soil is more consolidated. The advice in these cases would be to obtain the 'right' degree of consolidation in all parts of the crop although what is right in terms of machinery use can be difficult to judge.

A. myosuroides or meadow foxtail Alopecurus pratensis infected with ergot (Claviceps purpurea) on or around field margins can be a source of infection for wheat and some other cereals. No fungicidal control measures are available, and ergot should be prevented by controlling host weeds on the headland, and by deep ploughing to bury sclerotia.

Waste potatoes are occasionally dumped on land at field margins and this has two implications for the management of these areas. Firstly herbicides must be used to destroy any living tubers on the dump, although small areas can be sealed-off by plastic sheeting. Secondly undestroyed dumps can act as a major source of potato blight (Phytophthora infestans) for nearby potato crops. This could lead to greater use of blight sprays on headlands adjacent to dumps, and in extreme cases to a need for premature crop desiccation.

FERTILISER

Headlands do not generally require more or less nitrogen fertiliser than other areas of the crop. Similarly, timing of application should be the same unless headlands are thin or backward, in which case they should be given higher priority for early spring top-dressing. Even in these situations however the farmer does not always have time to treat these areas separately,and any advice given must take this into account.

When loose straw is removed from the headland in preparation for burning, nutrients (particularly potash) are lost. Traditionally ADAS have recommended up to 60 kg/ha of extra K_2O where straw has been baled for livestock use and removed from the field. Headlands treated in this way should be analysed for impending signs of potash defficiency, and extra fertiliser applied if necessary. This would involve treating headlands differently from the remainder of the crop and therefore requires further investigation to establish whether such measures are justified in practice.

APPLICATION TECHNIQUES

The way in which pesticides and fertiliser are applied to areas near the field margin can influence both their efficacy and effects on uncropped areas.

Crop sprayers should never overhang the field margin whilst in use, although modern tramlining techniques minimise the risk of this occurring unintentionally. Furthermore although herbicides will remove vegetation from uncropped areas this will not simplify weed control problems in the field. If anything weeds such as G. aparine and B. sterilis are encouraged by the presence of these bare areas eminently suitable for colonisation.

ADAS have conducted a limited series of investigations into the effects of selective herbicides on the hedge bottom flora where these have been badly damaged by sprays or fire (Roebuck pers comm). Total removal of herbaceous plants resulted in rapid colonisation by competitive weed species, so that the destruction of the hedge bottom flora to control weeds cannot be recommended.

Ethofumesate has also been used as a selective herbicide and found to encourage perennial grasses, such as couch (Elymus repens) at the expense of annuals. Agronomically this would be acceptable on field margins because the species encouraged would be less likely to spread into the crop than those selectively removed. However, the effects of ethofumesate on other common species in the hedgerow are unknown and therefore this technique cannot be recommended. Also there is no official clearance or label recommendation for herbicides to be used in this way.

Spray drift must be prevented from accidentally affecting uncropped areas, and this requires skill on the part of the tractor driver and the need for constant awareness of changes in wind speed or direction. Attempts can be made to reduce the risk of drift by increasing the mean spray droplet size, or by using additives to inhibit drift. These techniques require further investigation before they can be recommended with confidence.

Fertiliser spreaders should be operated with caution near field margins as nutrients placed accidentally in the hedge bottom may well give weed species a competitive advantage over the indigenous flora. Problems can arise with broadcast type distributors because they rely on overlapping at the edge of each bout to give an even spread throughout the crop. If driven along the headland tramline in the normal way a small amount of fertiliser will fall on the uncropped area at the field margin (Barrett pers comm). This can be avoided by mechanically reducing the spread width on the headland using tilting spreader beds, border discs, or by driving on the field side of the headland tramline to keep the spreader further from the field margin. None of these methods are entirely satisfactory and the effects of fertilisers on the field margin require full evaluation. This problem does not arise with pneumatic full-width spreaders.

UNCROPPED STRIPS

The use of uncropped strips around field margins has received considerable publicity. There are potential benefits for both crop and hedgerow. A well maintained uncropped strip may help prevent any ingress of weeds and reduce the risk of harvest contamination of grain. There is also likely to be less chance of weeds being pulled into the cropped area by cultivations. Such protection would be of special value where crops are grown for seed and is already used widely in these situations. On the other hand the hedgerow would be protected against accidental application of fertiliser and pesticides, particularly if a wide strip is used, and the headland tramline is marked off from the inner edge of this strip rather than the field perimeter.

Uncropped strips can be created by cultivation or the use of herbicides. A radical alternative is to sow grass in this area, but problems of establishment and subsequent management would then arise, although if these can be solved this could be a valuable technique. Cultivated strips tend to be wider, usually around 2 m in width, because of the need to use a tractor and rotavator for this operation. Chemically maintained strips vary in width, the minimum being one sprayer nozzle or approximately 50 cm. Both types can be created and maintained easily with existing farm equipment. Wide strips probably offer more protection to the crop and the hedgerow but result in a greater loss of croppable land. Few data are available on the agronomic value of uncropped strips, the methods and timing of establishment, optimum widths, or management. This information will be required before objective advice can be given.

CONCLUSION

Field margin management encompasses many different operations and specialist skills, some of which are different from those traditionally practised in arable farming. In order to simplify matters existing knowledge and recommendations should be summarised in a single publication to guide farmers and advisors, and to act as a springboard for new developments. This paper offers some suggestions for further development work, but due to the complex biological and ecological interactions involved, some gaps in our knowledge are likely to remain.

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