

ADAS/CSL RESEARCH AND DEVELOPMENT

Winter wheat: a survey of diseases

- 1997 -

A survey to determine the incidence and severity of winter wheat diseases
in England and Wales

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Abstract

In 1997, 367 randomly selected fields of winter wheat were sampled and assessed for the incidence and severity of disease in a survey undertaken jointly by CSL and ADAS. The fields were identified using a farm list stratified by the area of wheat grown in each region. Samples were taken in July when crops were at the milky-ripe growth stage (GS 73-75). Mildew affected 0.2% area of leaf 2, the lowest level since 1995, which was the lowest since the survey began in 1970. *Septoria tritici* was again the most severe foliar disease at 3.1% area of the second leaf, and was at a higher level than in 1996 (2.1%). *Septoria nodorum* was present at 0.3% area of the second leaf and at trace levels on the ears. In no region did the level of mildew exceed 0.3% of the area of leaf 2. Brown rust was recorded only at trace levels on leaf 2 on samples from the north the east and Wales. Yellow rust was recorded on the ears at trace levels for the first time since 1992 and affected 0.1% of leaf 1, the highest levels since 1990.

Levels of eyespot, at 14.2% stems affected with moderate and severe symptoms, were higher than any survey since 1988 (15.1%). Sharp eyespot levels at 4.2% stems affected by moderate and severe symptoms were higher than the recorded 2.5 % stems in 1996 but lower than 4.6% in 1995. The Fusarium complex affected 28.9% of stem bases. Fusarium ear blight and glume spot affected 8.6% of ears, the highest level since 1993. Take-all was present in 18% of crops and patches recorded in 2.8% of crops. Symptoms of BYDV were recorded in 7% of crops, levels similar to 1996.

Riband was the most commonly sampled cultivar at 22% of crops, a position it held for the seventh successive year, followed by Brigadier (21%) and Consort (11%). Buster carried the highest levels of mildew (0.4% area of leaf 2), Hussar the highest levels of *S. tritici* (4.5% area of leaf 2), Hunter the highest levels of *S. nodorum* (1.2% area of leaf 2) and Rialto the highest levels of yellow rust (0.2% area leaf 2).

Levels of eyespot were lowest following grass and sharp eyespot following wheat. Moderate and severe levels of fusarium stem base diseases were highest following other cereals. Take-all levels were lowest following pulse or potatoes, but most severe following set-aside. Monoculture had little effect on levels of either fusarium or sharp eyespot, but eyespot levels tended to be highest following a second or third wheat and take-all most severe in a second wheat.

S. tritici was most severe in crops drilled in mid-October and mildew in crops drilled after October. Eyespot and fusarium were most severe in crops drilled before October and sharp eyespot most severe in crops drilled in mid-October. Take-all was least severe in crops drilled after the end of October.

Fungicide sprays were used on 97% of the crops sampled, with 83% receiving two or more treatments. The most popular regime, applied to 23% of crops, was a two-spray programme

with the first spray applied at GS 31 followed by a second spray at GS 39. Twenty eight per cent of crops received a three-spray programme. The most popular being the first spray at GS 31, followed by GS 39 and 59, applied to 19% of crops. Crops received on average 2.2 fungicide spray applications, the same as 1995 and 1996. Fungicides from the strobilurin group were recorded for the first time. Seventeen crops were treated, receiving 21 applications of which 15 contained the active ingredient kresoxim-methyl and 6 azoxystrobin. The average percentage green leaf area of crops treated with azoxystrobin increased compared with the national figure, the flag leaf by 1.7% and the second leaf by 5.6%. Seventy nine per cent of crops were grown from certified seed with 98% of crops sown with fungicide treated seed. Disease levels are those recorded after 97% of crops have received at least one fungicide spray and represent the level of uncontrolled disease. These figures may reflect the efficacy of fungicide programmes and good or poor disease resistance. A total of 304 insecticide products were applied, 64% in the autumn, 20% from the spring to GS 37 and 14% from GS 38 to 75.

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Introduction

Plant pathologists at the Central Science Laboratory (CSL) and ADAS have conducted annual disease surveys of winter wheat crops since 1970 with the exception of 1983 and 1984. There is a continuing need to monitor crops in order to detect changes in the disease spectrum. These changes may be caused by the introduction of new cultivars with differing disease susceptibilities and by changes in husbandry practice and pesticide use.

This report contains the results of the survey of foliar, stem base and ear diseases of winter wheat for the 1996-1997 growing season.

The results, where appropriate, are compared with those from previous winter wheat surveys.

Methods

The 1997 survey of leaf, ear and stem-base diseases of winter wheat was carried out in late June to July when crops were at the early- to medium-milk growth stage (GS 73-75). A list of farm addresses was sent to ADAS staff responsible for collecting samples in the nine regional areas (Table 1). The distribution of addresses between regions was proportional to the regional area of winter wheat grown, except for Wales where additional addresses were requested in order to obtain meaningful figures for the area. The addresses were selected at random from the returns of the June 1996 MAFF agricultural census. A list of the counties within each region is given in Table 1.

Table 1. Key to regions referred to in the survey

Code	Region	County	ADAS Centre (previous centre in brackets)
NO(N)	North	Cleveland, Cumbria, Northumberland, Durham, N. Yorks (Northallerton), Tyne & Wear	High Mowthorpe (Newcastle)
NO(L)	North	Humberside, N. Yorks (Harrogate), S. Yorks, W. Yorks (Leeds)	High Mowthorpe (Leeds)
M&W	West Mids & East Mids	Cheshire, Derbyshire, Notts, Leics, Hereford & Worcester, Gr Manchester, Lancs., Merseyside, Shropshire, Staffordshire, Warwickshire, West Midlands.	Wolverhampton
EAST	East	Bedfordshire, Cambridgeshire Northants, Essex, Hertfordshire, Lincolnshire, Norfolk, Suffolk, Gr London (Eastern)	Boxworth, Kirton, Terrington, Arthur Rickwood (Cambridge)
SE(W)	South-East	Kent, Surrey, E. Sussex W. Sussex, Gr London (SE)	Arthur Rickwood (Wye)
SE(R)	South-East	Berkshire, Buckinghamshire Hampshire, Oxfordshire	Bridgets (Reading)
SW(B)	South-West	Avon, Dorset, Gloucestershire, Somerset, Wiltshire	Starcross (Bristol)
SW(S)	South-West	Cornwall, Devon	Starcross (Starcross)
Wales	Wales	All Welsh Counties	Pwllpeiran (Cardiff, Trawsgoed)

NOTE:- All figures for regional areas in the tables are means of the total number of samples assessed from those areas. All national figures are the mean of a stratified sample, within which the number of samples from each region is proportional to the area of winter wheat grown in the region.

Farms were visited by ADAS consultants at GS 73-75 when the dry matter of the grain is accumulating most rapidly. On each farm, a field was selected at random and a sample of 50 fertile tillers was collected at random from a diagonal traverse of the field. The samples were packed in polythene bags and dispatched immediately to CSL for assessment accompanied by a completed questionnaire giving agronomic details such as cultivar, sowing date and previous cropping, as well as details of all pesticide applications.

Sub-samples of 25 tillers were assessed on arrival at CSL. Leaf diseases were recorded as the percentage area of the flag and second leaves affected using standard area keys (Anon., 1976). Green leaf area and insect damage were similarly recorded.

Eyespot and sharp eyespot

Eyespot and sharp eyespot were recorded as the percentage of tillers affected in three categories:- slight, moderate and severe, after the method of Scott & Hollins (1974) below:

<i>slight</i>	lesions girdling less than half the circumference of the stem.
<i>moderate</i>	lesions girdling more than half the circumference of the stem.
<i>severe</i>	lesions girdling more than half the circumference of the stem, and tissue softened so that lodging would readily occur.

$$\text{Eyespot index} = \frac{\text{No. stems } \textit{slight} + 2(\text{No. stems } \textit{moderate}) + 3(\text{No. stems } \textit{severe})}{\text{Total number of stems in sample}} \times \frac{100}{3}$$

Take-all

Take-all was assessed in the field at the time of sampling using the following key:

<i>Category</i>	<i>Description</i>
0	no take-all seen
1	a scatter of plants showing premature ripening
2	occasional small patches (less than 5m across) showing premature ripening and/or stunting - less than 1% of field affected
3	many small or few large areas affected - 1% to 10% of field affected
4	many large areas affected - more than 10% of field area affected

(Examine the roots of a sample of plants showing symptoms to confirm the presence of blackening normally associated with take-all.)

Barley yellow dwarf virus

Barley yellow dwarf virus (BYDV) was assessed in the field at the time of sampling using the following key:

0	no BYDV seen
1	a scatter of plants showing BYDV symptoms (leaves, chlorotic with a bronze red extending downwards from their tips).
2	occasional small patches (less than 5m across) showing BYDV symptoms.
3	many small or a few large areas affected (1% to 10% of field area affected).
4	many large areas affected (more than 10% of field area affected).

Fusarium

The percentage of stems with slight, moderate and severe fusarium symptoms on the nodes and internodes was also recorded using the key shown below:

<i>Score</i>	<i>Nodes</i>	<i>Internodes</i>
00	no infection.	no infection.
01	"	slight streaks on stem base.
02	"	general browning on stem base.
03	"	stem base rotted - likely to cause lodging.
10	staining on one or more nodes but not covering the whole circumference of the stem.	no infection.
11	"	slight streaks on stem base.
12	"	general browning on stem base.
13	"	stem base rotted - likely to cause lodging.
20	staining on one or more nodes covering whole circumference of the stem.	no infection.
21	"	slight streaks on stem base.
22	"	general browning on stem base.
23	"	stem base rotted - likely to cause lodging.
30	one or more nodes rotted - likely to cause lodging.	no infection.
31	"	slight streaks on stem base.
32	"	general browning on stem base.
33	"	stem base rotted - likely to cause lodging.

Disease categories:

nodal: slight = 10,11,12,13 moderate = 20,21,22,23 severe = 30,31,32,33
internodal: slight = 01,11,21,31 moderate = 02,12,22,32 severe = 03,13,23,33

Combined categories (nodal + internodal):

slight = 01,10,11 moderate = 02,12,20,21,22 severe = 03,13,23,30,31,32,33

Fungicides

Tables providing information on fungicide use list the types of fungicides and their principal times of application. Throughout these tables, fungicides are grouped according to their mode of action using the following convention:

- MBC - any product or mixture containing one or more of the following:
benomyl, carbendazim
- DMI - any product or mixture containing one or more of the following:
bromuconazole, cyproconazole, epoxiconazole, difenoconazole,
fenbuconazole, flusilazole, flutriafol, prochloraz, propiconazole,
tebuconazole, triadimefon, triadimenol
- Morpholine - any product or mixture containing one or more of the following:
fenpropidin, fenpropimorph, tridemorph
- Strobilurin - any product or mixture containing one or more of the following:
azoxystrobin, kresoxim-methyl

Results and discussion

Selected data for the key diseases are presented in the following histograms, together with data from the previous four years to set the current results in context. The term disease incidence means either the percentage of crops, plants or stems affected; whereas disease severity refers to the percentage area of leaf or stems covered by disease symptoms. Data have not been subjected to statistical analysis.

A total of 451 samples were received and processed at CSL. The size of the stratified sample used to calculate national means was 367 (Table 2).

Table 2. Distribution of winter wheat in England and Wales and survey sample

Region	Area	ADAS Centre	% of area (1996 census)	No. of samples processed
NO(N)	North	High Mowthorpe	7.1	30
NO(L)	North	High Mowthorpe	10.8	47
M & W	E & W	Mids. Rosemaund	15.7	68
EAST	East	Boxworth, Terrington, Arthur Rickwood	42.3	174
SE(W)	S. East	Athur Rickwood	5.4	23
SE(R)	S. East	Bridgets	8.2	36
SW(B)	S. West	Starcross	8.4	35
SW(S)	S. West	Starcross	1.5	6
WALES	Wales	Trawsgoed	0.7	32
Total			100	451

The samples processed were taken from 3788 ha of winter wheat.

Severity of foliar and stem disease

Three diseases, mildew, *Septoria nodorum* and *S. tritici* were present at levels at more than 0.1% area leaf 2 affected (Fig. 1). Yellow rust and *Didymella* were present at only trace levels. Total foliar disease was higher than in the previous three years.

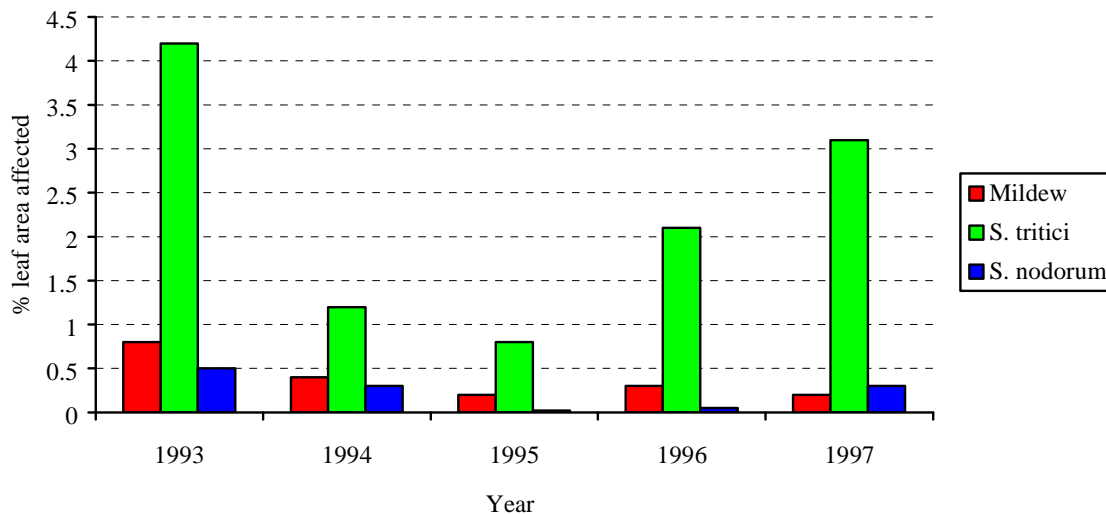


Fig. 1 National foliar disease levels (mean % area leaf 2 affected)

Eyespot was present in 89% of crops. Moderate and severe infections were higher than the previous three years (Fig. 2).

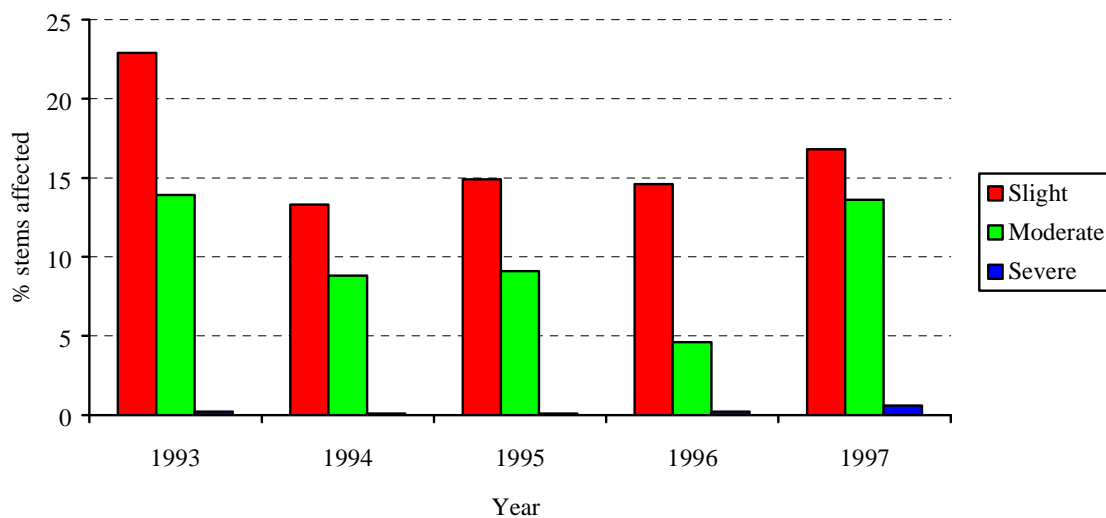


Fig. 2 National levels of eyespot (mean % stems affected)

Sharp eyespot was present in 60% of crops. Moderate and severe levels were higher compared with 1996 (Fig. 3).

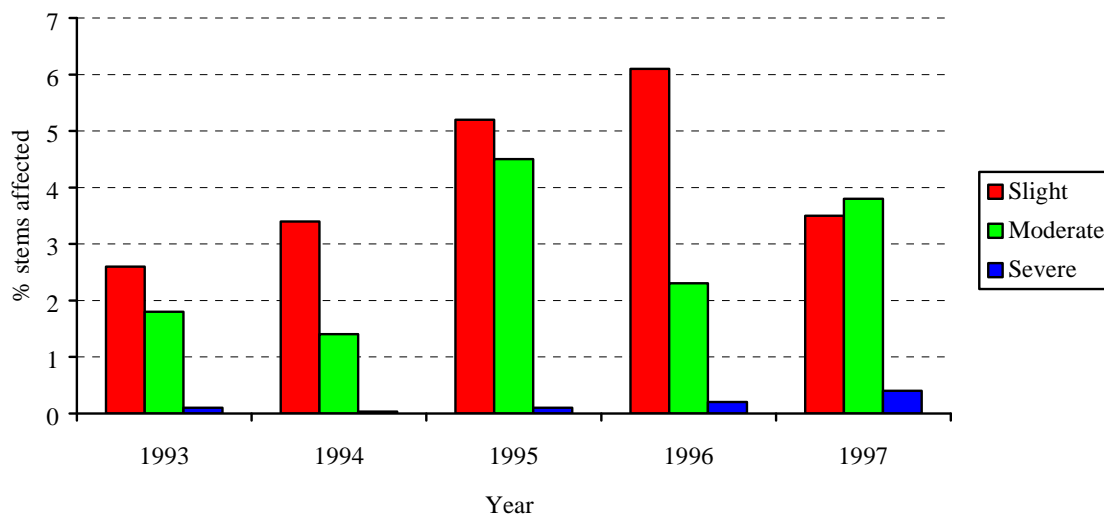


Fig. 3 National levels of sharp eyespot (mean % stems affected)

Stem base fusarium levels affected 29% of stems. Levels of fusarium ear blight and glume spot were higher than in any survey since 1993 (Fig. 4).

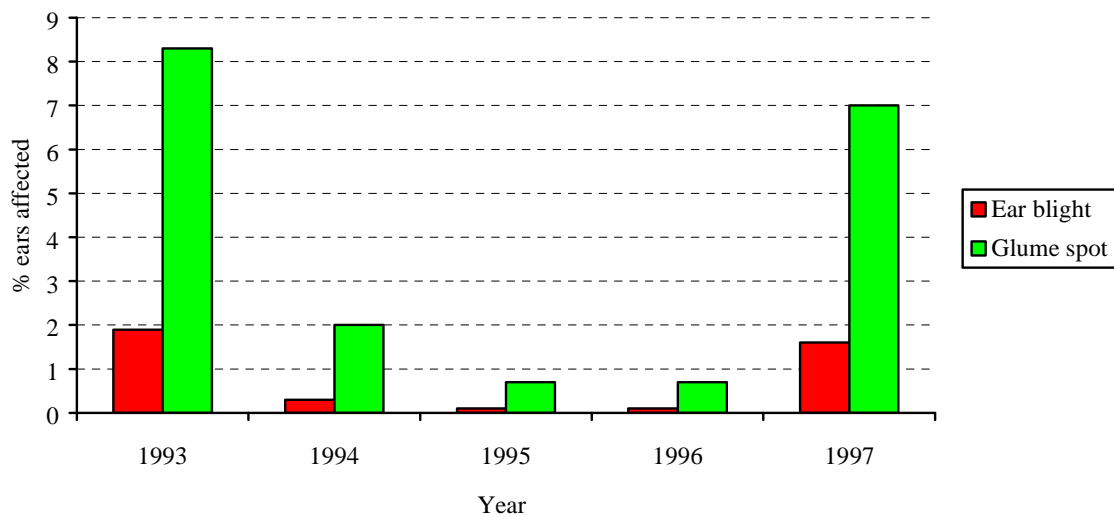


Fig. 4 National levels of fusarium on the ears (% ears affected)

The incidence of take-all was higher than in 1996 but the severity was lower, with only 3% of crops showing patches of the disease compared with 4% and 6% in the previous two surveys (Fig 5).

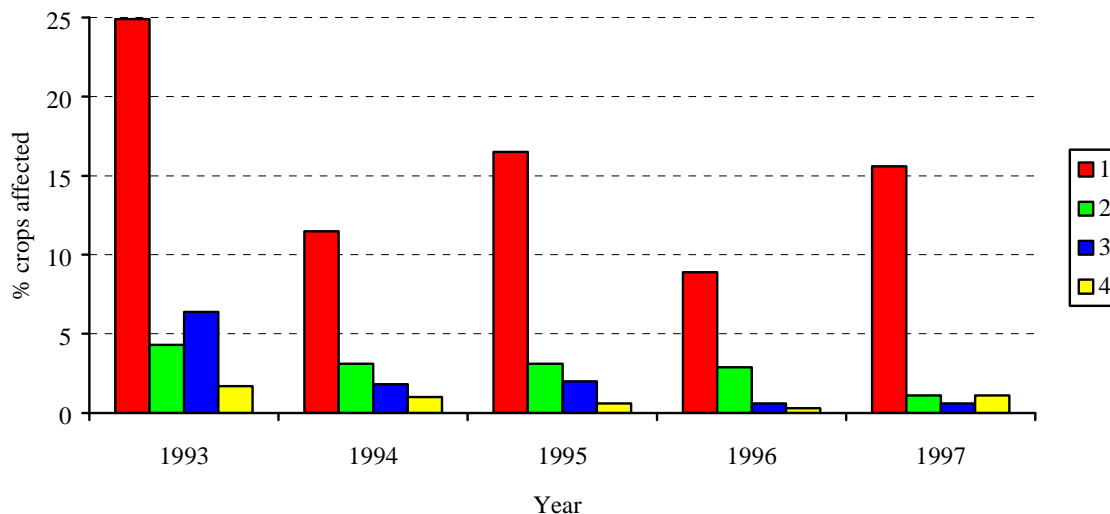


Fig. 5 National levels of take-all (% crops in each category)

The incidence and severity of BYDV was similar to 1996 and lower than in the previous three years, with only 2% crops showing patches (Fig. 6).

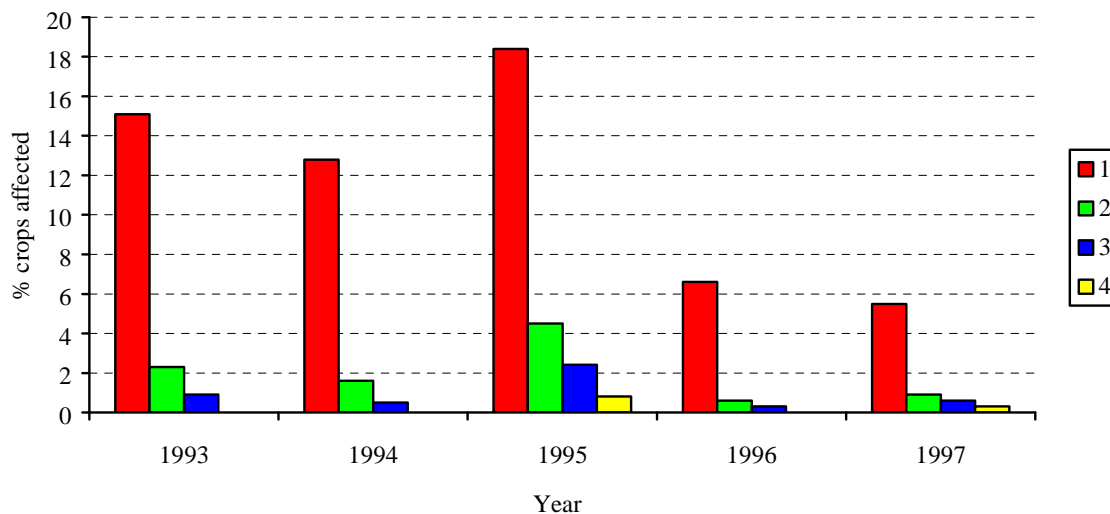


Fig. 6 National levels of BYDV (% crops in each category)

Regional disease incidence

The dominant disease was *S. tritici*, with the highest levels occurring in the South West (Starcross). The highest levels of *S. nodorum* were also recorded in the South West (Starcross). The lowest levels of *S. tritici* were recorded in the South East (Reading). Mildew was recorded at less than 0.4% on leaf 2 in all regions (Fig. 7). Yellow rust was recorded at trace levels in all regions except the South West (Starcross) where it was not found and in Wales at 0.1% area of leaf 2. Yellow rust, particularly on Brigadier, was reported as being widespread and severe in a number of areas. These concerns were not reflected in the survey. The survey, being random may miss local and prominent occurrences. Crops are sampled at a growth stage when the disease has been controlled by fungicide programmes and may no longer evident on the leaf. Brown rust was recorded only at trace levels on leaf 2 in samples from the East, North (Leeds) and Wales.

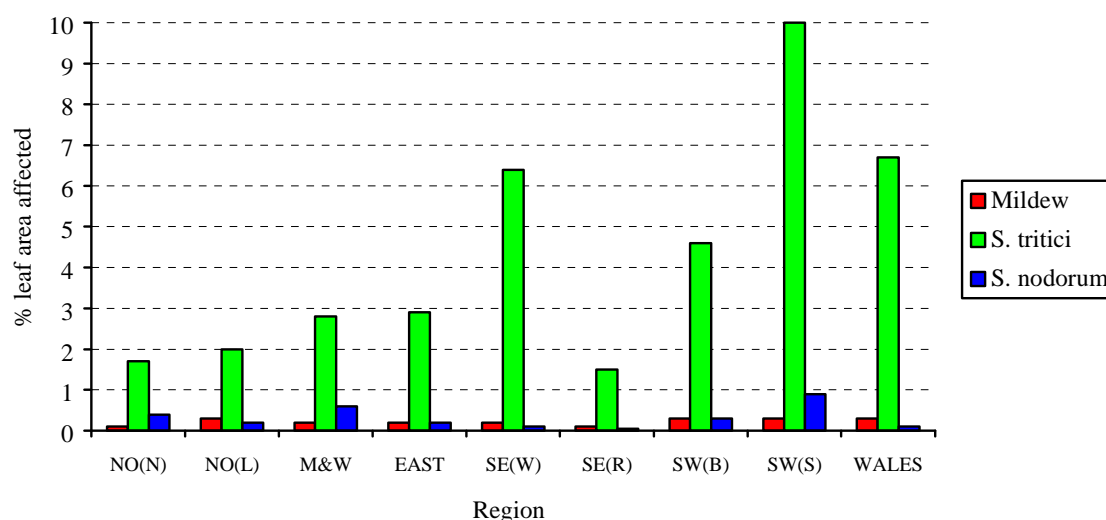


Fig. 7 Regional foliar diseases levels (mean % area leaf 2)

Eyespot was generally more severe on samples from the North (Fig. 8).

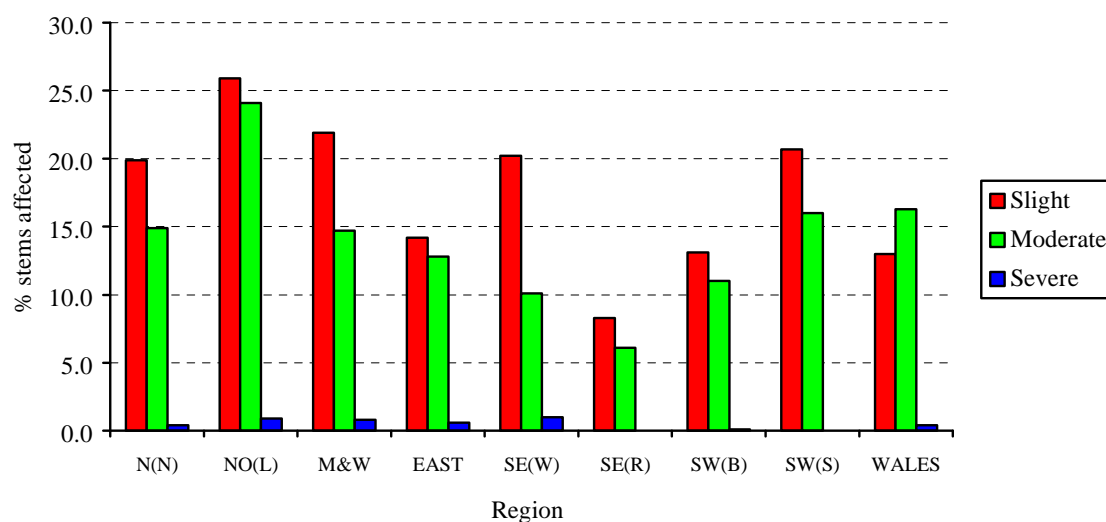


Fig. 8 Regional eyespot levels (mean % stems affected)

Sharp eyespot was most common in Wales and the South West, with the lowest levels being recorded in samples from the East and North (Fig. 9).

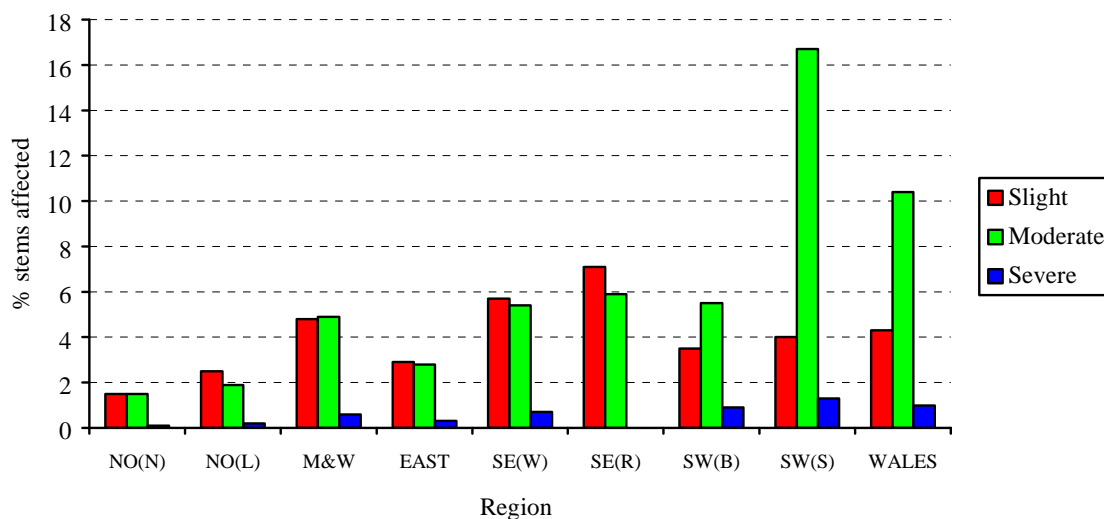


Fig. 9 Regional levels of sharp eyespot (mean % stems affected)

Effect of cultivar in disease severity

Riband was the most commonly sampled cultivar at 22% of crops, a position it has held for the seventh successive year, followed by Brigadier (21%) and Consort (11%). Buster carried the highest levels of mildew (0.4% area of leaf 2), Hussar the highest levels of *S. tritici* (4.5% area of leaf 2), Hunter the highest levels of *S. nodorum* (1.2% area of leaf 2) (Fig. 10) and Rialto the highest levels of yellow rust (0.2% area leaf 2).

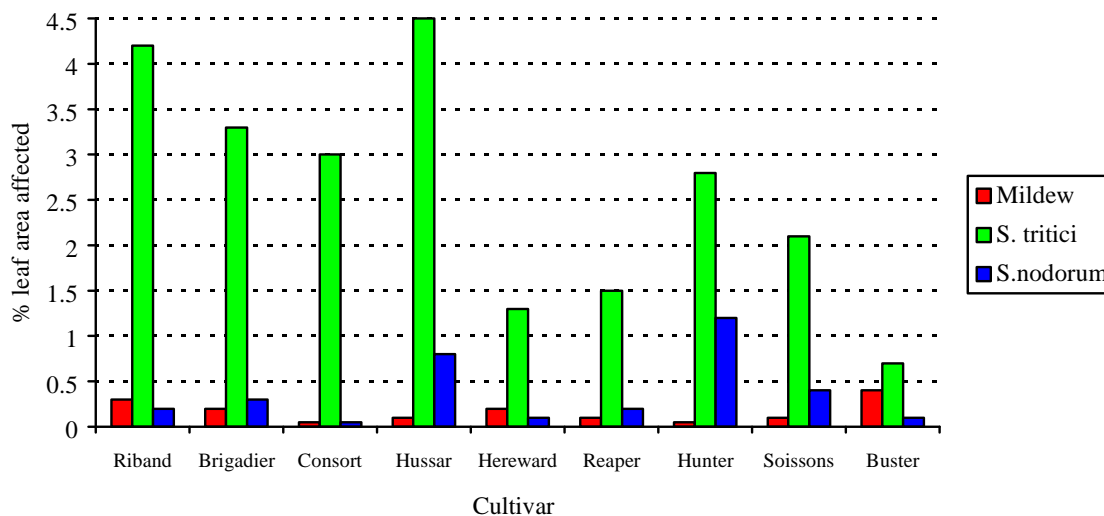


Fig. 10 Foliar diseases on main cultivars (mean % area leaf 2)

Fungicide use

The majority of crops were sprayed at GS 31 (77%) followed by GS 39 (67%) and at GS 59 onwards (55%) (Fig. 11). This year there has been an increase of 11% of the proportion of crops sprayed at GS 59 onwards. This is possibly a reflection of the wet June either resulting in difficulty in spraying crops at this stage or a greater perceived risk of ear disease.

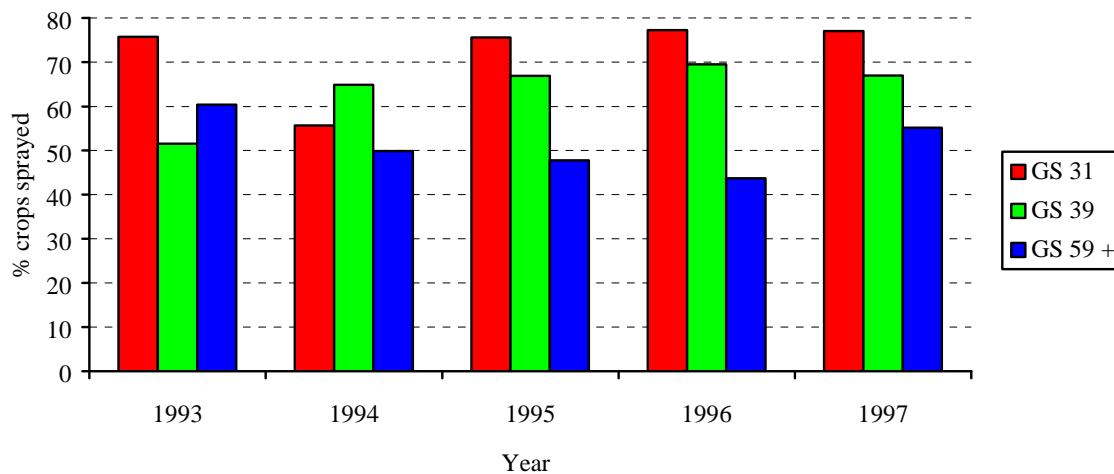
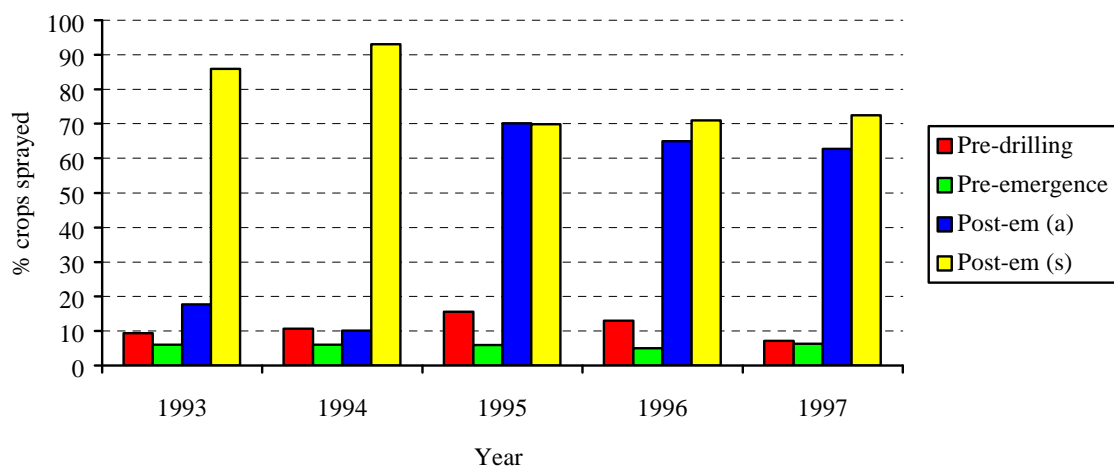


Fig. 11 Per cent crops sprayed at GS 31, GS 39 and at GS 59 onwards

Herbicide use

The majority of crops received a herbicide in the spring (73%) (Fig. 12). There has been a dramatic increase in the number of crops sprayed with a post-emergence herbicide in the autumn since 1994, following the wet autumns of 1992 and 1993 which restricted autumn treatment.



[Post em(a) post-emergence in the autumn, Post-em (s) - post-emergence in the spring]

Fig. 12 Timing of herbicide applications (% crops sprayed)

Insecticide use

The majority of crops treated with an insecticide received a spray in the autumn for the control of aphids (Fig. 13). Overall there was a slight decrease in the number of crops treated in the autumn and summer months although crops treated in the spring increased by 4%.

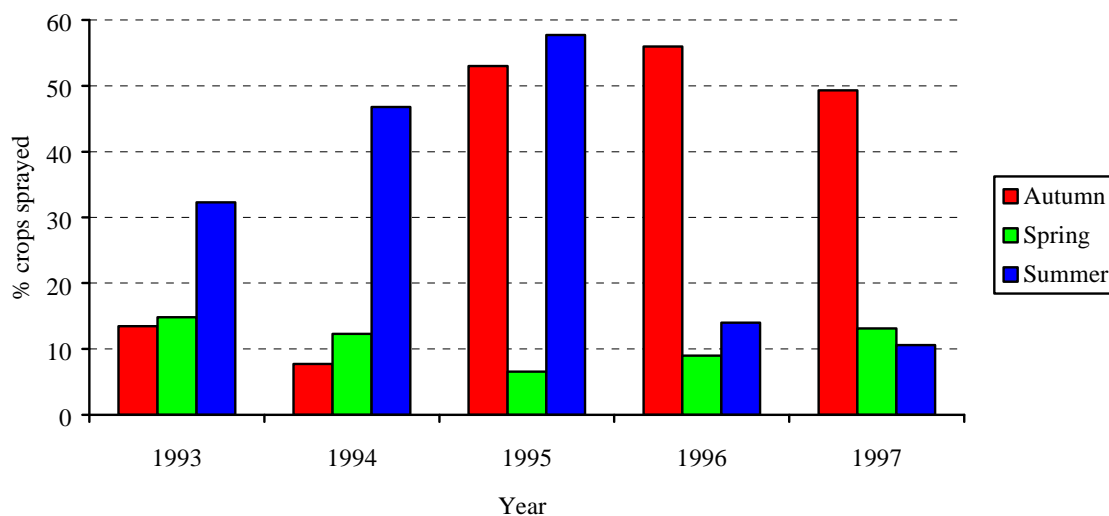


Fig. 13 Percentage crops treated with an insecticide in autumn, spring or summer

There were slightly fewer patches of BYDV infected plants in crops which had received an application of pyrethroids in the autumn (Fig. 14).

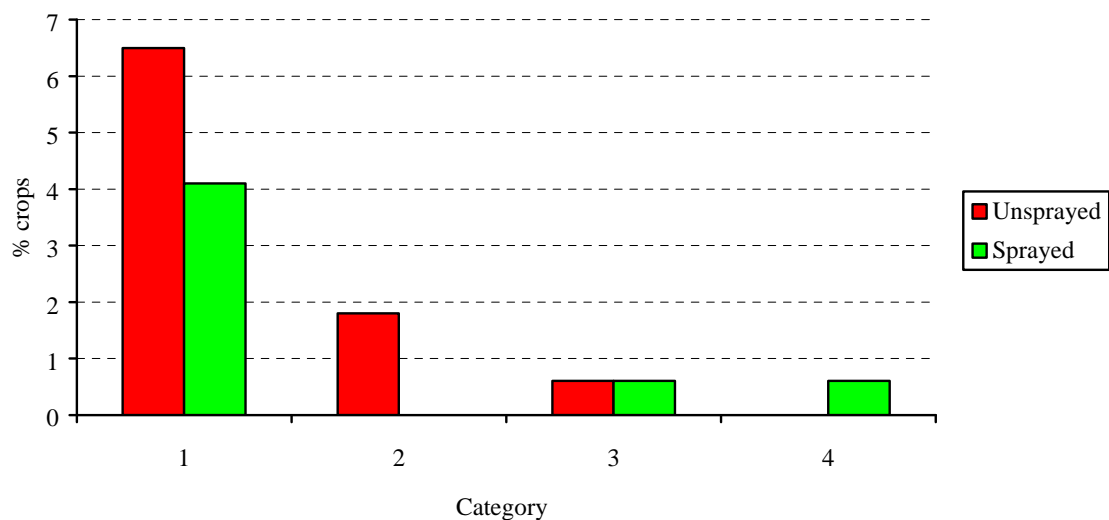


Fig. 14 Effect of pyrethroids applied in the autumn on BYDV

Drilling dates

The majority of crops were drilled at the beginning of October (35%). Only 13% were drilled after the middle of October (Fig. 15).

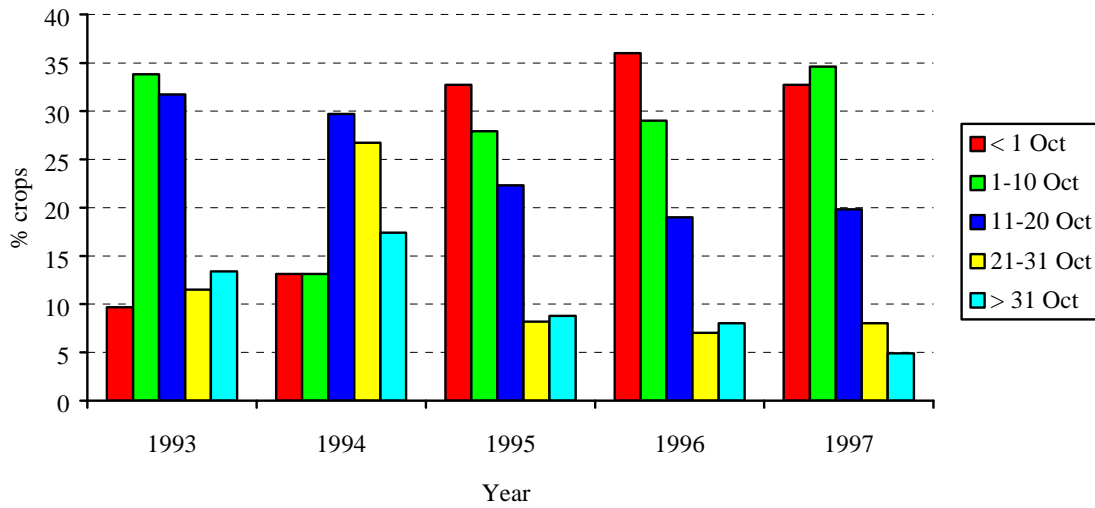


Fig. 15 Drilling dates for crops

Conclusions

1. Foliar diseases were more severe than in 1996. *Septoria tritici* was the most common foliar disease for the seventh consecutive year, occurring in 92% of crops and affecting on average 3.1% of the second leaf. The disease was most damaging in the South West (Starcross) where 10.0% of leaf 2 was affected.
2. *S. nodorum* was at its highest level since 1994, being fairly widespread except in the South East (Reading) region. It was found in similar proportions 43% of crop samples, affecting on average 0.3% of leaf 2 compared with 1994. The highest level was recorded in the South West (Starcross) where 0.9% of leaf 2 was affected.
3. Mildew was recorded in 55% of crops, affecting only 0.2% of leaf 2, a figure similar to 1995 which was the lowest of any survey year. The highest levels were recorded in the North (Leeds) the South West and Wales.
4. Brown rust was recorded in only 0.8% of crops, affecting less than 0.1% of leaf 2. It was not present in samples from the South West regions.
5. Yellow rust was more widespread than in the previous two surveys it was recorded in all regions except South West (Starcross).
6. Eyespot was recorded in 89% of samples. Both incidence and severity levels were higher than those recorded in any survey since 1992, with 14.2% of stem bases having moderate and severe symptoms. Levels were highest in the North (Leeds).
7. Sharp eyespot was recorded in 60% of samples a slight decrease compared to 1996. Moderate and severe symptoms totalled 4.2% stems affected. The disease was most severe in the South West (Starcross).
8. Stem base fusarium symptoms were recorded in 94% of samples, the severity of nodal symptoms was the highest since the 1992 survey with moderate symptoms affecting 10.2% of stems. Moderate internodal symptoms affected 2.7% of stems compared with 1.1% in the previous survey. Severe symptoms of brown foot rot affected only 0.2% of stems. Ear blight was recorded on 21.8% of samples with 1.6% of ears affected, the highest figure since 1993 when ear blight affected 1.9% of ears and 17.1% of samples. Glume spot symptoms affected 62.7% of samples an increase of 52.1% compared with the 1996 survey.

9. Take-all was seen in 18% of crops, 5% more than in 1996. Only 2.8% of crops had take-all patches, fewer than in any previous year. Take-all patches were most common in the North (Newcastle).
10. BYDV was less prevalent than in 1996 or 1995, being recorded in only 7% of crops. Patches of plants with BYDV symptoms were seen in 1.8% of crops compared with 1% in the previous year and 8% in 1995.
11. Riband maintained its position as the most popular cultivar for the seventh consecutive year, accounting for 22% of the stratified sample followed by Brigadier at 21% of crops. In comparison with the 1996 survey proportionally the percentages of the most popular cultivars fell except for Hussar and Consort. Reaper at 7.4% was the sixth most popular cultivar increasing by 6.3% from 1996. Buster also appeared among the nine most popular cultivars for the first time, with 3.3% of crops surveyed.
12. As in 1996 the highest level of *S. tritici* was recorded on Hussar. Buster carried the lowest level of *S. tritici* and the highest level of mildew and Hunter the highest level of *S. nodorum*. From the main cultivars the highest incidence of yellow rust occurred in crops of Soissons with 12.5% of samples affected at trace levels. The highest severity, although only at low levels, was recorded on Brigadier 0.1% of leaf 2. Compared with Riband, Brigadier received slightly more fungicide sprays, 2.57 sprays per crop compared to 2.29, possibly reflecting the rust outbreak.
13. Fifty per cent of the crops in the stratified survey followed a cereal crop with 43% of fields having been in wheat in the previous season. As in past surveys levels of eyespot were lower in crops following grass. Levels of sharp eyespot were lower in crops following wheat and take-all was least severe in crops following potatoes, for the fourth successive year, or pulse.
14. Eyespot was less severe in first year wheat crops than in second or subsequent wheat crops. Take-all was most severe in second wheat crops.
15. Good autumn drilling conditions resulted in a high proportion of early-drilled crops, with one crop in August and 32% being sown during September and 82% being drilled before mid-October. *S. tritici* was less severe in crops drilled after the end of October, as were eyespot, sharp eyespot and take-all. Delayed drilling also showed a reduction in stem base fusarium symptoms.

16. Fungicides were used on 97% of crops, with 83% receiving two or more sprays usually applied at GS 31 followed by further sprays at either GS 39 or GS 59 or both. Forty eight per cent of crops received a two-spray programme with the most popular regime of the first spray at GS 31 followed by a second at GS 39 being applied to 23% of crops. Twenty eight per cent of crops received a three-spray programme. The most popular, applied to 19% of crops, consisted of a first spray at GS 31, followed by a further two sprays at or around GS 39 and GS 59. Crops sampled in the survey received, on average, 2.2 fungicide sprays each.

17. MBC's were applied to 9.2% of crops treated with a fungicide at or around the first node stage (GS 31). They were usually applied with a fungicide from another group either tank-mixed or as part of a commercial product. DMI's were applied to 92% of crops treated with a fungicide at GS 31 and morpholines to 56%.
18. Fungicides in the DMI group were used on almost all the crops (98%) sprayed at or around flag leaf emergence (GS 39). Sixty four per cent of crops were treated with a morpholine at this growth stage and 3% with an MBC.
19. DMI fungicides were applied to 93% of fungicide treated crops from ear emergence onwards (>GS 59). Morpholines were applied to 38% of crops treated during this period, and 24% with MBC's.
20. Members of the new strobilurin fungicide group were applied to 17 (4.6%) crops in the stratified sample. 76% received a single spray; 6 sprays were targeted at GS 59, 5 sprays at GS 39 and one each at GS 31 and after GS 71. Of the 4 crops which received two sprays 3 received applications at GS 31 and GS 39 and the other at GS 31 and GS 59. All crops sprayed at GS 31 were treated with the product containing fenpropimorph and kresoxim-methyl applied with a fungicide from the conazole group. Only 4 crops received sprays of the branded products not tank mixed with another fungicide. The most popular strobilurin was kresoxim-methyl with fenpropimorph being a component of 15 sprays. Azoxystrobin was applied 6 times, 4 times singly and twice in a mixture with a conazole. The average green leaf area of crops where azoxystrobin was applied was greater than the national figure. Green leaf area of the flag leaf increased by 1.7% and the second leaf by 5.6%.
21. A total of 1432 fungicide products were applied to the crops in the survey with ai's totaling 1941. There were 135 different foliar applied products and 23 different active ingredients. At GS 31 the most widely used active ingredients were fenpropidin and chlorothalonil; at GS 39 fenpropidin, epoxiconazole and chlorothalonil and at GS 59

tebuconazole and fenpropidin. Overall fenpropidin was the most common active ingredient being a constituent of 34% of sprays.

22. Seventy nine per cent of crops in the survey were grown from certified seed and 21% from farm-saved seed, with 98% of all crops grown from fungicide treated seed. The most popular product was Sibutol (bitertanol plus fuberidazole).
23. Pre-drilling herbicides, mainly glyphosate, were applied to 7% of the fields included in the stratified survey, and pre-emergence herbicides were used on 6% of crops. Tri-allate and isoproturon were the most commonly used active ingredients applied pre-emergence.
24. Sixty three per cent of crops received a post-emergence herbicide spray in the autumn, a slight decrease from 1996. Most of the herbicide treatments were composed of two or more active ingredients with isoproturon being the most frequently used, occurring in 92% of all autumn sprayed crops.
25. Seventy three per cent of crops were treated with a herbicide from January onwards. This was the first herbicide treatment for 30% of crops, a slight increase compared to 1996. Fluroxypyr was the most frequently used active ingredient, being included in 41% of crops treated after 1st January. Metsulfuron-methyl was applied to 31% of crops and isoproturon to 25% sprayed at this time.
26. Growth regulators were applied to 76% of crops, a decline of 3% from 1996 the proportions of crops treated once, twice or three times remained the same. The market was dominated by products containing chlormequat, with 97% of crops treated at least once with these products. Of treated crops 83% received a growth regulator generally applied between GS 29 and GS 32, 15% received two sprays with 51% having two applications at these growth stages; 34% received a first spray aimed at GS 30 followed by a second at or after GS 37. Imazaquin was applied to 13% of treated crops and trinexapac-ethyl to 9%.
27. Sixty four per cent of crops received an insecticide treatment compared to 67% in 1996 and 77% in 1995. Forty nine per cent of crops received a single insecticide spray, 11% received two sprays and 4% three or more. Seventy seven per cent of treated crops received insecticide applications in the autumn, primarily to control the aphid vectors of BYDV. There was a slightly reduced level of BYDV symptoms in crops receiving an autumn pyrethroid application. Twenty one per cent of treated crops were sprayed in the spring and 17% in the summer. Two crops were treated pre drilling, one following grass

and the other after a second wheat. Five crops were treated prior to emergence four with pyrethroids and one with an organophosphate.

28. From the data presented in this report it may appear that disease levels, particularly mildew are declining annually. It should be noted that the majority of the crops surveyed are treated with the appropriate disease control fungicides. This may reflect the efficacy of fungicide used and the use of resistant cultivars.

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Acknowledgements

We are grateful to the many farmers who co-operated in this survey by allowing samples of their wheat crops to be taken, and by providing details of their cultural operations and pesticide use. We also thank ADAS colleagues for the collection of samples and field information, and the staff of the Central Science Laboratory for undertaking the disease assessments and data processing. Financial support for this work from MAFF is gratefully acknowledged.