HGCA

RESEARCH REVIEW No. 26

PRODUCTION METHODS FOR CEREALS WTHIN THE REFORMED CAP

JANUARY 1994

Price £7.00

RESEARCH REVIEW No. 26

PRODUCTION METHODS FOR CEREALS WITHIN THE REFORMED CAP

by

J. R. GARSTANG, W. S. CLARK and P. M.R. DAMPNEY
ADAS Arable Crops Development Centre,
Brooklands Avenue, Cambridge CB2 2BL

This review was conducted by ADAS. The work commenced in October 1992 and was funded for four months by a grant of £17,784 from the Home-Grown Cereals Authority (Project No. 0044/1/92).

CONTENTS

1.0 CAP Reform - chronology of events

The proposal to carry out this review of cereal production methods was put together immediately after the CAP reform package had been announced in summer 1992. Indeed, much of the set-aside management protocols for rotational set-aside had still to be announced, let alone the full details of non-rotational set-aside which were only announced in August 1993.

Some idea of the rate of change is given by the calendar of events listed below :

May 1992	EC Agriculture Ministers agree CAP reform provisions for support of cereals, oilseeds and pulses, and cereal marketing arrangements.
July 1992	Explanatory leaflet on arable area payment scheme published.
August 1992.	Detailed explanatory booklet on area payment scheme published.
Sept 1992.	Withdrawl of sterling from Exchange Rate Mechanism.
Jan 1993	Single Market arrangements bought in throughout the Community. Abolition of MCAs, and replacement with new Agrimonetary system.
April 1993	IACS forms and instructions issued for the registration of set-aside
May 1993	EC Agriculture Ministers agree CAP reform package for1993/94.
July 1 1993.	Area and set-aside payments fixed on the basis of a green rate of £0.948645 per ecu.
Sept. 1993.	Agrimonetary system suspended. Green rate fixed at 1 August rate £0.920969 per ecu "until the end of September"
Nov. 1993.	Agrimonetary system still suspended with green rate still at £0.920969
Dec. 1993.	Agreement of Uruguay round of GATT trade talks.

This list shows how the reforms have been, and are likely to remain, a process of evolution as UK and EC grain prices move inexorably towards world prices at a speed that will be determined by many external, and often non-agricultural factors.

The 'typical' wheat crop

The example gross margins and variable costs shown at the start of each section of this report, and used in the appendix examples of changes to gross margins, are based on a 'typical' 7 tonne wheat crop using variable inputs costing £200 per hectare. The allocation of the example variable costs are shown below.

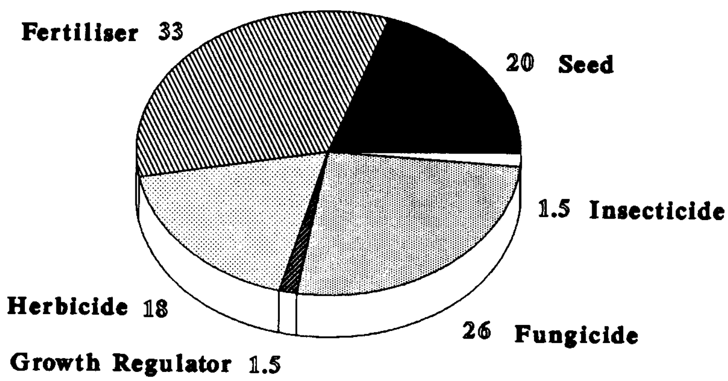
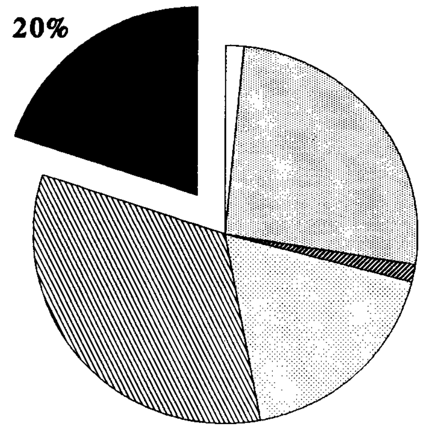


Figure 2 *Winter wheat variable costs : Typical total cost £200 per hectare (Costs as per cent of total)*

In many instances where costs are higher, or lower than the example, some assessment of the size of saving involved can be made by either increasing the proportion of the cost (if some inputs are higher, higher costs may be inevitable) or by changing the total £200 variable cost to a more appropriate figure and using the same proportions. In the section on diseases, there are slight changes in the costs for the winter and spring barley sections.

2.0 CROP ESTABLISHMENT AND VARIETY SELECTION

Winter Wheat Variable Costs
Seed : £40 per hectare



Scope for Savings:

* Select the best variety for your farming conditions and your intended markets.
* Using more accurate seed rates and taking into account seed size, sowing date and seedbed conditions could save £4 per hectare.
* Select rotations and varieties to ease bottlenecks in field work from drilling to harvest.
* Farm-saved seed can save around £8 in seed treatment costs.
* Increase yields and value by selecting the most appropriate variety for location and management.
* Use set-aside as entry for crops which respond most to early drilling (winter oilseed rape), or to reduce weed problems and herbicide bills.

Points to watch:

* If weeds, especially grass weeds, are a problem do not use minimum cultivation techniques to the detriment of effective weed control.
* When farm-saving seed take care to avoid problems from weeds, off-types and disease.
* Have seed tested for fungal seed-transmitted diseases.
* Do not save seed for more than one generation from fungicide treated certified seed without fungicide-treatment.

2.1 Cultivations

Only 14% of wheat straw and 6% of winter barley straw was burned after the 1992 harvest. A range of straw incorporation techniques is now being practised successfully on a wide range of soil types.

In normal weather, incorporation into the top few centimetres can work well (1), allowing rapid seedbed preparation without too great a power requirement. Where weeds are a problem, this option cannot be pursued. In particular high percentages of grass weeds have to be killed each year to maintain static weed populations where straw is no longer burnt.

Table 1. *Annual percentage kill by herbicides needed to maintain a static black-grass population* (2)

	Depth	Straw Burnt	Not Burnt
Cultivation	< 5 cm	94	97
Tine Cultivation	10 cm	92	95
	20 cm	87	93
Plough	20-25 cm	63	78

Consolidation can cause problems in dry conditions. Showery, superficially wetting rain, can cause seed to germinate. However, it may then die if straw prevents moisture reaching the seed.

As cultivations make up about 20% of total costs it is not surprising that minimum cultivation techniques are popular. On clay soils prone to clod formation when ploughed, minimum cultivations can present a fineness of tilth which improves the seed/soil contact. Any savings in cultivation which allow straw to reduce the seed/soil contact are to be avoided.

Incorporation of considerable amounts of surface trash will reduce the efficacy of soil acting herbicides. Where over 30% of the surface area is straw, on-going MAFF-funded research suggests herbicide efficacy will be reduced. This reduced efficacy, along with the need to have good establishment and weed control further emphasises the need to plough. To some extent the extra cost of ploughing can "buy" improved herbicide efficacy.

In recent years, seed has sometimes been broadcast when drilling has been unavoidably delayed by wet weather. In dry conditions emergence can be uneven and undecomposed straw may be a problem. Higher seedrates for broadcasting may tend to increase seed costs (currently 20% of variable costs). Broadcasting could offer savings on fixed costs. This could be particularly useful for rationalisation of operations, say, following the adoption of non-rotational set-aside. However, variable seed depth may limit the choice and timing of herbicides on broadcast crops and slug damage can be severe if not controlled.

2.2 Variety choice

Figure 1 shows variable cost, gross output and hence gross margin of the best 25% and worst 25% farm samples from *Farming in the Eastern Counties* 1990/91 (3). At the top of the gross output bar a value of yield range bar has been superimposed. The distance between the top and bottom of this bar represents the value of the range in yield between the highest and lowest yielding fully recommended varieties on the UK Recommended List. The range value was calculated assuming all grain was worth £112 per tonne. Variety choice is important and determines the relative yield of the crop and the potential markets. However, all the lowest yielding varieties of winter wheat, winter barley and spring barley are either bread wheats or malting barleys and would attract premiums which would narrow the value of the range.

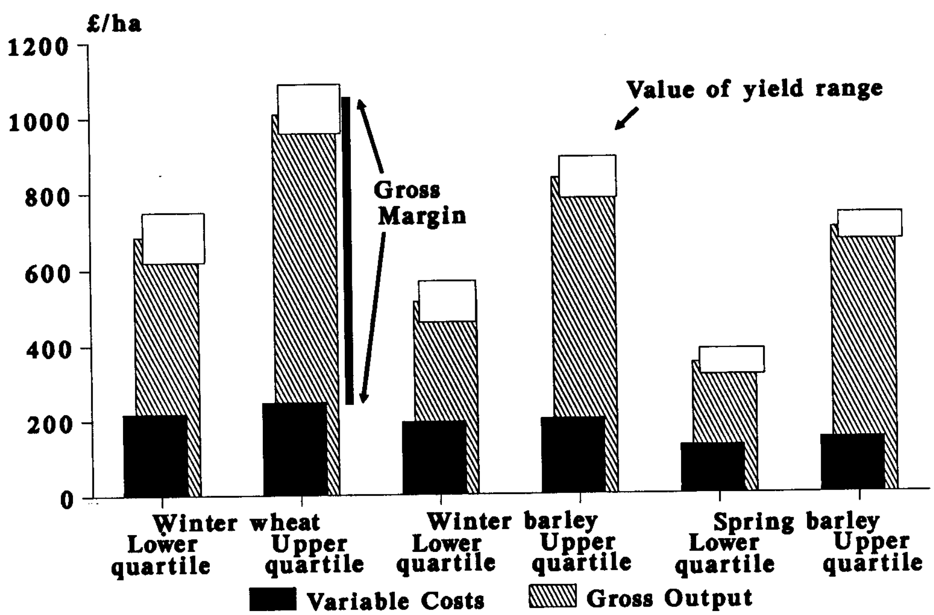


Figure 1. *Relative value of the range between highest and lowest yields of fully recommended winter wheat, winter barley and spring barley.*

Several points emerge from Figure 1.

1) Changing from the lowest to the highest yielding variety may get you into the next 25% grouping, but cannot move you from the bottom to the top 25%.

2) Choosing a higher yielding variety in the lowest margin group has, proportionately, a much greater effect on margins than in the top group, if the full yield potential can be achieved.

3) The impact of variety yield on the margin of spring barley [or the other spring cereals not shown] is markedly less than either winter barley or winter wheat.

4) The range in variable costs between the lowest and highest 25% groups was very small.

Variety choice has an important role in maximising profit, but the yield of individual varieties is relatively unimportant. This is not surprising in view of the continual improvement of cereal yields achieved by breeders.

The future quality demands of markets will increase growers demands for varieties that accurately meet these specifications. Yield however, will continue to be the main factor in reducing production costs per tonne.

The UK Recommended List forms the basis of variety selection for most growers and provides useful information on management inputs such as fungicide and standing power. Other factors can offer savings depending on the season, such as latest sowing date, winter hardiness, earliness of ripening, resistance to ear loss and tendency to sprout.

Currently available wheat varieties are widely adapted a wide range of environments (4), and for the first time the 1993 UK Recommended List, quotes regional yields for varieties, (5).

Although the data does not permit comparisons of varieties between regions, regional yield data can be used to show which varieties are inappropriate for certain regions. The difference between regions is largely due to yield reduction due to disease and related environmental factors of the regions, rather than from increases associated with the weather and physical location of the region. The regional yields are a reflection of this reduction, and as such are an indication of where varieties may do badly.

2.3 Quality

A major question now facing UK wheat growers is whether to move more of their crop into bread making, common wheat varieties. The definition of common wheat differs from the previous UK bread wheat standards in that passing the Zeleny protein precipitation test with a volume of more than 20 mls is mandatory. Because of the relatively large area of feed wheats grown in the UK, grain in the 20-30 mls range is only acceptable for intervention support, provided a dough made from that grain is not too sticky to pass the machinability test.

Farmers may try to adapt to these new standards by late applications of nitrogen to increase the protein content. This cannot guarantee success and could waste nitrogen and money. High Hagberg feed wheat is also no guarantee of success in the marginal Zeleny cases, as the Hagberg of flour used in the machinability test is adjusted by the addition of malt flour to a standard 200-250 band(6) . Storing wheat for a few months may help to improve machinability, (7).

Understanding and meeting market specifications will become more important. Although varietal choice is important, blending grain is of increasing significance in meeting market specifications. To meet blending requirements, co-operatives, merchants and shippers need uniform batches of known quality.

This has implications for managing varieties in the field and on-farm storage. Hagberg falling number is already affected by small amounts of low value material. Zeleny protein volumes on the other hand are additive - and therefore allow a little more flexibility if batches are mixed.

The figure below shows Zeleny volumes derived from common varieties in the 1992 and 1993 harvest.

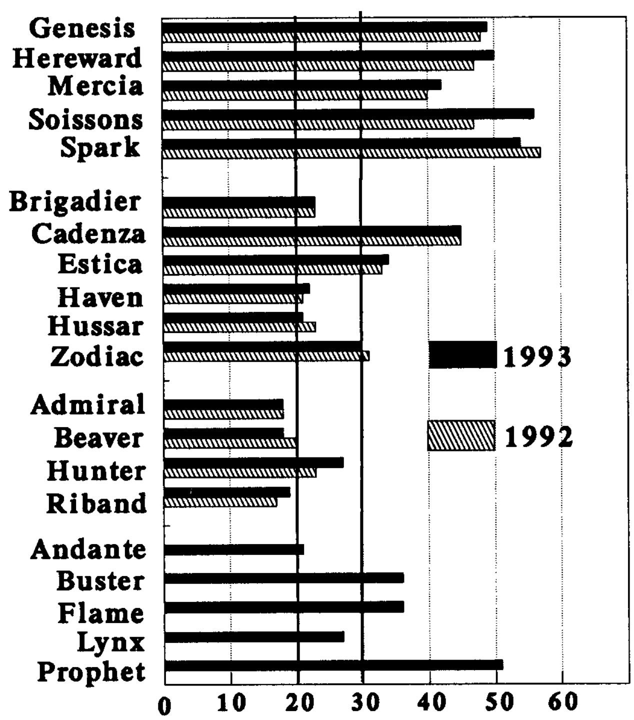


Figure 2. *Zeleny sedimentation values and ranges 1992 & 1993*
Source: FMBRA (8) & HGCA (9)

Some so called 'feed' varieties will reach intervention standards provided they pass the machinability test. With the minimum intervention intake of 500 tonnes for wheat, and 100 tonnes for barley and rye, there is ample scope for blending. This affects all growers - large and small. The limit of grain from four locations in any one batch will require even relatively small lots to be uniform if blending is to figure in their end use.

2.4 Farm saving seed

Untreated farm-saved seed is cheap. There are , however, considerable risks involved in using seed which has not been treated with a fungicide. In wheat, bunt can result in total crop loss if not controlled. Seed treatment costs approximately £6-8/ha, whereas total crop failure costs up to £1500/ha in the case of bunt, or a major yield loss of (up to 50%) for Fusarium (10). Bunt, in particular, can build up rapidly in farm-saved seed. The disease can go from undetectable levels to a situation of crop failure in a season or two.

Other diseases include Septoria seedling blight on wheat, covered smut and net-blotch on barley and loose smut on both wheat and barley.

Barley losses are less serious but leaf stripe can produce large reductions in yield. Seed treatment is essentially insurance against serious crop loss. Seed testing of winter wheat and spring cereals is well worthwhile in order to determine the specific seed treatment required.

Another, although uncommon, drawback of farm-saved seed is possible contamination with the sclerotia of ergot (11). Although some seed treatments, notably Baytan, give suppression of the sclerotia, in practice the risk of serious crop loss is small. However, contaminated grain will not be accepted by most mills. Control of ergot on farm should be based around black-grass control, timely cultivations and topping of grass swards. The use of fungicides as ear sprays in susceptible crops such as durum wheat is sometimes advised although timing is critical.

2.5 Impact of set-aside

One of the most positive benefits resulting from set-aside is the timely sowing of crops following the rotational option. Cultivations to control weeds go a long way to help in the preparation of seed-bed. The increased flexibility of herbicide usage allowed in the 1993 revisions of the regulations will allow better control of specific weed problems, which in turn should lead to cleaner following crops.

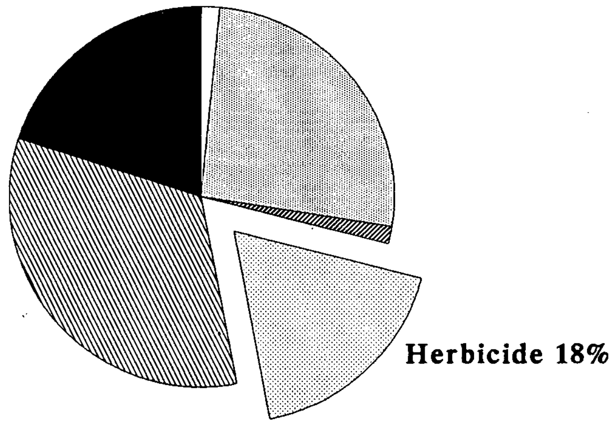
Timely seed-bed preparation from pre-cultivated land should give better seed-beds for less cost. Good seed-beds give better establishment and allow lower seed rates to be used. Cultivation for weed control and topping of naturally regenerated set-aside should reduce the risk of volunteers heading and shedding seed, although weeds and volunteers are more of a problem in winter oilseed rape following set-aside, than in those crops drilled after conventionally managed crops within the rotation. Benefits will be greatest in the most adverse seasons.

Non-rotational set-aside avoids the annual need to return land to cultivation, and if particularly intractable land has been set-aside, it avoids having to work that land regularly thereafter. On certain farms this may give the opportunity for fixed cost savings.

When non-rotational, set-aside with well established cover crops, is returned to cropping the cultivations required will be significant; akin to ploughing out leys. Savings from high quality seed beds such as can follow rotational set-aside will be less easily achieved. Savings from reduced seed rates will be rare.

3. WEED CONTROL

Winter wheat Variable Costs
Herbicide : £36 per hectare



Scope for savings

* Use reduced rates where appropriate, i.e. weed size and weather conditions allow savings. Savings of £5-10 per hectare may be possible in favourable conditions.
* Low rates of herbicide used in conjunction with mechanical weeding operations can give effective control.
* Spray severe infestation patches, using weed mapping if pre-emergence treatment is planned.
* Consider spring crops to reduce the burden of grass weeds, although wild oats will still remain a potential problem.
* Use set-aside for weed control.

Points to watch

* Reduced rates can be less reliable on larger weeds or in poor weather. Check label.
* Severe weed problems, particularly of competitive grass weeds, are less amenable to large reductions in input and consequent savings.
* If repeated treatments fail to control grass weeds check for resistance.
* Timely topping of set-aside prevents seed return, and reduces the bulk of material which needs ploughing in, and can be done much faster.
* Following the straw burning ban, use the plough to bury weed seeds where weeds are a problem. Where ploughing is not practicable use rotations, stubble management and set-aside as means to reduce weed burden.

Some weeds such as wild-oats, black-grass, brome species and cleavers can significantly reduce crop yield or quality.

Other weeds are relatively uncompetitive. For example pansy, speedwell and dead-nettle at low densities may have to be controlled to prevent the populations getting out of hand in later crops.

Modern herbicides can in many instances be used over a fairly long periods of crop development. Because of this, the potential for favourable conditions for their use is increased. Dose can be reduced in certain situations, often with little impact on efficacy. The use of these reduced rate applications is therefore likely to increase.

Figure 3, shows the effect on margin over herbicide cost of various treatments relative to a full 'insurance' of autumn broad-leaved and grass weed control, plus spring broad-leaved and, if required, spring grass weed control (12).

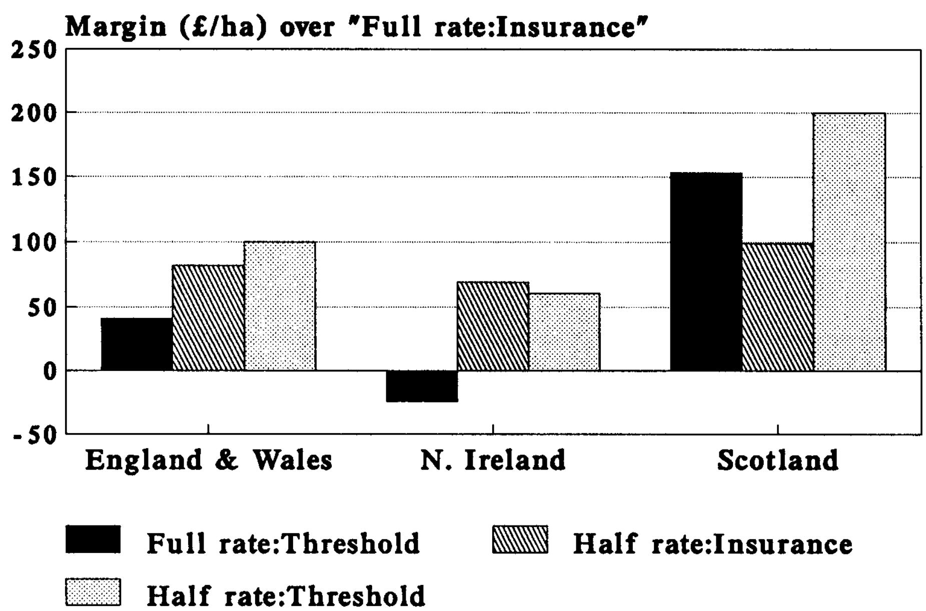


Figure 3. *The effect on margin of using thresholds and half rates*

Spraying on the basis of thresholds based on the weed density and their crop equivalence (loss of crop per unit of weed) improved margins, but not as reliably as reducing rate by 50%. The data above from the experimental series did not include a site with black-grass for which reduced rates would not be recommended.

Thresholds can be a useful tool for deciding on the appropriateness of reduced rates, the two approaches helping to reduce the overall risk. If thresholds are to be used, some time and effort must be put into identifying weed species and density.

At one site in this trial series, there was a clear and significant benefit to full rate herbicide when high levels of chickweed were a problem. It is just as important to see where rates should not be reduced, as to recognise where savings can be made. Similarly if rates are reduced it is important that tank mixes do not jeopardise efficacy at the lower rate.

Where reduced rates of herbicide are used, say as low as 20% of normal dose, effective control can be achieved if weeds are also subject to mechanical control measures, (13). The herbicides disrupt the normal functioning of the plant sufficiently to prevent competitive regrowth.

3.1 Control of annual weed grasses

These are the most serious group of weeds for the cereal farmer, and if costs are to be controlled there is a need to avoid serious grass weed problems with high seed returns that demand costly sequences of residual and contact herbicides. This is particularly important where barren brome is a problem.

The ban on straw burning has helped improve performance of residual herbicides due to lower levels of ash in the surface layers of soil, although care with cultivations are still needed to ensure excess straw does not produce problems. Cultivations are also important because of the need for seed-beds that discourage the emergence from depth of grass weeds, with rooting systems forming below the depth of efficient residual herbicide operation (14).

Ploughing down straw is one of the most reliable methods of straw incorporation, but on larger farms may take too long and other more rapid techniques may be required. Where such techniques are used it is important that reliability of grass weed control is sustained, and ploughing is still used on areas where weed grasses are bad. It is important to use a cultivation technique which inverts the soil and buries weed seeds.

Where possible tackle grass weeds in broad-leaved crops. Similarly broad-leaved weed problems can be controlled effectively in cereal crops. If using set-aside to reduce weeds, the new rules on herbicide use introduced for 1994 help, but only adopt this approach if you are confident that the set-aside can be managed to prevent seed return.

Brome species are a main grass weeds around the headlands. Baling is one option, provided it is not simply moving the problem to another field. Early preparation of a stale seed-bed will encourage the seed to chit for non-selective control or cultivation, although recent research (1,14) is showing the straw mulch left after straw chopping can encourage weed germination in certain situations. Headland set-aside is also an option for brome control particularly with a sown grass cover and can be useful in irregular shaped fields to ease field operations provided the 20m minimum width is adhered to.

Spring cropping, with the possibilities of autumn cultivations and non-selective herbicide use, should be considered if soil type and weather allow reliable seed-bed preparation and drilling in the spring. The increasing contribution from area payments under CAP reform to some extent reduces the impact of the lower yields of spring crops.

Figure 4 shows the impact of the CAP reform on winter and spring cereal margins in 1992/93 and 1995/96.

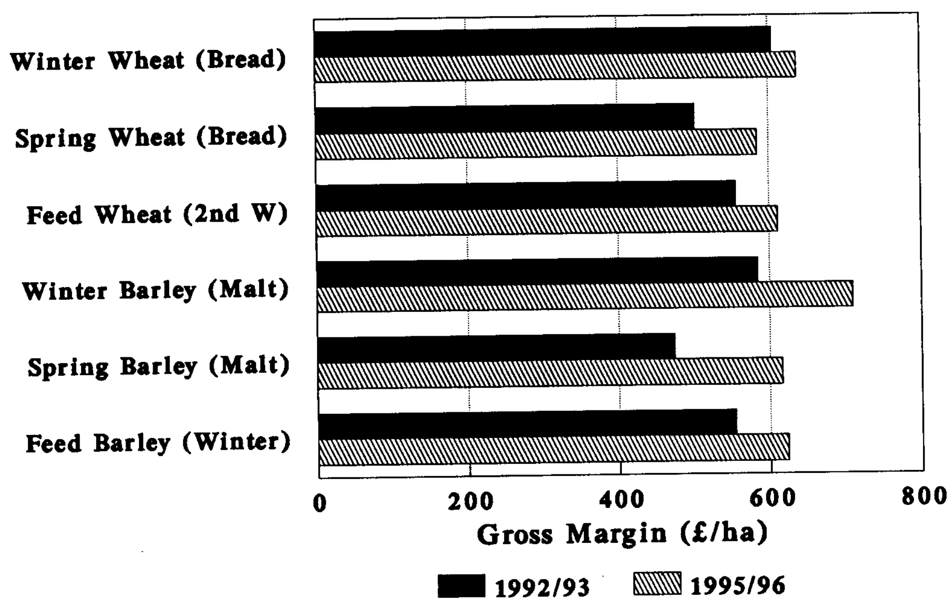


Figure 4. *Gross margins 1992/93 and 1995/96*

(Calculations based on 1 ecu=£0.948645. See Appendix table 2a. Barley GM excludes straw sales)

3.2 Resistance

World-wide more weeds are developing resistance to herbicides (15). At present in the UK, the problem is largely confined to grass weeds (particularly black-grass) in some cereal crops. Often resistance is associated with mono-cultures using non-plough cultivations, and frequent use of the same class of herbicide.

Poor weed control can often be attributed to factors other than resistance (14). However suspected resistance should be checked by growing plants from seed under controlled conditions then comparing them with known resistant strains when sprayed.

Once resistance has been identified greater use should made of cultural control measures. Guidelines for the choice, combination and use of herbicides have been drawn up by the Weed Resistance Action Group (WRAG), (16), and are available from HGCA, or ADAS.

3.3 Impact of set-aside

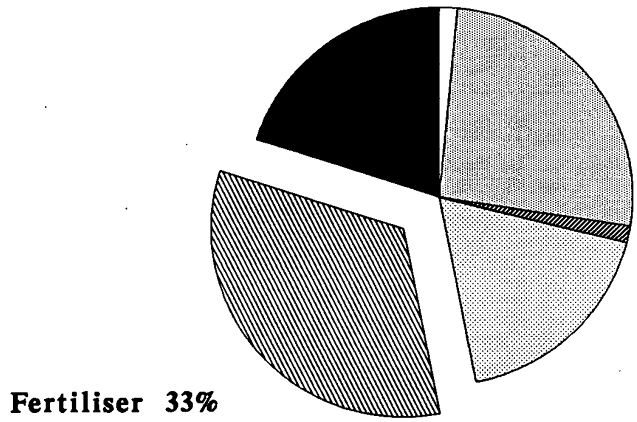
Current set-aside regulations allow for the use of cultivation for weed control from May 1. There are several reasons for seriously considering cultivating land which has been set-aside since the previous autumn.

By May, most weeds and volunteers will be quite large plants. Topping followed by cultivations is a useful method of control, as even quite large plants do not recover well. However, if a total weedkiller is used, vigorous undisturbed plants are the most suitable targets. This weed control cultivation, although not specifically aimed at seed-bed preparation, inevitably helps, and is is particularly useful for timely oilseed rape establishment, but heavy rain may cap the surface or destroy early prepared seedbeds.

Cultivations are one of the most useful weapons in the fight against herbicide resistance especially of black-grass. They are also important in preventing the seeding of volunteer cereals and oilseed rape. Seed return of crop species should also be prevented from natural regeneration or specifically sown cover crops.

4. 0 FERTILISER MANAGEMENT

Winter Wheat Variable Costs
Fertiliser : £66 per hectare



Scope for savings:

* Match fertiliser rates to crop demand and soil nutrient supply; following break crops nitrogen fertiliser costs can be reduced by up to £15 per hectare.
* Reduce or omit P and K use where soil Indices are above 2/3; use simplified timings of PK to reduce application costs (e.g. rotational applications).
* Allowance for the NPK value of farm manures or sewage sludge can result in savings of over £25 per hectare.
* No seed-bed nitrogen needed for autumn cereals.
* Careful selection of 'best buy' fertilisers; sourcing fertiliser in a competitive market gives a range of prices, delivery and finance packages.
* Up to 20 kg/ha N may be saved if grain prices fall to £80 per tonne.

Points to watch:

* Even spreading of fertilisers and manures is critical for cost effective use. Check spreaders.
* Control manganese and/or copper deficiencies where identified.
* Lime to maintain pH 6.5 on mineral soils and pH 5.8 on peaty soils.
* Cleaner atmosphere means less sulphur in some areas. Check by plant analysis if in doubt.

Fertilisers represent about one third of variable costs. There are opportunities for substantial savings on many farms, either through rotation changes, reduced rates or simplified application systems. On some farms, increased fertiliser use may be needed to maximise yield potential.

4.1 Nitrogen - feed wheat, feed barley.

Nitrogen is one of the most cost effective cereal inputs, even as grain prices fall. Apart from CAP reform, legislative controls will increasingly affect fertiliser and farm manure use, particularly under agreements in Nitrate Sensitive Areas and for all farms in Nitrate Vulnerable Zones. To meet pollution control requirements whilst maintaining profits, all farmers will need to pay close attention to correct nitrogen use.

A typical nitrogen response curve (Figure 5) shows how yields at least double in most situations through nitrogen use, although most of the yield benefit comes at the lower rates of nitrogen use. At the top end of the response curve, N rates can be reduced significantly in the short term with only small yield changes (see Table 2). Excessive N use can reduce yields and grain quality.

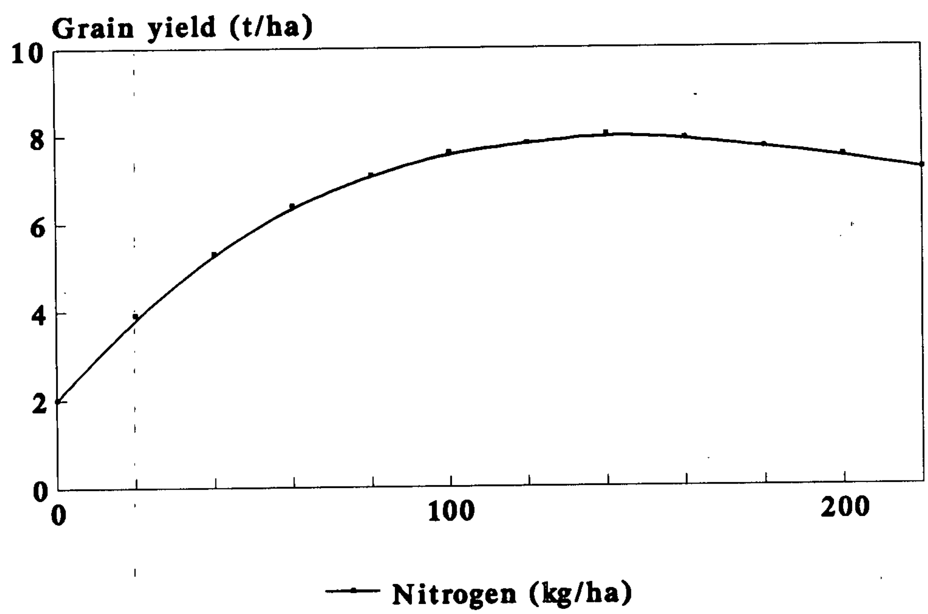


Figure 5. *Nitrogen response curve - typical winter wheat values*

Economic optimum rates of spring nitrogen may reduce slightly as grain prices drop. This will depend not only on the expected market price for grain but also on the cost of nitrogen. Nitrogen fertiliser prices have dropped in recent years due to substantial amounts of imported fertiliser and a competitive home market. The future direction of nitrogen prices is uncertain.

If grain prices fall £20 per tonne from 1993 levels, and the cost of nitrogen fertiliser increased slightly then optimum N rates would fall by up to 20 kg per hectare. This would result in very small yield reductions of less than 0.1 tonnes per hectare. Using cheap nitrogen fertiliser does not justify use of higher N rates for cereals. Increased disease and lodging risks will generally outweigh any small yield advantage.

Some N fertilisers have been very cheap at prices as low as 20p/kg N. These materials may be satisfactory provided they can be spread accurately in solid or liquid form. Urea is suitable for all applications up to the end of April and will give equivalent yields to ammonium nitrate on most soil types. Urea may be less effective on chalk soils.

Table 2. *Effect of changing prices on optimum nitrogen rates for cereals*
[*All data for ADAS N Index 0, unless shown otherwise*]

	Grain £112/t Nitrogen 28p/kg (2.5:1 ratio*)	Grain £96/t Nitrogen 29p/kg (3:1 ratio*)	Grain £80/t Nitrogen 32p/kg (4:1 ratio*)
Winter wheat			
:N Index 0	222 (+0.03)	212	193 (-0.07)
:N Index 1	172 (+0.02)	167	156 (-0.04)
Spring wheat	164 (+0.02)	157	138 (-0.04)
Winter barley	169 (+0.02)	164	154 (-0.03)
Spring barley	147 (+0.02)	142	133 (-0.03)
Winter oats	122 (+0.01)	119	114 (-0.02)

(Source: MAFF and HGCA funded R&D projects)
Equivalent ammonium nitrate prices: 28p/kg = £97/tonne; 29p/kg = £100/tonne; 32p/kg = £110/tonne

Yield change t/ha from N use at 3:1 ratio shown in brackets

* The break-even ratio is the quantity of grain (kg) needed to cover the cost of 1 kg of nitrogen.

The rates given in Table 2 are NOT necessarily recommended rates for individual crops. These depend on soil type, previous cropping and manuring history, and expected crop yield. Soil analysis can be used to determine the supply of soil mineral nitrogen available to the crop in a particular field and so to provide a more precise estimate of the optimum N rate. This approach is particularly valuable where soil nitrogen reserves are likely to be high, e.g. following organic manure applications, ploughed out grassland, high N use on vegetable crops.

On many farms, there is scope for savings in purchased nitrogen use following break crops, manures or sewage sludges. From Table 2, the optimum N rate for a wheat crop following a break crop (N Index 1) is 45 kg/ha lower than for wheat following wheat in an arable rotation (N Index O).

Table 3. *Estimated quantities of NPK produced in animal manures during housing (kg per year)*

	Plant available nitrogen* (N)	Total phosphate (P_2O_5)	Total potash (K_2O)	Value £
1 dairy cow	13	21	52	£19
1 fattening pig	4	7	6	£4
1000 broilers	214	525	380	£275

* from spring application. Less N will be available for plant uptake from an autumn or winter application.

Multiply by 9 to convert kg/m^3 to units/1000 gallons.

Farm manures and sewage sludges are valuable sources of nutrients. Careful use of these materials can result in substantial fertiliser savings.

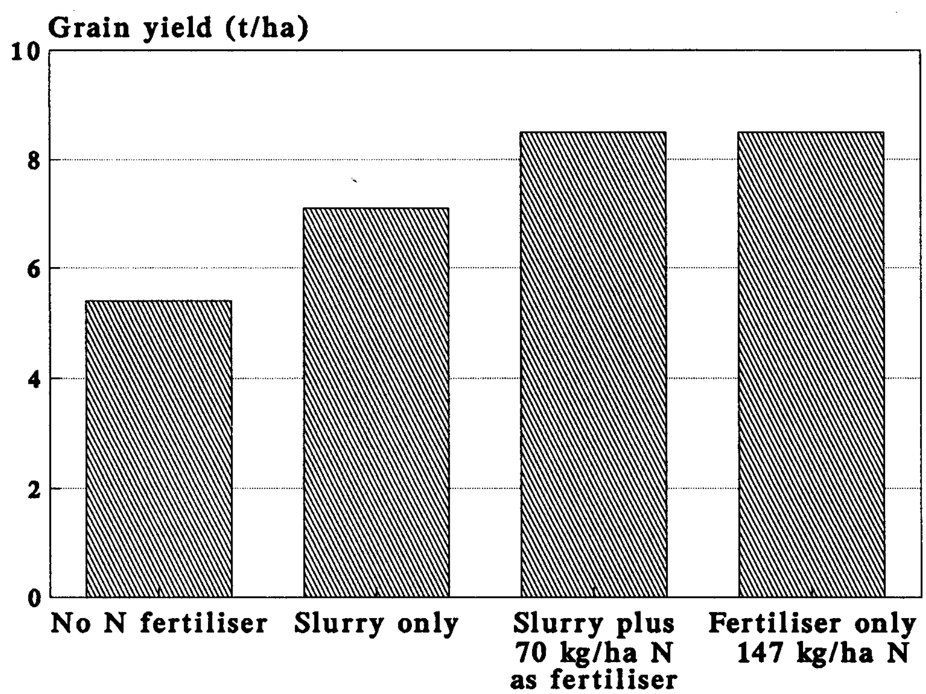


Figure 6. *Effect of spring topdressing of slurry on winter wheat (ADAS Bridgets, 1992)* (17)

Organic manures should be applied in spring (February to April) in order to make best use of nitrogen and minimise losses. Spring topdressing of cereals with slurries and poultry manure can effectively reduce the need for nitrogen fertiliser without reducing yields. Even spreading of organic manures as well as fertiliser is critical.

4.2 Nitrogen - breadmaking wheats

Intervention support is only available for wheat meeting the common wheat quality standard. For grain protein, this means achieving 9.9% protein (14% moisture basis) or 11.5% (dry matter basis). For breadmaking wheat varieties, higher grain protein levels over 11.0% will commonly be required and may attract premiums as at present. The longer term difference in price per tonne between breadmaking common wheats and feed wheats is still far from clear.

There is a two-stage decision process when considering the use of extra N (above that required for yield) to increase the protein content.

1. Is any extra N justified to boost protein? 2. When and how should the extra N be applied?

The increase in protein will only be cost effective if it results in a worthwhile additional premium. To achieve this requires *all* the required quality criteria to be satisfied - Hagberg, specific weight, freedom from discoloration etc.

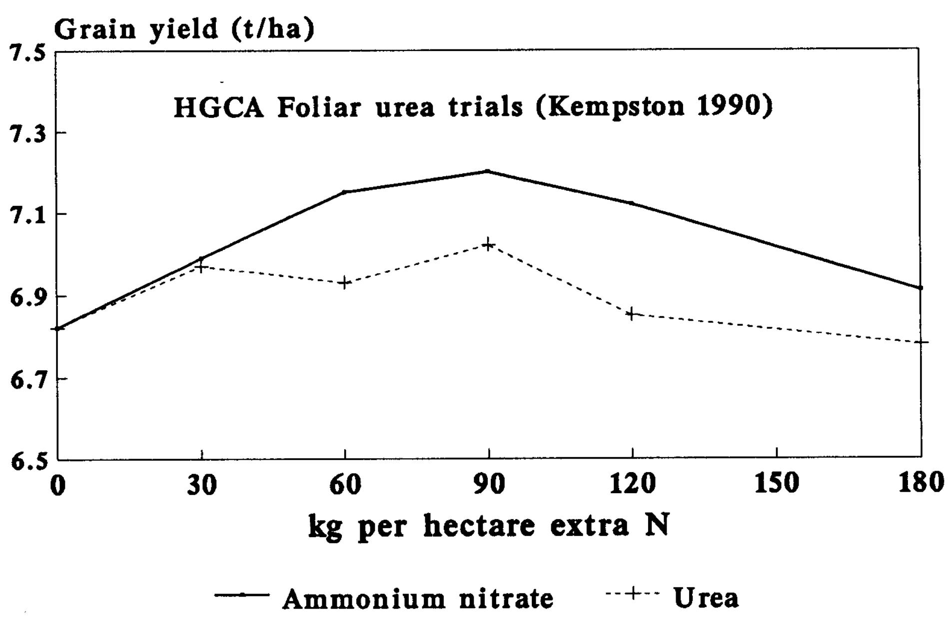


Figure 7i *The effect of foliar urea and ammonium nitrate on yield (HGCA trials)*

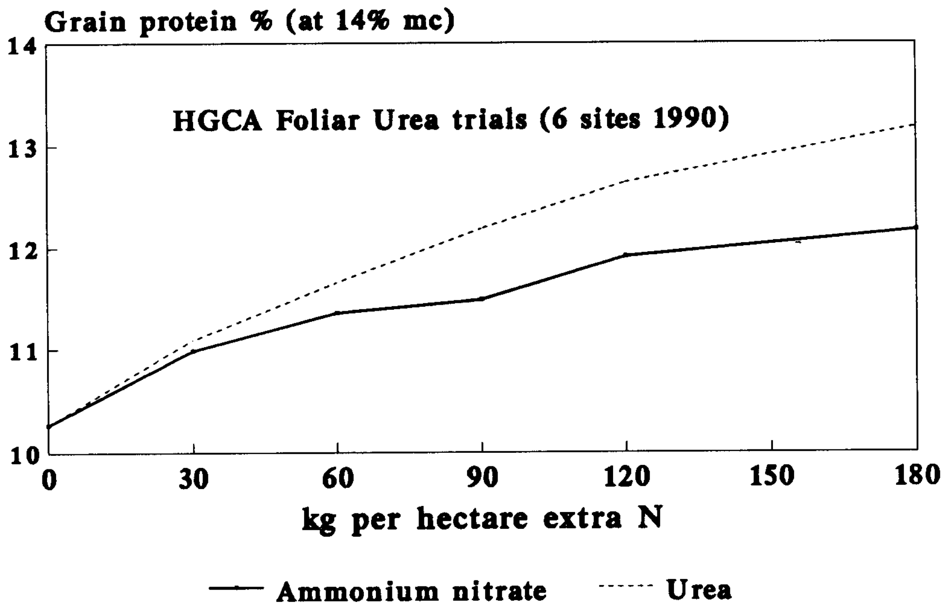


Figure 7i i *The effect of foliar urea and ammonium nitrate on protein (HGCA trials)*

Figure 7 shows that 30 kg/ha foliar urea N will raise grain protein by an average of 0.6 -0.7%, compared to 0.4-0.5% from the same amount of N applied as prilled ammonium nitrate at 2nd node stage (GS 32) (18). Larger increases in grain protein can result if more than 30kg/ha is used but no more than 40 kg/ha N is recommended. On-going HGCA-funded research indicates that both nitrogen sources produce good quality protein that gives useful improvements in baking quality (19).

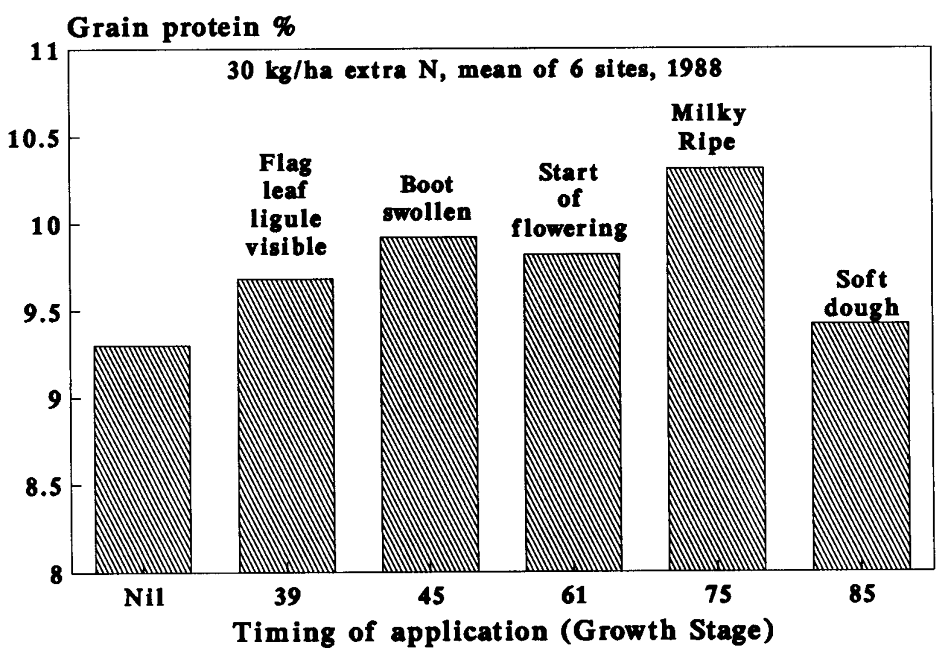


Figure 8. *Effect of timing of foliar urea on grain protein content*

However, extra N as ammonium nitrate will commonly give a small yield increase which partially offsets the extra cost of N. Any yield increase is very unlikely from foliar urea. The timing of foliar urea (Figure 8) is critical, and for maximum effect application should be during milk development (GS 70-77)

Ammonium nitrate at GS 32 is the preferred strategy because of its combined yield and protein benefit. The development of a technique to predict grain protein before the milky ripe stage would allow more targeted and effective use of foliar urea to boost protein.

4.3 Nitrogen - malting barley.

Site selection is crucial to producing a good malting barley sample. Soil type is a major factor affecting grain N content, along with the level of residual soil nitrogen, fertiliser-N and organic manures applications. Deep heavier textured soils of high AWC (available water capacity) can more reliably produce crops of high yield with acceptable grain N contents than sandy or shallow soils of low AWC. The extra soil moisture that is available during grain filling raises yield and dilutes grain N content (20).

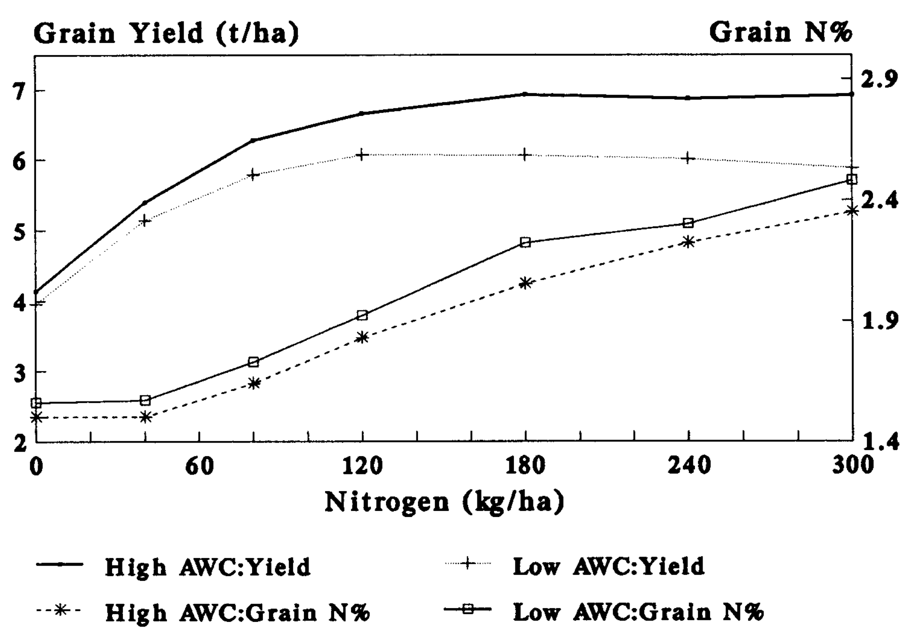


Figure 9. *Effect of AWC on response of autumn sown malting barley to nitrogen*

Optimum nitrogen rates for malting barleys are limited by the need to achieve a low grain N (usually below 1.75%). They will remain unaffected by lower grain prices so long as the current relative premiums remain the same. Trials show that about 90 kg/ha N is optimum for winter malting barley on sandy or shallow soils of low AWC, and about 105 kg/ha N for deep, heavier textured soils. Using higher rates of nitrogen can raise grain N by approximately 0.1% for every 25 kg/ha N applied.

For autumn sown crops, all nitrogen should be applied by mid-end March, whilst for spring crops all nitrogen can be applied in the seed-bed, though not more than 40 kg/ha before the end of February on sandy or shallow soils.

4.4 Seed-bed nitrogen for autumn sown cereals

Levels of nitrogen in the soil at this time are usually more than adequate to meet the low crop N uptake during the autumn/winter period.

Although straw or stubble can temporarily immobilise nitrogen, trials have shown that autumn sown cereals do not require the use of seed-bed nitrogen.

4.5 Lime, phosphate and potash - all cereals

Soil acidity, as well as lack of phosphate or potash, can reduce the response to nitrogen, and may also reduce the crops ability to withstand disease or to respond fully to fungicides, insecticides and herbicides (21). The need for lime, phosphate and potash will not change from current recommendations.

Although there are opportunities to change the use of P and K on many farms, care must be taken to ensure that appropriate applications are made to avoid jeopardising responses to other inputs. Lime must continue to be applied to maintain optimum soil pH levels.

* Use soil analysis every 4 years to identify soil pH and nutrient reserves. Many arable soils have unnecessarily high soil nutrient Indices (see Table 4). Soil PK levels vary widely but approximately 52% of arable soils are at P Index 3 or over and 20% at K Index 3 or over. Reducing or omitting P and/or K for some crops is usually possible at these levels.

* Balance PK application with PK removal in crop produce to maintain P, K and Mg Index 2 in combinable crop rotations.

* Make full use of the nutrient value of organic manures.

* Make full allowance for residues from previous cropping.

Table 4. *Range of soil nutrient Indices in arable soils in England and Wales (% in each Index)*

	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5
Phosphorus	4	13	31	37	11	4
Potassium	1	24	55	17	2	1
Magnesium	2	24	36	18	8	12

Source: (MAFF Representative Soil Sampling Scheme)

Straw contains large amounts of potash which must be replaced unless there are adequate natural reserves in the soil.. The effect on P offtake is very small.

4.6 Sulphur - all cereals

Sulphur (S) is an essential nutrient for all agricultural crops and is particularly important for the protein quality of bread making wheat.

The uptake of sulphur by cereals is typically 15-20 kg S/ha. In 1970, (22), large areas of Britain received well over 40 kg/ha S per year from the atmosphere; today most arable areas receive less than 20 kg/ha S and some areas less than 10 kg/ha.

Sulphur deficiency has consequently become a major limiting nutrient in crops with a high sulphur requirement (eg. oilseed rape) particularly on sandy or shallow chalk soils where Sulphur losses by leaching are high. Although cereals are less susceptible to sulphur deficiency because of their lower requirement, deficiency symptoms and small yield responses (up to 10%) have been found in cereals grown on very sandy soils in SW England, Scotland, Wales and Ireland.

Results from an HGCA funded survey of grain sulphur in breadmaking wheat varieties has indicated that grain S concentrations have declined substantially over the last decade, (23). Since it is possible that deficiency will affect bread-making quality before grain yield, this trend should be monitored to avoid falling quality affecting domestic and export markets.

In 1992, a survey of winter cereal crops in potentially sulphur deficient areas, showed that less than 5% of wheat crops and 10% of barley crops might be considered deficient. At present, sulphur deficiency is only likely to be a potential problem on a minority of cereal crops on sandy or shallow calcareous soils receiving low inputs of atmospheric sulphur. However, the low cost of correcting sulphur shortage will be justified where a potential deficiency is confirmed.

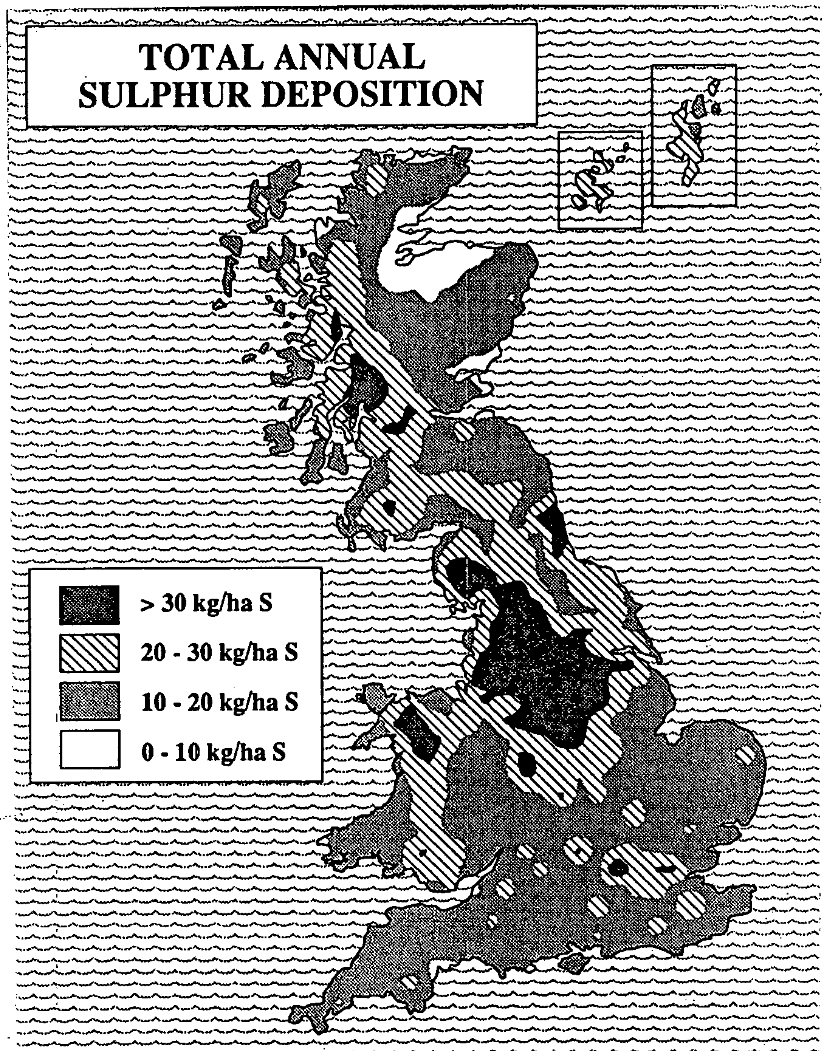


Figure 10. *Mean annual sulphur deposition 1986 - 88*
Information supplied by Warren Spring Laboratory 1990

At present, the requirement for sulphur fertiliser can only be assessed by knowledge of soil type and location, or by leaf tissue analysis. HGCA funded research is in progress to develop a more reliable method of predicting sulphur need based on soil analysis.

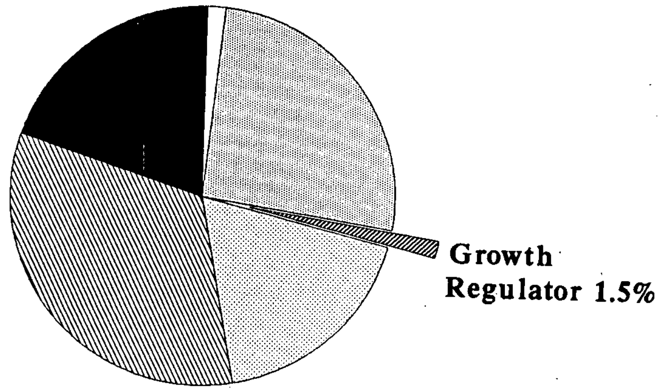
4.7 Impact of set-aside

MAFF funded research suggests the benefits resulting from rotational set-aside are small increases in yield, equivalent to about half that expected from most break crops . Cereal crops following set-aside should be fertilised assuming an N index O, (24).

The effects of non-rotational set-aside are likely to be similar to rotational, early R&D suggesting no difference in optimum nitrogen requirements for subsequent crops. Biofuel production is allowed with short rotation coppice or *Miscanthus* spp. Short term impoverishment may occur, although much will depend on the organic residues left each year at harvesting, and when the land is returned to cropping and its subsequent manure policy.

5.0 GROWTH REGULATORS

Winter Wheat Variable Costs
Growth Regulator : £3 per hectare



<u>Scope for savings</u>

* Risk assessment can allow savings of between £4 and £30 per hectare

* Savings from cutting out cheap chlormequat treatments are hard to justify if large quality premiums are involved.

<u>Points to watch</u>

* Carefully weigh the reduced lodging risks against any possible adverse effects of PGR on grain quality, particularly on dry soils.

* With the review of inputs involved in adjusting to CAP reform, it may be that an *increase* in PGR use is required. Their overall cost is modest when premiums of £20 - £30 per tonne are involved.

* Where lodging occurs regularly despite PGR use, change to a variety with stiffer straw.

5.1 Insurance treatments

Plant growth regulators (PGRs) are used to reduce the risk of lodging.

Yield losses may vary very much depending on when lodging occurs and the type of lodging (25). High yielding crops subject to adverse weather around harvest time are more likely to lodge than low yielding crops, but the percentage yield loss from both crops will be minimal if harvesting is unimpaired. Lodging resulting from root upheaval cannot be recovered from as easily as that caused by stem flexing.

Much greater financial losses can ensue from the loss of quality. Cleaning and drying can together amount to £20 per tonne. Sprouted grain will be unsuitable for malting or milling.

Sprouted wheat has a disproportionate effect on Hagberg falling number (HFN). Figure 11 shows the effect of admixtures of 5%, 10% and 20% 100 HFN grain, (26)

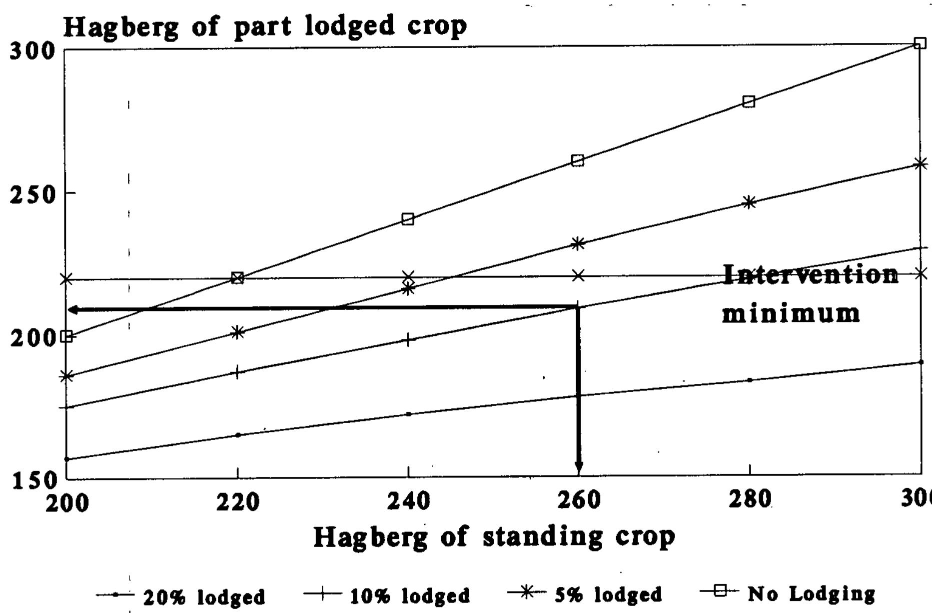


Figure 11. *Effect of lodging on Hagberg falling number (lodged crop sprouted and 100 HFN)*

Thus a crop which would have been 260 HFN in the absence of lodging, would fail to achieve intervention standards if 10% of the crop lodged flat and ended up with sprouted grain of 100

HFN. This can be a significant risk in breadmaking wheats, and justifies separation of lodged and unlodged crop in store.
The typical price for a single PGR treatment (chlormequat at GS 30/31) is about £4.50 per hectare, whilst a sequence of chlormequat and a later applied ethephon (2-chloroethylphosphonic acid) amounts to between £17 and £30 per hectare.

Lodging risk assessment

If savings are to be made in PGR use, they must be done against the background of a rationally based risk assessment. A risk assessment scheme is given below:

- The total risk can be assessed by totalling the number of stars for a given variety in a given situation.

Risk factors

1. Use the Recommended List 'standing power' rating for the variety grown

NIAB	Wheat	Barley
9		**
8		**
7	*	**
6	**	***
5	***	****
4	****	****
3	****	****

	Winter Wheat	Add
2.	Applying more than 200 kg/ha N	*
3.	Fertile site	*
4.	Bread making or seed	*
5.	Exposed site	*
6.	Plant population 250 - 300/m2	*
	> 300/m2	*
7.	Sown before September 30	*
	after October 31 subtract *	

	Winter Barley	Add
2.	Applying more than 150 kg/ha N	*
3.	Fertile site	*
4.	Malting or seed	*
5.	Exposed site	*
6.	Sown after mid October	*

- Add one extra star if prior knowledge of a field indicates a high lodging risk, and one if your nitrogen use is earlier than ADAS recommendations.

- Remove one star on very light soils.

- Add up the variety and growing condition stars and for winter wheat with

***	Or more, use Chlormequat at GS 30/31
*****	Or more, use Chlormequat at GS 30/31 and consider ethephon at GS 37/39

  and for winter barley apply the same treatments for ** or more and **** or more respectively.

5.2 Role of variety

Lodging risk can be reduced by chosing varieties with strong straw. However, where a premium market can be obtained with a lodging prone variety and this can guarantee a 20% higher return, even the more expensive PGR programmes are a good investment.

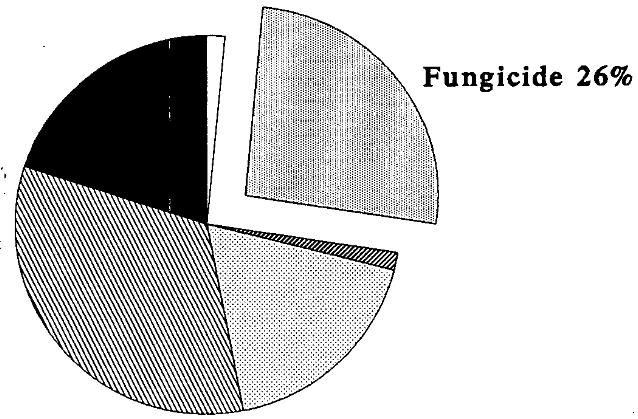
Quality and marketability attributes are likely to become more significant than they have been in the past. Relying on a variety's straw strength and lodging risk have been tolerable risks with a guaranteed market. This seems less likely in the future.

5.3 Impact of set-aside

The effect of set-aside on growth regulator use will be slight. Cereals following rotational set-aside should receive nitrogen fertiliser as though the crop were grown on a nitrogen index 0 site (24), and are therefore, are not likely to produce large amounts of excess vegetative growth. Indeed, the timeliness of seedbed preparation should allow sowing dates to be nearer the ideal for minimising lodging risk.

6.0 DISEASE CONTROL

Winter Wheat Variable Costs
Fungicide : £52 per hectare



6.1 Soil -borne diseases - Wheat

Scope for savings

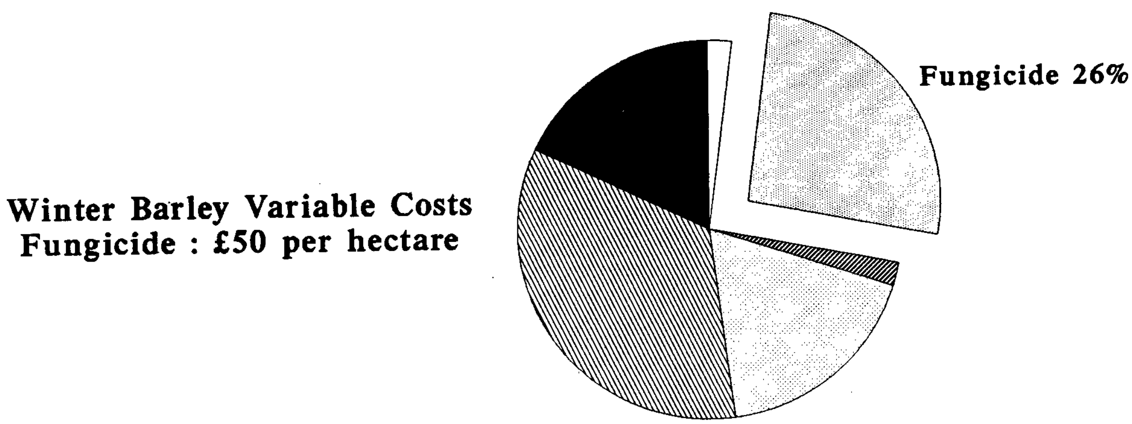
* Take-all frequently gives a yield loss in the order of 5%. Savings of around £40 / ha can be made by minimising the effects of the disease.
* Set-aside offers an opportunity to control perennial grass weeds which can carry the take-all fungus through subsequent cereal breaks.
* Rotational set-aside allows more timely establishment of autumn-sown crops and thus higher potential yields
* Rotation is the main means of reducing disease pressure.

Points to watch

Rotational set-aside does not provide a true break from take-all. Re-entry into a cereal following set-aside can lead to severe take-all.

The most important soil-borne disease of cereals is take-all. This disease, most severe in second and subsequent wheats, has so far eluded all attempts at chemical control so rotation is the major disease control strategy. Set-aside can be used to reduce take-all in subsequent crops. Currently the most common option for set-aside is natural regeneration of stubble. This however, does not constitute a true 'break' from take-all, as the fungus can survive on dead cereal roots and on the roots of living volunteer plants reasonably successfully for some months (27). The most successful option would be to cultivate immediately after harvest and establish an oat/rape mixture. However, this is costly and so cultivation and establishment of a green cover by natural regeneration is a reasonable compromise. In practice, set-aside offers the perfect entry for establishment of oilseed rape which could be followed by a cereal with minimal risk from take-all.

6.2 Soil-borne diseases - Barley



Scope for savings	
*	Non-rotational set-aside can allow fields which are severely infested by BaYMV/BaMMV to be taken out of the rotation, thus avoiding losses of up to £300/ha when the disease is severe.
*	Varietal choice is the only effective control measure.
*	Savings will also be made where the disease is prevented from spreading to other fields.
Points to watch:	
*	Rotational set-aside does not provide a significant break and would not reduce disease levels in subsequent winter barley crops.

Barley Yellow Mosaic Virus (BaYMV) and Barley Mild Mosaic Virus (BaMMV) can cause considerable yield loss in the UK barley crop. They are second only to take-all as the most important soil-borne cereal disease. Both cause similar symptoms and are now found in most barley growing areas. They are transmitted by the soil-borne fungus *Polymyxa graminis* and once infested, a field remains contaminated. (28) & (29)

There are no prospects of controlling the fungal vector with fungicides. Little can be achieved by modifying rotations and although later sowings are less affected, delaying drilling is not a practical solution. The only effective control measure is varietal selection. Resistant varieties currently available, including Firefly, Gaulois, Sprite, Target, Torrent and Willow, give good yields on infested sites.

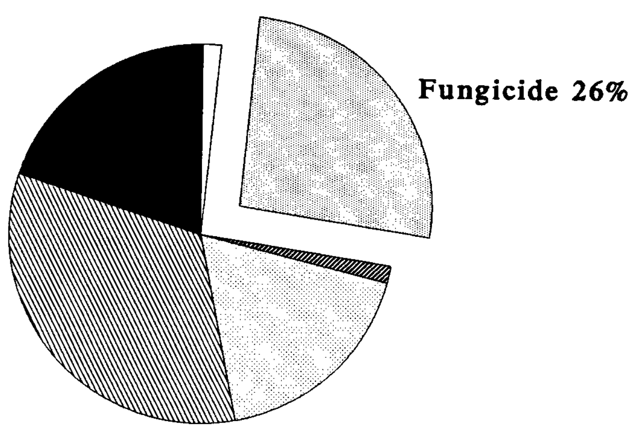
There are now strains of Barley Yellow Mosaic Virus which are capable of overcoming the resistance in the above varieties but the incidence of such strains is still relatively small.

The disease is particularly a problem for malting barley growers as most resistant varieties are feed types. Sprite, the only resistant malting variety, is currently provisionally approved by the Institute of Brewing.

Farmers may consider non-rotational set-aside for areas of the farm which are severely affected by these viruses. This will help prevent disease spread which, although slow, is inevitable where normal cropping continues.

6.3 Foliar diseases of wheat

Winter Wheat Variable Costs
Fungicide : £52 per hectare



Scope for savings:

* On high-yielding, disease prone varieties such as Riband there is limited scope for savings on fungicide inputs. However, there are large financial penalties for incorrect timing or choice of fungicides.

* Savings in the order of £25/ha are possible for moderately disease resistant varieties such as Beaver and Haven, provided that fungicide timing is optimised.

* Disease resistant varieties such as Hunter and Hussar offer considerable scope for savings in fungicide cost, up to £35/ha, when grown as replacements for Riband, Beaver and Haven - type varieties

* Options for multiple application of reduced rate fungicides are generally more suited to varieties with moderate to good disease resistance.

* With a good decision support system, savings in the order of 25% (equivalent to approximately £13/ha) should be easily achievable without loss of yield.

* Timing of fungicides is critically important and by adjusting application dates to near optimal timings increases in yield in the order of 0.5t/ha can be achieved with no extra fungicide cost.

Points to watch:

* Reductions in the price of grain does not reduce the need for effective disease control.

* Inappropriate reductions in the rate of fungicides applied can be very costly. A 25% reduction in the rate of fungicide applied (giving a notional 'saving' of £5/ha) which results in a 1% reduction in yield will actually result in a loss of £3/ha.

The foliar diseases of wheat have major effects on yield but can be well controlled with fungicides. Despite spending over £100M per annum on fungicides for winter wheat, foliar diseases still causes grain losses worth over £30M. Recent MAFF-funded surveys have shown that many farmers apply fungicides at timings incompatible with optimal disease control and yield response. Weather problems often prevent the optimal timing of fungicides but even in dry years fungicide timing is frequently not ideal. Table 5 below shows that the majority of fungicide applications are not timed at GS39, (full flag leaf emergence) although this is the timing which gives the largest yield response.

Table 5. *Spraying regimes used in winter wheat in 1992*

Fungicide timing	% of crops *
Crops sprayed at GS31 (GS29-GS35)	74.7
Crops sprayed at GS39 (GS36-GS44)	36.3
Crops sprayed at GS59 (GS45-GS71)	64.5
* From a sample of 380 crops	

GS 31 - First node ; GS 39 - Full flag leaf emergence; GS 59 - Full ear emergence

The failure to optimise fungicide use is partly because good decision support systems to aid farmers are not available. HGCA is currently part-funding the development of such systems.

Data from the HGCA winter wheat variety/fungicide interaction experiment (30) and the MAFF Cereal Pest and Disease surveys 1989 - 91 indicate that the mean margin to actual fungicide use was in the region of £20 - 30/ha. The mean economic benefit from four decision support systems currently under test in the HGCA/MAFF/Bayer LINK project (31) was £69 / ha (1992). Applied to the 2 million hectares of the UK wheat crop this equates to a benefit of £138 million.

The "Integrated Disease Risk" (IDR) system, currently being developed, incorporates information on varietal disease resistance, disease pressure and weather conditions to guide decisions on fungicide choice and timing, and allow appropriate dose. With a successful decision support system, UK savings on fungicide cost in the order of £35 million per year should be achievable. This would also reduce the total amount of fungicide active ingredient applied by about 700 tonnes per year.

Disease prone varieties such as Riband, Admiral, Hornet and Slejpner are very responsive to fungicide input, providing it is correctly timed. With all varieties, fungicides applied at the wrong times are less effective and may not be cost-effective. However, the yield responses to well-timed fungicides in high-yielding, disease prone varieties can be very large. This easily covers the cost of fungicide applications when wheat is being traded at prices well in excess of £120/t. But what would happen when prices fall below £100/t - perhaps as low as £80/t ? Figure 12 below shows the way in which profitability of various fungicide spray programmes, on responsive varieties, alters as wheat prices change.

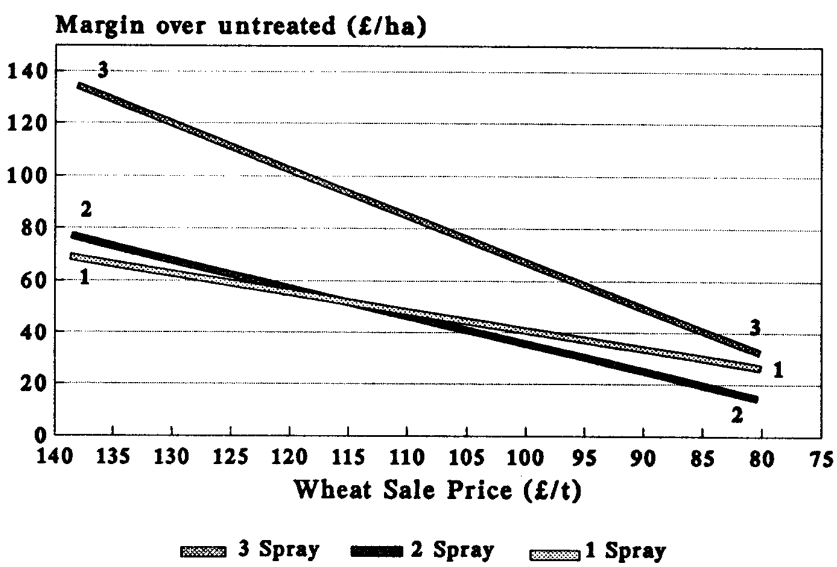


Figure 12. *Profitability of 1-,2- and 3-spray fungicide programmes for high-yielding disease susceptible wheat (32).*

Figure 13. shows the same information, but for varieties with good disease resistance, such as Hereward, Galahad, and the newer varieties Hunter and Hussar. Such varieties do not respond to fungicide input to the same degree as Riband types and if fungicide use is excessive, profit from fungicide use can easily turn to loss (with responsive varieties excessive fungicide use usually results in lower margins, rather than a true loss).

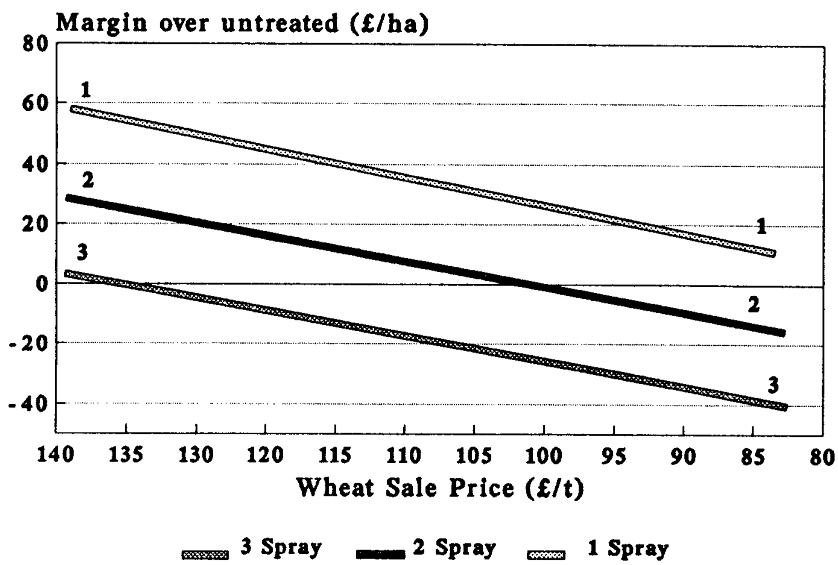


Figure 13. *Profitability of 1-,2- and 3-spray fungicide programmes for wheat with high level of disease resistance.*

The UK Recommended List of Cereal Varieties gives an indication of the responsiveness of a variety by comparing fungicide treated and untreated yields. The treated yields shown, however, are in response to a considerable fungicide input, showing the potential of the variety. These 'treated' yields may not, in fact, be economically justifiable and a less intensive 'treated' yield may well be more profitable.

Table 6. *Range in responsiveness of wheat to fungicide input of varieties*

	Relative yields		
Variety	**Fungicide treated**	**Untreated**	**% Difference**
Riband	126	99	27
Admiral	123	100	23
Hereward	115	101	14
Hunter	126	110	16

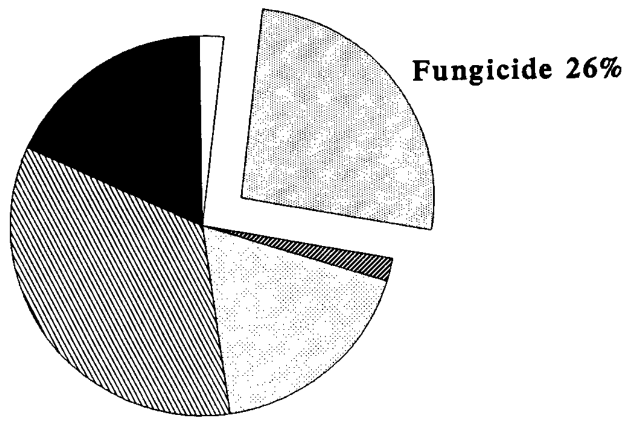
UK Recommended List of Cereal Varieties 1993.

Table 6 above shows examples of the fungicide treated and untreated yields, taken from the 1993 UK Recommended List. Clearly, Hereward and Hunter have much lower differences between treated and untreated yields than do Riband and Admiral. However, it may not be economic to try to achieve a 14-16% response to fungicide treatment for Hereward and Hunter, or a 27% response for Riband, particularly when wheat prices fall.

During 1991 and 1992, the most profitable treatment for Riband (a 3-spray programme) gave on average a 23.5% response. (HGCA Variety/Fungicide interaction experiment). The most profitable treatment for Hereward (a single flag-leaf spray) gave on average a 7.5% response. Thus, matching fungicide input to variety is clearly important as wheat prices fall, particularly with the less-responsive types of variety.

6.4 Foliar diseases of winter barley

Winter Barley Variable Costs
Fungicide : £50 per hectare



<u>Scope for savings:</u>

* Fungicide use on winter barley is very cost effective.

* Matching fungicide rate and choice to varietal disease resistance will optimise fungicide use.

* Use of reduced rates of fungicides in low disease situations.

Points to watch:

* Relatively little scope for savings on disease-prone varieties.
* The optimum fungicide treatment for an individual crop of barley is likely to remain the same as barley prices fall.
* Fungicide rate reduction on inappropriate varieties or at incorrect times can lead to significant yield loss and financial penalty.

The responsiveness of barley varieties to fungicide input is less clearly defined by their disease ratings than it is in wheat. Barley tends to respond to two fairly clearly defined timings for fungicide input (GS 30-31 - stem erect to first node, and GS39-50 flag-leaf to awns visible). The degree of yield response is better related to the diseases present in the individual crop, rather than to the inherent resistance of the variety. ADAS has carried out many experiments, funded by MAFF, to look at the response to fungicide timing in barley and, more recently, Winter Barley Variety/Fungicide experiments. The latter experiment series is very similar to the wheat experiments described earlier.

Figure 14 shows the yield response of winter barley to the main fungicide timings over the 7-year period 1986-1992, (33). Traditionally, the yield response to spring treatment was greater than that of the summer treatment - as can be seen by the results from the mid 1980's. In more recent years, the contribution from the summer spray has increased although it is clear that both timings give substantial yield responses.

Figure 15 shows how the margin of fungicide spray timings (compared with an untreated) changes with falling cereal prices. Clearly, the barley sale price has to fall considerably before it becomes worthwhile to reduce fungicide input. As prices approach £80/t, the difference between one- and 2-spray programmes becomes small and it is possible that, for ease of management, a one-spray programme would be adopted. At prices approaching £80/t, there would also be considerably more scope for fungicide rate reduction coupled with multiple applications. Varietal choice also becomes more important if reduction in fungicide applications are to be achieved without financial loss.

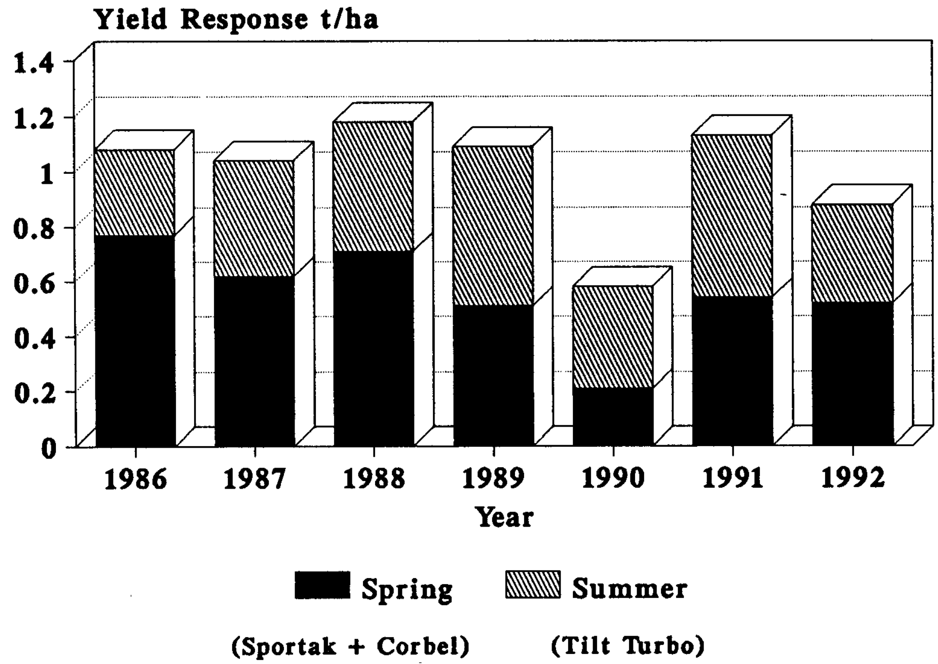


Figure 14. *Mean yield response to a two-spray fungicide programme in ADAS winter barley trials 1986-92.*

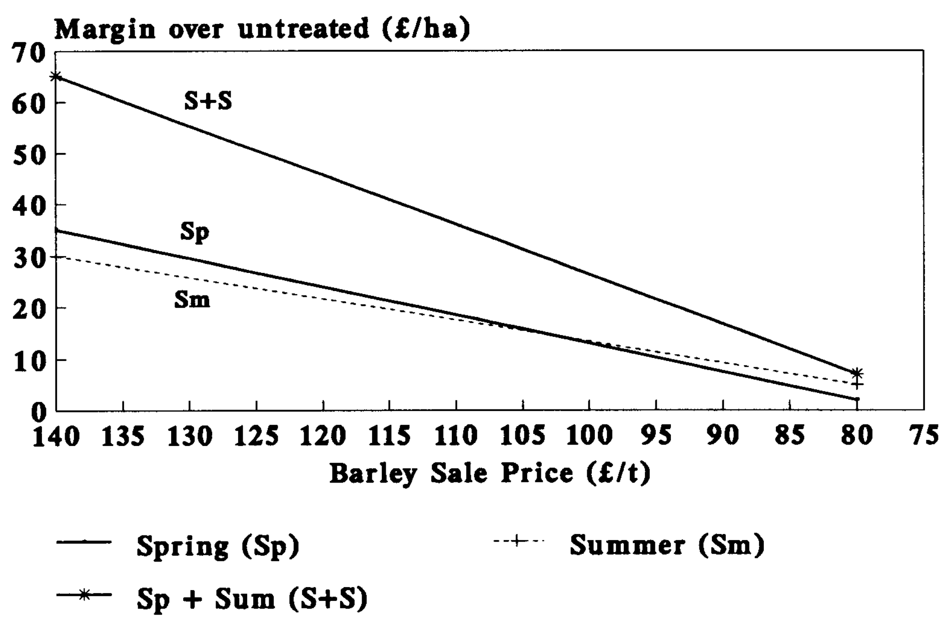
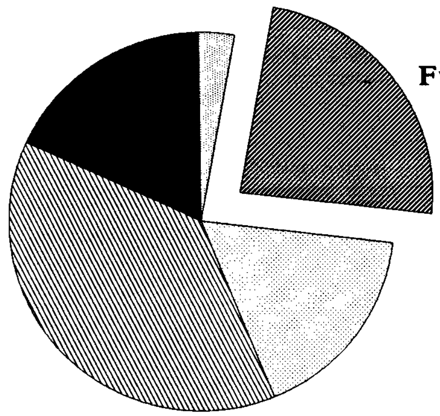


Figure 15. *Margin over untreated from 1- and 2-spray fungicide programmes on winter barley.*

6.5 Foliar diseases of spring barley:

Spring Barley Variable Costs
Fungicide : £37 per hectare



Scope for savings:
* With correct varietal choice, fungicide savings in the order of £20 - 30 / ha can be achieved in high disease years.
* Mildew susceptible varieties are very responsive to fungicide use.
* Varietal choice is of overwhelming importance in determining fungicide requirement.

In most of the UK, the main disease of spring barley is mildew. The greatest response to disease control is usually in varieties prone to mildew attack. The UK Recommended List of Cereal Varieties shows this clearly if fungicide-treated and untreated yields are compared. Table 7 compares treated and untreated yield percentage.

Blenheim, Camargue and Prisma are mildew-prone varieties (Disease score 3) and respond well to fungicide use. The other varieties have good mildew resistance (Disease Score 9) and have only small responses to fungicide input. Clearly, some varieties such as Derkado have untreated yields as high as treated yields for other varieties (e.g. Camargue and Blenheim). In this situation, treatment against mildew is unlikely to be necessary or economically worthwhile .

Table 7. *Yield response of spring barley varieties to full fungicide programme.*

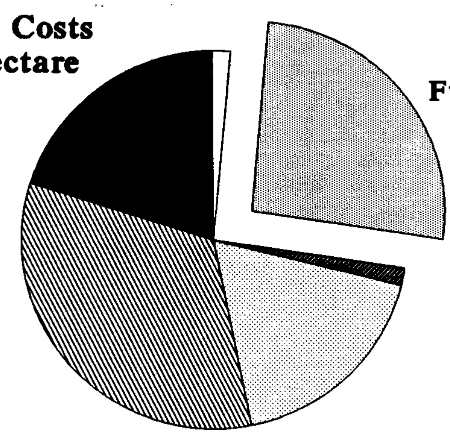
Variety	Yield Fungicide treated	Untreated	% difference
Blenheim	112	90	22
Camargue	111	93	18
Prisma	109	86	23
Hart	115	105	10
Alexis	111	105	6
Chariot	116	112	4
Derkado	114	112	2

UK Recommended List of Cereal varieties 1993

Other diseases such as rhynchosporium can be important in high-risk areas as few varieties have good disease resistance. This disease is erratic in its severity, and dependent very much on weather conditions. HGCA-funded work on fungicide resistance in rhynchosporium (34) has clearly shown that the use of fungicide mixtures is essential for reliable control of the disease.

6.6 Storage diseases

Winter Wheat Variable Costs
Fungicide : £52 per hectare



Scope for savings:

* Some recently introduced fungicides are particularly active against ear diseases.

* Grain should be stored at a moisture content of less than 15%.

Points to watch:

* Fungal contamination can lead to rejection of entire loads.

* Mycotoxins in grain are common but generally at very low levels.

* Wet harvest conditions favour Fusarium ear infection.

* Poor storage conditions can increase mycotoxin production.

Fusarium is not a true storage disease but contamination of grain can occur pre-harvest and after storage. The recently introduced fungicide tebuconazole (in Silvacur and Folicur) controls the ear disease complex (which includes Fusarium) well.

Fusarium infection of grain can develop in store to produce mycotoxins. Human poisoning due to mycotoxins in bread is virtually unknown in modern industrial countries but is possible. More likely is the presence of mycotoxins in feed grain stored and used on farm. Surveys of UK grain have shown that species of Fusarium capable of producing mycotoxins are commonly found on grain. Mycotoxins are relatively common in some years, usually at low levels. The HGCA survey of Fusarium (35) in wheat in 1989/90 confirmed that 25% of the 97 samples tested contained Fusarium mycotoxins, albeit at very low levels. A year with a wetter harvest period could be expected to produce both a higher incidence and higher overall levels.

If grain is not stored correctly, and particularly if moisture levels in grain are too high, mycotoxins can develop after harvest. Thus, disease control in field, harvest conditions and storage can all have significant effects on the levels of mycotoxins in the final product.

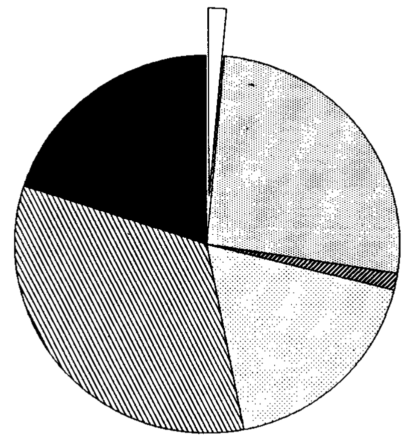
6.7 Set-aside and foliar diseases

The area of land in the UK now occupied by set-aside is in excess of 500,000 ha, and cereal stubble exists on more than half of this area. Volunteer cereals are an established source of some cereal diseases, particularly mildew and the rusts. The rust fungi are dependent on the presence of living plant material throughout the period between harvest and the emergence of the next crop. This 'green bridge' is normally provided by the previous year's stubble where ploughing is carried out late. Thus, an increase in the amount of land carrying volunteers is likely to result in an increased risk of disease spread.

Normally, the risk of disease spread is greatest to crops adjacent to fields carrying volunteers and MAFF-funded surveys of set-aside land and adjacent crops have shown evidence of disease spread to crops adjacent to set-aside land. However, it is likely that disease inoculum levels will increase generally because of the large area of set-aside land which will be carrying volunteers.

7.0. PEST CONTROL

Winter Wheat Variable Costs
Insecticide : £3 per hectare



Scope for savings

* The variable cost savings from omitting insecticides, particularly the pyrethroids, are small.
* The major savings from insecticide use come from avoiding loss of yield.
* The environmental 'savings' can be considerable, and the use of reliable assessment thresholds enable these to be obtained along with any cash saving.
* Use set-aside cultivations to reduce pest risk.
* Earlier sowing reduces the risk from most pests at the expense of a cheap spray against BYDV vectors, and well established crops will suffer less slug and wheat bulb fly damage.
* Use pest thresholds to reduce spray application.
* Use crop changes in the rotation to reduce pests levels.

Points to watch

* Cultivation of set-aside at the wrong times can increase pest risk.
* Changing cropping systems can increase the risk from unexpected pests.
* Reduced rate insecticides and molluscicides may be used, but only where the risk is moderate. Little is saved by reducing the rate of BYDV vector sprays.

Insecticides to control pests should be applied when necessary and where a cost-effective return is probable on the basis of thresholds.

Economies in other inputs which may lead to an increase in pest damage should be avoided. Vigorous crops are more able to withstand pest attack. Cultivations need to be timed appropriately to minimise the impact of 'green bridge' transfer of BYDV, slugs and wheat bulb fly, (36). Cereal stubble regrowths need to be incorporated thoroughly or desiccated to reduce green bridge risks, (37).

Many management practices help reduce pests without additional expense. Early sowing reduces the risk of slug and wheat bulb fly damage, but can increase weed populations. Risks from BYDV will be roughly doubled for each week earlier sowing, but apart from the far south west, sufficient control can still be provided by one well-timed pyrethroid spray, provided that crop are not sown before the middle of September. Sowing seed at least 30mm deep into a firm seed bed will greatly reduce the risks of seed hollowing by slugs. Where slug damage is likely on the basis of history, trap capture, previous cropping, poor seedbed conditions or weather, apply pellets soon after drilling to protect the crop. Delay can result in increased risk of grain hollowing or severing of shoots. If seedbeds are good application can be delayed until after emergence. Careful monitoring of crops and damage can avoid unnecessary applications, (38).

Applications of pyrethroids at reduced rates for control of BYDV vectors is not recommended as efficacy is quickly lost, and the chemicals are cheap. Reduced rate molluscicides are frequently used, when conditions for efficacy are favourable, and the slug risk is moderate. Reductions in the rate of summer aphicides may be appropriate where aphids are increasing slowly above threshold levels and aphid predators and parasites are active in the crop.

7.1 Impact of set-aside

Set-aside land poses some increased risk in allowing build up of pest levels on the farm, but also offers some opportunities for cultural control of pest damage.

Wheat bulb fly levels may be increased where set-aside land is cultivated before the egg laying period in the last week of July and the first three weeks of August. This pest is relatively slow to disperse and needs a suitable egg laying site adjacent to a source field each year to allow damaging populations to be sustained on a farm. Farms with 20% or more of land in first wheats following suitable egg laying situations tend to build-up and maintain damaging populations as a source field tends to be adjacent to a suitable egg laying site every year. In addition to bare land after early harvested crops such as vining peas, wheat bulb fly also lays eggs on bare soil between row crops such as potatoes, sugar beet and onions. The introduction of 15% bare summer fallow into farms growing less than 20% of first wheats, but with an intermittent wheat bulb fly problem could rapidly increase the levels of this pest. On farms with a lower percentage of first wheats, the pest will be at very low levels initially and it will take several years before the pest can reach damaging levels.

The attractiveness of bare fallow as an egg laying site depends on the roughness of the tilth and when the field was last worked. Working fields to a rough tilth during the egg laying period can greatly increase the risk.

Table 8. *Effects of cultivation on the incidence of wheat bulb fly.*

Treatment	Risk Rating
Plough (May) Power harrow (July/August)	1 **High**
Plough (May), Power harrow (July/August) Plough (September)	2
Plough (May)	3
Plough, power harrow and roll (May)	4
Plough, power harrow and roll (May) Sow cover crop of mustard (May) Shallow cultivations (September)	5
Plough, power harrow and roll (May) Sow cover crop of mustard (May) Plough (September)	6
Allow natural regeneration, mow every 4 weeks Pre-drilling cultivations (September)	7 **Low**

Recent MAFF funded work on wheat bulb fly on set-aside has produced the risk rating shown above (39).

Levels of wheat bulb fly can be reduced by exploiting this knowledge. Fields worked to a rough tilth in the first week of August for oats or non-cereal crops attract flies and draw them away from fields where crops at risk will be sown.

Slug damage may be increased after set-aside where cultivations are left until close to harvest. Spring and summer cultivation for grass weed control should greatly reduce the risk of slug damage to the following crop.

There is little risk of BYDV aphid vectors flying from one year set-aside to cereal fields in the autumn. In most areas the amount of set-aside land in relation to the area of grass is small. Where fields are ploughed close to drilling time there is a risk of direct `green bridge' transfer of aphids from the ploughed down vegetation to the following cereal. Thorough incorporation will greatly reduce this risk, which can be eliminated by ploughing at least 5 weeks before drilling the following crop on farms where wheat bulb fly is not a significant risk.

One beneficial aspect of set-aside has been its attractiveness to gout flies, an occasional pest. The majority of gout fly eggs are now laid on volunteer plants on set-aside, reducing risks to early sown crops.

8.0 SUMMARY OF SAVINGS

The analysis of the impact of the reforms at the start of this report suggested a £50 per hectare saving should be the required target for savings from revised production methods.

As the various sections have shown, savings are not uniform, nor are they equally achievable by all. Many will already have implemented some of the possible savings and will have to consider savings in other areas, or increased revenue where possible

Listed below are example savings from each of the sections. Where values in the report are small, the figure in the report has been used. Where the values quoted in the report are large with a relatively wide range of savings, figures towards the lower end of those claimed have been quote.

Savings	**£/ha**	**Potential for increased revenue**
Seed		
:Farm-saved	8	Better variety choice
:Reduced seed rate	4	Early OSR after set-aside
		Better establised crops with
Weed control	8	lower seed-bed losses
Fertiliser		
:Modified P&K, buying, applications	10	Savings in field operations
:Break crop residues	5	
:Organic wastes	(5)	
Growth regulators	3	Reliable premiums
Fungicides		
:Matching use to variety / Decision support	20	Savings in field operations
TOTAL SAVINGS	**£58**	(£63 if organic wastes available)

The target savings are likely to be achievable on most farms, although the exact combination of saving is likely to differ from the example above. This is based on the 'typical' hectare of wheat introduced at the start of this report. In addition the significance of the revenue increases should not be discounted. In many instances these may exceed savings.

8.1 Fixed costs

The aim of this report has been to review production methods for cereals; Primarily those involving variable costs.

The fixed costs for cereal enterprises typically make up about two thirds of the total costs, and therefore cannot be overlooked. However many fixed costs may change by responding to changes within the mass of the industry rather than the cereals sector in particular.. Competing on world markets will demand low total costs per tonne (both fixed and variable). To date the most effective way of achieving this has been by increasing yield. Figure 15 shows the effect of reduction in total costs on the break-even yield.

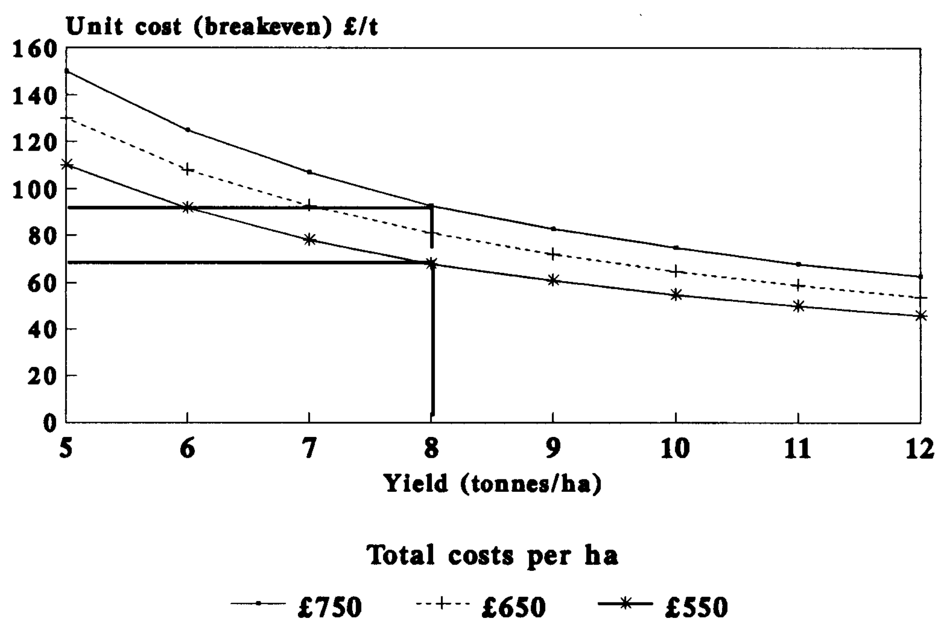


Figure 15. *Fixed costs and yield per hectare; effect on breakeven price per tonne.*

Effective financial and technical managerial skills will be essential to steer businesses successfully through the coming years of inevitable change. UK growers have many assets and are likely to remain competitive world class producers.

REFERENCES

1. B Davies. Reduced Cultivation for cereals. R & D Research Review No. 5 (0052/1/87). £7.50

2. S R Moss. (1990). Seed cycle of *Alopecurus mysuroides* in winter cereals - a quantitative analysis .In Integrated weed management in cereals. *Proceedings of European Weed Research Society,* Helsinki

3. M J Murphy. (1992) Farming in the Eastern Counties 1990/91. Department of Land Economy. University of Cambridge.

4. R J Fenwick. Winter wheat variety/husbandry interaction trials. Variety performance in a range of environmental and cultural situations. R & D Project Report No. 37. (0057/1/87) £5.00

5. NIAB. (1993). Farmers Leaflet No 8. Recommended varieties of cereals 1993.

6. ANON. Official Journal of the EC (1986). Commission Regulation (EEC) No 2281/86 of 22 July 1986 amending Regulation (EEC) No 1908/84 fixing the standard methods for determining the quality of cereals.

7. S E Salmon. Investigations of the causes of seasonal variation and short term changes during storage in breadmaking performance of home-grown wheat. R & D Project Report (0020/1/91). Available 1994.

8. S E Salmon and B G Osborne. Alveograph characteristics and Zeleny Sedimentation volumes of UK wheat varieties grown in the 1992 Recommended List trials. FMBRA. £5.00

9. HGCA.(1993). Zeleny Sedimentation volumes from the 1993 harvest. Weekly Digest 20, No 17.

10. J E E Jenkins, W S Clark and A E Buckle. Fusarium diseases of cereals. R & D Research Review No.4 (0050/1/87). £10

11. D Yarham. Ergot of cereals: a literature review and survey of trade grain. R & D Research Review No. 25. (0001/1/92). £12.

12. D H K Davies. Appropriate rates of herbicide for cereal crops. R & D Project 0049/2/91. Report available 1994.

13. A M Blair and M R Green. (1993). Integrating chemical and mechanical weed control to reduce herbicide use. In: *Proceedings of Brighton Crop Protection Conference - Weeds*. pp 985-990

14. J H Orson. Variability in the control of black-grass with herbicides in winter cereals - harvest years 1987-1989. R & D Project Report No 27. (0045/1/88) £10.00.

15. H M le Baron. (1991).Distribution and seriousness of herbicide resistant weed infestations world-wide. In *Herbicide Resistance in Weeds* and Crops. Eds. J C Casely, G W Cussans, and R K Atkin. Butterworth-Heinmann. London.

16. S R Moss and J C Clarke. (1993). Guidelines for the prevention and control of herbicide resistant black-grass. HGCA/ Weed Resistance Action Group.

17. M A Froment and K A Smith. (1993). Effects of spring slurry on yield, crop lodging and grain nitrogen content in winter wheat. Tests of agrochemicals and cultivars. No 14. 116-117.

18. P M R Dampney (1992). Fertiliser requirements for quality wheat grain production. In *Proceedings of second HGCA cereals R & D conference*. Robinson College, Cambridge.

19. S E Salmon. (1992). The relationship between crop nutrition and breadmaking quality. In *Proceedings of second HGCA cereals R & D conference*. Robinson College, Cambridge.

20. J R Garstang, J Vaughan, and C J Dyer. (1993). The effects of soils type and nitrogen on the quality of autumn sown malting barley. R & D Project Report No 70. (0026/3/87). £7.50.

21. P W Arnold and M A Shepherd. Phosphorous and potassium requirements of cereals. R & D Research Review No.16. (0083/1/87). £10.00.

22. Soil and fertiliser sulphur in the UK. The Fertiliser Society Proceedings No 264.

23. S P McGrath. Development of sulphur deficiency in cereal growing regions of the UK, its consequences for cereal yield and quality, and response of cereals to sulphur fertilisers. R & D Project Report 0051/1/91. Report Available 1996

24. M A Froment and J P Grylls. (1992). Changes in soil mineral nitrogen during set-aside and the effect of rotational fallows on the yield and N-optima of subsequent cereal crops. In *Set-aside,* J Clarke, Ed. BCPC Monograph No 50.

25. D L Easson, E M White and S J Pickles. A study of lodging in cereals. R & D Project Report No.52. (0040/1/87). £10.00

26. J R Garstang. (1993). The effect of volunteers on cereal quality and profitability. *Aspects of Applied Biology* 35, *Volunteer Crops as Weeds*, pp 67-74.

28. M J Adams and S A Hill. Soil-borne mosaic viruses of cereals: the UK situation. (Free leaflet)

29 HGCA. Theme Review - Diseases (1993).

30. R J Cook. Winter wheat: fungicide evaluation, timing and interaction with varieties. R & D Project Report 0009/1/90 A-F. Available 1994

31. HGCA/MAFF/Bayer LINK project; Decision models for integrated use of fungicides in wheat. Project No 0066/1/91

32. W S Clark. (1993). Exploiting variety/fungicide interactions. In *Proceedings of third HGCA cereals R&D conference*, Robinson College, Cambridge.

33. MAFF. R&D Project Winter Barley: Response of varieties to different fungicide regimes. (R 204-002).

34. D W Hollomon. Monitoring and forecasting fungicide resistance in rhynchosporium. R & D Project Report No.59, (0011/3/87). £3.

35. R W Polley, J A Turner, V Cockerell, J Robb, K A Scudamore, M F Sanders and N Magan. Survey of Fusarium species infecting winter wheat in England, Wales and Scotland, 1989 and 1990. R & D Project Report No. 39. (0005/1/89). £12.

36. J E B Young. Control of wheat bulb fly in winter wheat I. Chemical methods, II. Varietal susceptibility. R & D Project Report. (0053/2/87).£10.00

37. J N Oakley, S D Wratten, A F G Dixon and N Carter. The biology and control of cereal aphids. R & D Research Review No. 10 (0073/1/87). £7.50.

38. D Glen. Slug forecasting in cereals. R & D Project Report (0010/1/87). £4.00

39. J E B Young. Cultural control of wheat bulb fly in set-aside fallow. MAFF Research Project SA 0107. (Interim results in High time to tackle the fly. S Henley, Crops Vol 11. 14)

40. MAFF.(1993). Arable Area payments. Explanatory Booklets I & II . London.

41. HGCA. (1993). Intervention standards 1993/94. Marketing Note (Supplement to Weekly Bulletin 28, 3 (3). London.

42. MAFF. (1992) Agricultural Price Indices. London.

43. I Sturgess. (1991). The economic implications of GATT - world-wide, in Europe and for the United Kingdom. Paper given to annual joint conference of Cambridgeshire and Suffolk CMA. January 1991.

44. HGCA. (1993). EC Cereal Intervention Review, Weekly Digest 19. No. 49.

45. HGCA. (1993). Cereal Statistics, 1992. . London.

APPENDIX

PRODUCTION METHODS FOR CEREALS WITHIN THE REFORMED CAP

1. Background to changes and policy.

The Common Agricultural Policy (CAP) has long been one of the cornerstones of the European Community (EC). However, mounting pressure on the Community's budget from dealing with over production, either through intervention storage or through subsidised export, has lead to the current set of reforms being introduced. Their initial effect will to increase expenditure on agricultural support that is directed at producers rather than products. In the intermediate and long term pressure on budgets would seem likely to reduce this support.

The main overall objectives of the reforms are to control production and to allow the price of products to fall towards more competitive levels in relation to world markets. If achieved, these will reduce the total cost of intervention in the community, and the subsidy paid when EC's surplus produce is exported on to the world market.

To compensate for the drop in prices and production restraints, growers are offered an arable aid scheme based on areas of eligible crops (currently cereals, oilseeds and pulses) they grow, in exchange for setting aside a specific percentage of their eligible crop area, (40). Details of the payments are shown in Table 1a.

In addition to the area aid scheme, the reform also includes the cessation of processing subsidies on oilseeds and pulses and a reduction in intervention over the transition period.

The set-aside requirement is set, at present, at 15% for rotational set-aside. Non-rotational set-aside has been fixed throughout the Community at 20%, a 5% higher rate to make up for the fact that poorer land may be set-aside over the non-rotational period, which has initially been set at 5 years. Those member states where 13% or more of the eligible base area has been taken out of production have been able to apply a lower rate of 18%. The UK will operate the 18% rate, and is the only country eligible to do so. The UK differs from the other EC countries in having a high percentage of large farms eligible for the 'main' scheme. This 18% rate will, however, be reviewed after 2 years to ensure appropriate reductions in production are being achieved.

In many EC countries, the majority of farmers will opt for the 'small farm' simplified scheme. Producers with an area of land that would produce less than 92 tonnes of grain can obtain cereal area payments without the need to set-aside land, and similarly those who choose not to participate in the main scheme will only be eligible for payments on the area equivalent to their first 92 tonnes of production.

Area payments are linked with yield through the regional yields shown in Table 1 via the calculation.

Regional Yield (t/ha) x ecu/t = Area payment (ecu/ha)

The area payment rates are then fixed by the prevailing green £ exchange rate on July 1 preceding the relevant harvest and marketing season. The base areas used to derive this information are derived from 1989, '90 and '91 census data, and the yields from the average of 1986-1991, excluding the maximum and minimum yields during that period.

Under both rotational and non-rotational set-aside, individual farms are not operating under any direct production controls. These are applied on a regional basis in relation to the regional base area. However, the EC has implemented the Integrated Administration and Control System (IACS) throughout the Community to monitor the effectiveness of the reforms, and if production base areas are exceeded by the total areas claimed then area payments are reduced and additional set-aside is required in the following year.

It is worth remembering that area aid and set-aside payments are fixed on July 1 of each year. This can provide useful stability to the business. Intervention prices however, will vary continuously each year as the £/ecu exchange rate varies, so knowledge of currency changes as well as the grain market will be useful information when planning a selling strategy.

Variable cost savings and improvements in yield can, to some extent, offset the reduced output resulting from set-aside. However, in some situations it is unlikely that this will fully recoup lost profit, and some adjustment to fixed costs will be necessary.

The CAP reforms have become interlinked with the changes negotiated as part of the settlement of the General Agreement on Tariffs and Trade (GATT). Although these trade negotiations started in 1986, their somewhat protracted nature caused them to be interlinked with the more recent CAP reform. This interlinking is discussed in section 1.2

Since the announcement of the CAP reform package the UK has withdrawn sterling from the relative stability of the Exchange Rate Mechanism (ERM) of the European Monetary System. This has lead to an increased volatility in the £ sterling exchange rate. As part of the single European market a new agrimonetary system was introduced on January 1 1993. This allowed this volatility to be reflected in regularly changing area and set-aside payments, until they were finally fixed on July 1 1993. Further pressure on currencies in the ERM this summer caused the introduction of a 15% wide currency band in August for the all currencies within the ERM.

The payment rates set on July 1 for the 1992/93 crops are shown in Table 1. The values for 1994 and 1995 harvested crops will be fixed on 1 July 1994 and 1995 respectively.

Table 1a. *Area payments for cereals and set-aside - marketing years 1993/94, 1994/95 and 1995/96.*

(As at July 1 1993 exchange rate £0.948645/ecu for 93/94 payments). Following years use current exchange rate £0.920969/ecu (Variable to be fixed July 1 of relevant year)

		Area payments			**Set-aside**	
	Regional base yield	**1993/94**	**1994/95**	**1995/96**	**1993/94**	**1994/95**
England	5.93	140.64	191.15	245.76	253.15	311.30
Wales	4.65	110.28	149.89	192.71	198.51	244.10
Scotland	5.65	134.00	*182.12*	*234.16*	*241.19*	*296.60*
Scotland LFA	4.81	114.07	155.05	199.34	205.34	252.50
N. Ireland	4.71	111.70	151.82	195.20	201.07	247.25

(LFA = Less favoured area)

(1995/96 Set-aside payments same as 1994/95)

Lowland Scotland exceeded its base area during 1993. Future payments will change from these original values.

Along with the introduction of these payments, the type and quality of cereals eligible for intervention have been changed. The feed wheats, which tend to be the highest yielding, are at present excluded from direct intervention. Common (bread-making) wheat and barley are both eligible for intervention along with rye at the same buying-in price. Unlike the area and set-aside payments, which are fixed for the marketing year on July 1 before harvest starts in the UK, the intervention price alters with each change in the green £ exchange rate as well as with the monthly increments. In addition, these changes take place against a reducing price per tonne over the 3-year transition period. These were fixed in ecu per tonne at approximately 117, 108 and 100 for the marketing years 1993/94, 94/95 and 95/96 respectively and represented prices of £107, £99 and £92 per tonne. However because of the changes resulting from the EMS realignment these have been reduced to 115.49, 106.60 and 98.71 ecu/tonne or £116.36, £98.17, and £90.90 per tonne at the current exchange rate of £0.920969/ecu .

If a strong pound reduces margins growers must look to extra income from increased yields and where possible, from premia for bread wheat or malting barley. Wheats that fail to meet the common wheat standards would appear to be most vulnerable to low prices. However, feed wheat will be eligible for intervention if Zeleny test results (protein sedimentation test based on white flour) exceed 30 ml, or if they fall between 20-30 ml, and machinablity tests prove positive, (41). Also, an as yet undefined support regime has been proposed, should feed wheat prices fall below barley prices sufficiently to be a significant factor in distorting trade.

2. Immediate impact of CAP reform

Table 2a shows the effects of the reform package on the gross margin of one hectare of a 'typical' crop of common wheat sold into Intervention in November, exclusive of transport cost. The crop is assumed to have produced 7 tonnes per hectare, and was sold into intervention at opening in November 1992 at £120 per tonne.

Table 2a. Effect of CAP reform , and exchange rates on the gross margin £ of a hectare of 'typical' wheat with 15%, 18% or 20% hectares set-aside

	Crop harvested			
15% set-aside Option no. (see below)	1992	1993	1994	1995
1	640	647	655	658
2	640	628	631	634
3	640	608	606	609
18% set-aside				
1	640	634*	643	647
2	640	615	620	623
3	640	595	594	598
20% set-aside#				
1	640	624*	636	639
2	640	606	612	615
3	640	587	588	591

* not applicable since only 15% set-aside in 1992/93

not yet in use in UK

Option:

1. All calculations at 1 ecu =0.948645, the July 1 rate.
2. Only 1993 area and set-aside payments at 0.948645, the remainder at the current (0.920969) rate.
3. As 2 but with the current rate revalued by 6% from the July rate

The figures in Table 2a have been calculated on the assumption that the 18% non-rotational set-aside is on land of the same yield potential as the 15% rotational set-aside. This is probably over simplistic in that land chosen for seaside for several seasons will be likely to be lower yielding. If the set-aside land is 10% lower yielding, the lost output is 6.3 tonnes per hectare, and the 82% remaining land is slightly higher yielding at 7.15 tonnes (overall mean 7 tonnes). The gross margins from all the 18% set-aside options are then the same as the 15% set-aside gross margins

There are many possible combinations that must be assessed in individual circumstances. The differences in possible margins in 1992 would alter the comparisons in Table 2a, as would future currency fluctuations. Producers will only opt for 18% and 20% set-aside if the savings from poorer, awkward shaped or distant fields offsets the lower margins.

If the pound strengthens by 6% over the July 1993 rate, gross margins for the 1995 crop will be £31, £42 and £49 per hectare lower from 15%, 18% and 20% set-aside respectively. By contrast if the pound were devalued by 6%, gross margins would be £68, £55 and £46 higher per hectare from these rates of set-aside on the 1995 crop). If French proposals had been implemented to increase area payments in 1995/96 to the same level as that shown in Table 1 for set-aside (£311.30), all the gross margins for the final year of reform would be higher than the starting level of £640, except those in option 3 which would be virtually neutral. However in the longer term the proposal would have increased pressure for further cuts in CAP expenditure, and in due course lead to pressure for further cuts.

Although devaluation looks attractive many inputs would increase in price and high variable costs would erode some of the benefits. Figure 1a shows how input costs, particularly agrochemicals and machinery, have risen since 1985, (42).

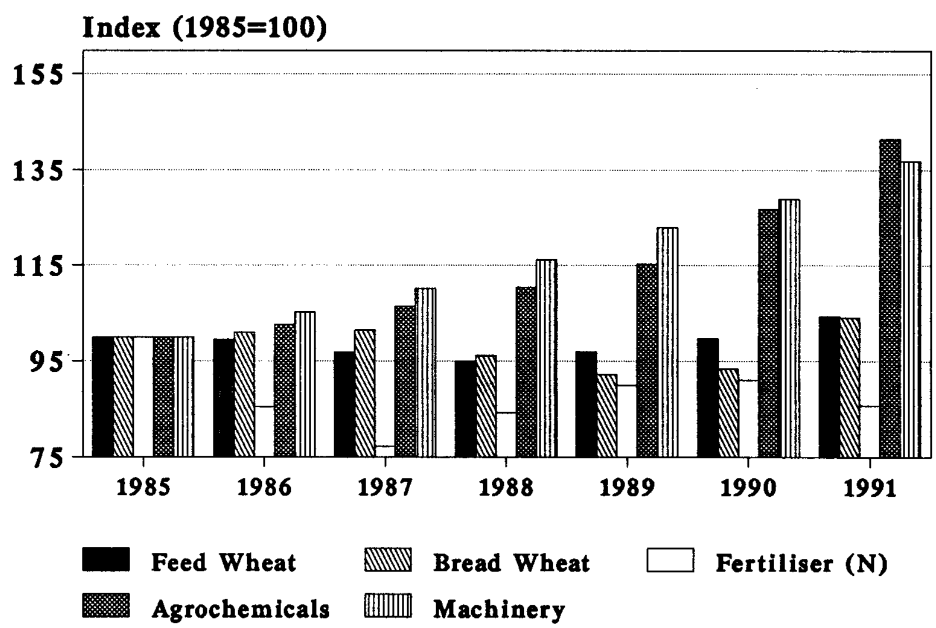


Figure 1a. *Price indices 1985-1992 : Producer and purchase prices (wheat)*

It is reasonable to assume therefore, that a 5% increase in input costs over the next 2 years is probable.

There were extensive discussions throughout the industry whether to adopt set-aside, or to stick with full production on 100% of the cropping area when the new regime was first introduced. The conclusion reached, irrespective of exchange rate, is that the main scheme is attractive for all but the smaller producer.

Appendix

Farmers with only small areas of cereals (and other eligible crops) have to decide whether to opt in or out of the main scheme. Table 3 shows the net effect of opting for the simplified scheme on areas of eligible crop from 20 to 30 hectares with gross margins from £450 to £650 per hectare.

Table 3a. *The effect on total farm gross margin of opting for the simplified scheme as affected by gross margins produced from land that would otherwise be set-aside*

Eligible cereal area grown (ha)	Gross margin of set-aside area without area aid (£/ha)				
1992/93 Set-aside	450	500	550	600	650
20	382	532	682	832	982
22	202	367	532	697	862
24	22	202	382	562	742
26	-158	37	232	427	622
28	-338	-128	82	292	502
30	-519	-294	-69	156	381
1995/96 Set-aside					
20	12	162	312	462	612
22	-380	-215	-50	115	280
24	-771	-591	-411	-231	-51
26	-1163	-966	-773	-578	-383
18	1554	-1344	-1344	-924	-714
30	-1946	-1721	-1496	-1271	-1046

[Margins exclude direct costs of cultivation, harvesting etc.]

The values relate to the English regime and the 1993 and 1995 crops, but with the July 1 exchange rate of £0.948645/ecu. The calculations will vary with exchange rate, set-aside rate gross margin. The higher the gross margin of the crop, the greater the area justified in the simplified scheme. But as the area and set-aside payments increase so the amount warranted for inclusion in the simplified scheme decreases.

This report assumes that £50 per hectare is the approximate level of savings that will be necessary, for both rotational and non-rotational set-aside.

3. CAP and GATT

Both the CAP reform and the settlement of GATT entail proposed reductions in either supported production and/or subsidised export volumes. As the two packages have ended up with attempts to resolve them almost simultaneously, there has been an element of confusion amongst those not closely involved, as to what these reduction would involve in the long term.

In addition, if the current levels of protection for agriculture are reduced multilaterally under further GATT settlements, production could be discouraged in both importing and exporting countries, and as supply and demand come into line world prices may rise. By how much is complex to estimate, but an increase in wheat prices of around 25% has been suggested, with a marked reduction in price variability of temperate products (43). Coarse grains like barley and maize would be affected far less. With reduction in output from competitors, decreased production costs, increases in world market prices and less variability, exports, as in the 1980's and early 90's, could in the future once again support production. If set-aside rates are increased to 20% or more, the reductions in the UK's total production potential could loose any benefits from multilateral reductions in protectionism, because we would be unable to regularly produce sufficient volumes to maintain export markets. Although this report addresses the possible reductions in production costs bought about by CAP reform, the areas and savings considered are equally applicable in reducing costs to export competitively in the absence of substantial export refunds.

To date it appears that as a result of set-aside and poorer weather, overall cereal production may be reduced by 10-12% in the UK, and 6-8% over the rest of the EC. However the higher yields from 1993 as compared with the 1992 harvest mean that the 10-12% reduction should be based on the mean of several previous seasons, rather than the disappointing 22 million tonne 1992 production.

Alongside these reductions in production resulting from the EC set-aside policy, the Blair House agreement reached last November between the EC and the United States as part of the GATT settlement, involves a 21% reduction in subsidised export volumes and a 36% reduction in tariffs. However, it is the EC that is party to this agreement, not the individual member states, and it is exports from the community that are involved. The intra-community exports which make up a substantial part of UK exports are, in theory, unaffected. Nevertheless, a 21% reduction in subsidised export volumes going outside the EC, but only an overall internal reduction in output due to set-aside, of say 8-10% within the EC, will result in intense competition for the intercommunity export trade. This situation is made all the more difficult with the record 29 million tonnes of intervention stocks in community stores at the end of May 1993, (43).

Whilst the longer term aim of GATT is for Western Europe to reduce net grain exports and Japan to increase net imports, the immediate future is less clear. The above outline shows there are considerable stocks to be disposed of, and appropriations of 3.4 billion ecu to support exports over the forthcoming season bear this out. This is an increase of 11% on 1992.

In addition to export refunds, area and set-aside payments will have to be paid over the same period as stocks are being reduced. These are going to put enormous pressures on the EC agricultural budget over the next few years, and these are coinciding with recession in many member states.

With this scenario in mind it is worth reiterating the increased need to control both variable and fixed costs to become competitive under CAP reform and currency changes. Increasing output to make up for production foregone through set-aside makes CAP reform less effective and more costly. Although set-aside payments have recently been increased, the above situation suggests adverse adjustments could easily be precipitated by any one of a large number of financial pressures.

4. Industry statistics

When considering how to adapt business in the wake of CAP reform, it is worth a brief look at the structure of UK cereal production, and how it is positioned in the world cereal industry as a whole.

The output and value of UK cereal production is shown in Table 4.

Table 4a. Output and value of UK cereals in 1991/92 (July/June year)

	Grain marketed	Grain used on farm	Total
Quantity (million t.)			
Wheat	12.97	1.40 (10%)*	14.37
Barley	5.18	2.45 (32%)	7.63
Oats	0.34	0.19 (36%)	0.53
Total	18.49	4.03	22.52
Value (£ million)			
Wheat	1527.9	161.3 (9.5%)	1689.1
Barley	602.2	263.1 (30.4%)	867.3
Oats	37.5	20.1 (34.9%)	57.6
Total	167.5	444.5	2612.0

* Percent of total

Domestic usage: wheat 10.625 million t. Barley 5.900 million t.,
Intervention stocks: wheat 0.010 million t., barley 0.760 million t.)
Total production of mixed corn, rye, triticale and other cereals 0.120 million tonnes (45).

The average wheat yield in Great Britain in 1991 was 7.25 t/ha (MAFF 1992), whilst the world average yield of wheat in the year 1991/92 was 2.45 t/ha (USDA). In the 1991/92 season 4.775 million tonnes of wheat and 1.870 million tonnes of barley were exported in the 1991/92 season. It seems unlikely that these levels of exports will be able to be maintained over the near future at present production costs.

However the £770 million of UK cereal exports in 1991/92, 37% went outside the EC and required export refunds at a net cost to the EC budget.

5. Impact of set-aside

The role of set-aside is to reduce production so the costs of storage and exporting are reduced. Coincidentally this also helps to meet the GATT requirements for reduction in subsidised export volumes.

If yield increases are possible, losses from set-aside can be made up by greater volumes of grain sales. MAFF funded R&D suggests rotational set-aside has an almost neutral effect on yield, producing yield improvements about half those expected from most break crops. Yield improvements therefore have to come from improved crop management. Furthermore, the failure of set-aside generally to achieve the production control required may lead to greater areas to be set-aside, and changes in the support payments.

Most businesses will probably be able to maintain profitability through a mix of marginal increases in production, reductions in variable costs that optimise yields, and adjustments to operations and fixed costs that will arise from the reduced area of tillage and enhanced efficiency of operation. Non-rotational set-aside appears to offer more opportunities for the last item, but much will depend on the individual structure of each business.