HGCA

PROJECT REPORT No. 37

WINTER WHEAT VARIETY/HUSBANDRY INTERACTION TRIALS (VARIETY PERFORMANCE IN A RANGE OF ENVIRONMENTAL AND CULTURAL SITUATIONS)

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WINTER WHEAT VARIETY/HUSBANDRY INTERACTION TRIALS (VARIETY PERFORMANCE IN A RANGE OF ENVIRONMENTAL AND CULTURAL SITUATIONS)

by

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Final report of a three year project at the National Institute of Agricultural Botany, Huntingdon Road, Cambridge, CB3 0LE. The work commenced in September 1987 and was supported by a grant of £13,058 from the Home-Grown Cereals Authority (Project No. 0057/2/87).

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1. INTRODUCTION AND SUMMARY

The importance of being able to determine which varieties perform best under specific environmental and cultural situations has long been recognised by growers and advisers. Many varied environments will be encountered throughout the cereal growing regions of the United Kingdom and it is vital that the most appropriate advice on choice of variety for any particular situation is given in order that a grower can maximise his gross margins. However, whilst this is a desirable objective it has not often been possible to achieve for a number of reasons.

Firstly, there is the lack of a large enough database with which to work. The study of genotype x environment interactions necessitates that a sufficient number of sites be present within any one environment before meaningful results can be obtained. The resources of any one research body up to the present have been insufficient for enough sites to be sampled at any one location. These were the conclusions reached by Mann (1980) and Mann (1982) in his research of genotype x environment interactions in winter wheat and winter barley respectively.

Secondly, no reliable and consistent method of statistical analysis of the data has yet been found which will give an indication of whether observed genotype x environment interactions are real or merely a reflection of experimental error. Although many methods of analysis have been tried, none have been consistently better than the others (Freeman, 1988).

Thirdly, most cereal breeders select varieties which are relatively environmentally stable. Breeding programmes are very expensive and commercial pressures mean that varieties must be widely adaptable to be viable. A variety which is widely adaptable is also more likely to perform better during its trialling period when variety performance is tested at a large number of sites over several seasons (Silvey and Fiddian, 1972).

The need to investigate genotype x environment interactions still exists however and this project was undertaken to determine if any evidence of such interactions could be found.

During the three years of the project, data from 138 trials were investigated. The overall conclusion reached was that currently commercially available wheat varieties are widely adaptable to many different environments and husbandry practices. The only strong evidence found of variety interaction was with the use of fungicides when the differing genetic disease resistances of varieties gave large differences in performance depending on the use or not of fungicides.

Some evidence of the occasional variety interaction with environment or husbandry practice was found but the lack of a suitable statistical technique to analyse the data precluded the assignment of any statistical significances. Further work in this area needs to be undertaken since there is a large amount of data available nationally with which to work.

2. OBJECTIVES

The main objective of the project was to explore the performance of winter wheat varieties in a range of environmental and cultural situations.

Winter wheat was chosen because it is the most important cereal crop grown in the UK and one for which most advice is needed. Most organisations performing cereal variety trials have winter wheat trials and therefore the available database of information is correspondingly greater.

Environmental conditions where variety interactions may be reflected such as regional suitability and soil type, or cultural practices such as rotations, fertiliser applications or yield potential would be explored.

A second objective was to explore statistical methods of data analysis for the interpretation of genotype x environment interactions.

3. METHODS

3.1 Collecting the data

In order to investigate variety performance in a wide range of situations it was necessary to bring together the trial results from as large a range of organisations as possible.

The National Institute of Agricultural Botany (NIAB) has for many years conducted Recommended List trials on the main commercial and promising varieties of winter wheats. Each year these trials are performed at about twenty locations throughout England and Wales and the results form the main database from which the well known Recommended Lists are formulated. These trials are conducted at NIAB regional centres and also at other trial centres by the ADAS in a co-operative exercise. Although this number of trials has been found sufficient to form the basis for an overall assessment of performance as given in the Recommended List it has not been enough to investigate any environmental interactions. Accordingly the NIAB have been co-ordinating additional winter wheat trials in recent years at other locations in order to increase the amount of data available for variety x environment studies. These trials have been conducted at about 15 sites each year using the same varieties as in the Recommended List trials. Unlike Recommended List trials which have split treatments of with or without a comprehensive fungicide treatment, these additional trials are conducted with one treatment only, namely with fungicide applications. This is done in order to minimise any major disease interactions.

In Scotland the Scottish Agricultural College (SAC) perform Recommended List trials in a similar way to NIAB and produce Recommended Lists using the data, whilst in N Ireland the Plant Testing Station at Crossnacreevy also carry out trials for their Recommended List system.

Other organisations conducting variety trials are farmer funded crop centres run by ADAS, the Arable Research Centres, Morley Research Centre, several plant breeders and other commercial organisations with an interest in varieties.

All of the trials run by these various organisations are carried out to a similar protocol and so the aim was to bring together as much data as possible in order to carry out the objectives of the project.

At the outset of the project details were circulated to all relevant organisations, outlining the project and inviting those willing to participate to submit their data at the end of each season. In order

for the data to be of use certain "ground rules" were specified. These were:-

a) Specified "core" varieties must be included in the trials each year. Core varieties were commercially available varieties in the fully or provisionally recommended category of the Recommended List plus candidate varieties for the list in each year. The results for other varieties in the trial, grown at the discretion of the individual organisations, were to be included in the results submitted.

b) Certain items of site data, such as date of sowing, previous cropping, soil type, fertiliser application and other husbandry inputs were required to be submitted.

c) A full analysis of yields was required, including variety mean yield summary, Coefficient of Variation (CV), Least Significant Difference (LSD) and Standard Error (SE).

d) The trials were to be treated with a comprehensive fungicide programme designed to minimise disease infection.

3.2 Investigating new statistical analysis techniques

This work was carried out by the Statistics and Data Processing Department of the NIAB. It involved a literature search to locate any published statistical methods for calculating the significance of variety interaction effects. Methods which appeared to be of use with the type of data collected in this project were further evaluated on a practical basis.

3.3 Using existing methods of data analysis

For some years now Cereals Department of NIAB have been subjecting the data obtained from Recommended List trials to a technique devised and described by Fenwick (1988). This technique involves storing the site data from individual trials in an interrogative database on a microcomputer. Over several years a large enough database has been built up to enable site selection to be made on certain criteria. For example a list of winter wheat trials which were grown as first wheats or all those trials grown on heavy soils can be obtained. The yields from these selected sites can then be analysed to ascertain whether relative variety performance varies between the different environments selected.

This procedure gives a useful picture of variety performances between different environments but it does not allow for any statistical significances to be applied to these differences. The larger the database the better since a small database tends to result in only a few trials being selected for any particular environments, thus increasing the scope for experimental error.

Because of the amount of trial data to be obtained from the project it seemed appropriate to apply this type of analysis as a guide to variety x environment interactions.

4. RESULTS

4.1 Data obtained

During the three years of the project, 1988, 1989 and 1990, results were obtained from a total of 138 acceptable trials. Most of the data received from various organisations throughout the United Kingdom satisfied the criteria for use in the project. A small percentage of the data received during the three years was not used in the project because it did not satisfy the required criteria. A list of the sites used is given in Appendix I and shows various site details including the mean yield of the control varieties at each site. The number of trials received each year was 53 in 1988, 46 in 1989 and 39 in 1990.

The number of varieties at each site varied but always included the prescribed core varieties. The total number of varieties grown during the three years was 64 with the frequency of variety appearances varying from 1 to 138. A list of the varieties grown is given in Appendix II. Of the 64 varieties, 12 made a consistently high appearance in the total number of trials, being on average in 120 of the 138 trials with the range being 85 to 138. The variety Beaver, a recent introduction, was the lowest of these at 85 because it was not in any trials in 1988. However, it has been included in the results of this project since it is an important commercial variety. The variety Hornet made the most appearances at 138.

The site data details from the trials were loaded onto an interrogative database and the yields of all the varieties at every site were also stored.

4.2 Statistical analysis techniques

There are a very large number of published papers concerned with statistical analysis for testing genotype x environment interactions. Useful review papers are Westcott (1986) and Freeman (1988). Several methods have already been explored and are used on a routine basis at NIAB in different situations. Examples of these are the Finlay Wilkinson technique, (Finlay and Wilkinson, 1963), which is used for assessing the sensitivity of varieties to the environment, and standardised residuals which are used for monitoring cereal trials, but also give information about the interaction of varieties with environment. Biplot graphical displays are also used to aid the interpretation of interaction effects (Campbell, 1989; Gabriel, 1971; Kempton, 1984).

It was thought useful in the context of regional recommendations to study the methods propounded by Calinski (Calinski et al, 1987a, 1987b, 1989a and 1989b). These methods are based on a complex model which involves the estimation of many parameters connected with site, region, sites within regions, year and their associated interaction with varieties. This requires a large almost complete data set. In Calinski's original work only 3% of the data was missing and this was confined to only two of the 16 sites missing in two of the four years.

The methods used by Calinski were programmed and verified by using the original data set. Some large variety interactions with region were identified which were statistically significant. Unfortunately these

methods did not work so well with the data collected under this project since the data matrix was not complete (about 10% missing, spread over sites, years and varieties). Further work needs to be done to consider how the technique can be modified so that it can be used in situations where there is incomplete data.

In the short term, the standardised residual technique could be used to look at the interaction of a particular variety with sites and with regions. In order to test the significance of environmental and time interactions with variety, the analysis of variance technique which is already in use for monitoring differences between official and licensed trials, could be used.

4.3 Existing methods

From the 138 useful trials received over the 3 year period the following 12 varieties were identified as being in a large proportion of these trials and also as being currently important commercial varieties for which genotype x environment interactions would be useful.

Apollo	Hornet
Avalon	Mercia
Beaver	Norman
Brock	Pastiche
Galahad	Riband
Haven	Slejpner

The effects of several environmental factors upon the performance of these varieties were investigated. The yield analyses were all computed using the Fitted Constants technique (Patterson, 1978; Patterson, 1982) which allows adjustment for missing data and enables valid comparisons to be made between the mean results for each variety.

In the tables that follow the results have been presented in two ways. Firstly yields have been expressed as a percentage of the mean of the control varieties within each environment. Mean yield of the controls in t/ha, Standard Error (SE), Least Significant Difference (LSD and maximum number of trials are given for each environment. Valid comparisons can be made for variety performance within any environment but relative performance between environments is not directly comparable. The control varieties used in the calculation of the mean yield in every case were:

Apollo
Galahad
Haven
Mercia
Riband

The second method of presenting the results is by ranking the yields of the varieties within each environment. This enables any relative movement to be seen either between varieties within any environment or between environments for any variety. It must be remembered however that a 1% difference in yield (not significant) can alter the ranking by one place. Nevertheless, it is a useful method for picking up major changes in variety performance.

All the data which follows are based on fungicide treated yield results, unless otherwise stated. These results were used in order to negate any variety x disease resistance interaction.

4.3.1 Effect of variety

Since the trial set used in this project was different to that used in the NIAB Recommended List matrix it was first necessary to test how well the results from this data fitted with the existing Recommended List order for varieties.

The relative yields and ranking order of the 12 varieties at the 138 sites over the three years are shown in Table 1.

Table 1: Relative yield and ranking order at all sites over three years

Variety	Yield as % control	Ranking Order
Beaver	106	1
Haven	105	2=
Riband	105	2=
Hornet	100	4=
Apollo	100	4=
Brock	99	6=
Slejpner	99	6=
Norman	97	8
Galahad	95	9=
Mercia	95	9=
Pastiche	90	11
Avalon	89	12
Control yield (t/ha)	8.75	
S.E.	0.50	
L.S.D.	1.4	
No. of sites	138	

The ranking order of the varieties is virtually the same as that in the NIAB Recommended List of winter wheat varieties (1991) and shows that the high yielding feed wheats Beaver, Haven and Riband have performed very well, whilst the bread-making wheats, Mercia, Pastiche and Avalon show a yield deficit compared with feed wheats.

The order of varieties and the relative yield from this investigation are used in all subsequent tables for comparative purposes.

4.3.2 Effect of year

Results for all sites in each of the three years are given in Tables 2 and 3. The variety Beaver was not grown in 1988 therefore no results are presented for that year.

Table 2: Yield as % control at all sites 1988, 89 & 90

Varieties	All sites and years	1988	1989	1990
Beaver	106	*	107	105
Haven	105	103	106	104
Riband	105	105	105	105
Hornet	100	102	99	99
Apollo	100	101	101	97
Brock	99	97	102	102
Slejpner	99	100	99	97
Norman	97	97	98	100
Galahad	95	96	94	98
Mercia	95	94	94	96
Pastiche	90	92	88	88
Avalon	89	90	88	89
Control yield (t/ha)	8.75	8.53	8.85	8.88
S.E. (Average)	0.50	0.90	0.73	1.03
L.S.D.	1.4	2.5	2.0	2.9
No. of sites	138	53	46	39

Table 3: Ranking order at all sites 1988, 89 & 90

Varieties	All sites and years	1988	1989	1990
Beaver	1	*	1	1=
Haven	2=	2	2	3
Riband	2=	1	3	1=
Hornet	4=	3	6=	6
Apollo	4=	4	5	8=
Brock	6=	6=	4	4
Slejpner	6=	5	6=	8=
Norman	8	6=	8	5
Galahad	9=	8	9=	7
Mercia	9=	9	9=	10
Pastiche	11	10	11=	12
Avalon	12	11	11=	11

Yields over the three years were reasonably consistent with 1988 giving the lowest yields and 1990 the highest. As usual there were several variety x year interactions, although the varieties Beaver, Haven and Riband were always the highest yielding varieties. Hornet gave relatively better yields in 1988 than 1989 or 1990. Apollo was disappointing in 1990, whilst Brock had a poor year in 1988. Slejpner's relative performance became progressively poorer over the three years as did that of Pastiche.

These variety x year interactions can be explained by seasonal variations in climate, particularly rainfall, radiation and temperature changes, for which varieties have different adaption abilities.

4.3.3 Effect of country within the United Kingdom

Results in England and Wales, Scotland and N. Ireland are given in Tables 4 and 5. These countries are currently each producing their own Recommended Lists, based on trials within each country. The variety Brock was not grown in Scotland therefore no results are presented.

Table 4: Yield as % control in countries within the UK

Varieties	All UK sites and years	England/Wales	Scotland	N Ireland
Beaver	106	107	103	103
Haven	105	106	104	102
Riband	105	105	105	107
Hornet	100	100	103	99
Apollo	100	100	97	99
Brock	99	99	*	100
Slejpner	99	98	100	99
Norman	97	96	101	100
Galahad	95	95	96	100
Mercia	95	94	98	92
Pastiche	90	90	85	92
Avalon	89	89	93	86
Control yield (t/ha)	8.75	8.76	8.83	8.38
S.E. (Average)	0.50	0.53	1.69	2.56
L.S.D.	1.4	1.5	4.7	7.3
No. of sites	138	114	16	8

Table 5: Ranking order in countries within the UK

Varieties	All UK sites and years	England/Wales	Scotland	N.Ireland
Beaver	1	1	3=	2
Haven	2=	2	2	3
Riband	2=	3	1	1
Hornet	4=	4=	3=	7=
Apollo	4=	4=	8	7=
Brock	6=	6	*	4=
Slejpner	6=	7	6	7=
Norman	8	8	5	4=
Galahad	9=	9	9	4=
Mercia	9=	10	7	10=
Pastiche	11	11	11	10=
Avalon	12	12	10	12

The number of trials within each country varied greatly, from 114 in England and Wales to 16 and 8 in Scotland and N. Ireland respectively and this should be borne in mind in comparing performances across countries.

Yields were marginally higher in Scotland than average but somewhat lower in N. Ireland. The highest yielding variety in England and Wales was Beaver whereas in Scotland and N. Ireland it was Riband. Hornet performed relatively poorer in N. Ireland as did Apollo in Scotland and N. Ireland. Norman in Scotland and Galahad and Norman in N. Ireland did relatively better than in England and Wales. Other varieties gave much the same relative performances across countries.

Differences in performance between the countries in some varieties may be due to climatic variations with Scotland and N. Ireland receiving more rainfall and having later harvests than England and Wales. However, the limited data base in Scotland and N. Ireland may be responsible for some differences.

4.3.4 Effect of region within England and Wales

Results for four regions within England and Wales are given in Tables 6 and 7. The North region is that area north of the Wash up to the England/Scotland border and bounded by the Pennines in the west. The South region is that area south of a line from London to Bristol. The East is that area south of the Wash down to London and east of the Midlands and the West is that area west of, and including, the Midlands, north of Bristol up to the Scottish border and including Wales. A map showing these regions is given in Appendix III.

Table 6: Yield as % control within regions of England and Wales

Varieties	All UK sites and years	All England and Wales sites	England and Wales			
			North	South	East	West
Beaver	106	107	108	108	107	107
Haven	105	106	105	105	106	106
Riband	105	105	106	106	104	106
Hornet	100	100	101	97	101	98
Apollo	100	100	99	99	102	101
Brock	99	99	100	99	99	98
Slejpner	99	98	99	96	100	99
Norman	97	96	96	95	98	95
Galahad	95	95	94	97	94	94
Mercia	95	94	96	93	94	94
Pastiche	90	90	92	88	90	86
Avalon	89	89	89	88	89	86
Control yield (t/ha)	8.75	8.76	9.47	8.06	9.05	8.14
S.E. (Average)	0.50	0.53	1.15	0.94	0.85	1.40
L.S.D.	1.4	1.5	3.2	2.6	2.4	3.9
No. of sites	138	114	28	30	39	17

Table 7: Ranking order within regions of England and Wales

Varieties	All UK sites and years	All England and Wales sites	England and Wales			
			North	South	East	West
Beaver	1	1	1	1	1	1
Haven	2=	2=	3	3	2	2=
Riband	2=	3=	2	2	3	2=
Hornet	4=	4=	4	6=	5	6=
Apollo	4=	4=	6=	4=	4	4
Brock	6=	6	5	4=	7	6=
Slejpner	6=	7	6=	8	6	5
Norman	8	8	8=	9	8	8
Galahad	9=	9	10	6=	9=	9=
Mercia	9=	10	8=	10	9=	9=
Pastiche	11	11	11	11=	11	11=
Avalon	12	12	12	11=	12	11=

Relative variety performance between regions did not vary greatly, with most varieties maintaining similar relationships. Exceptions appeared to be Slejpner, which performed relatively poorly, and Galahad, which performed relatively well, in the South. Yields were highest in the North and lowest in the South, perhaps indicative of the effect of the two dry seasons of 1989 and 1990 where the Southern region was particularly affected.

4.3.5 Effect of region within Scotland

Results from three regions within Scotland are given in Tables 8 and 9. The regions are those corresponding to the boundaries of the three agricultural colleges and are shown on the map in Appendix III. It should be noted that the data are based on few trials, particularly those from the North and West with only 4 and 2 trials respectively. The variety Brock was not grown in Scotland during the three year period, nor was Pastiche in the West region therefore no data are presented.

Table 8: Yield as % control within regions of Scotland

Varieties	All UK sites and years	All Scottish sites	Scotland		
			North	East	West
Beaver	106	103	101	104	101
Haven	105	104	108	104	102
Riband	105	105	102	108	100
Hornet	100	103	102	104	99
Apollo	100	97	98	97	93
Brock	99	*	*	*	*
Slejpner	99	100	99	101	97
Norman	97	101	99	102	100
Galahad	95	96	95	95	104
Mercia	95	98	98	97	100
Pastiche	90	85	87	85	*
Avalon	89	93	95	93	87
Control yield (t/ha)	8.75	8.83	8.61	8.96	8.67
S.E. (Average)	0.50	1.69	3.18	2.19	4.11
L.S.D.	1.4	4.7	9.3	6.2	13.4
No. of sites	138	16	4	10	2

Table 9: Ranking order within regions of Scotland

Varieties	All UK sites and years	All Scottish sites	Scotland		
			North	East	West
Beaver	1	3=	4	2=	3
Haven	2=	2	1	2=	2
Riband	2=	1	2=	1	4=
Hornet	4=	3=	2=	2=	7
Apollo	4=	8	7=	7=	9
Brock	6=	*	*	*	*
Slejpner	6=	6	5=	6	8
Norman	8	5	5=	5	4=
Galahad	9=	9	9=	9	1
Mercia	9=	7	7=	7=	4=
Pastiche	11	11	11	11	*
Avalon	12	10	9=	10	10

The most notable effect is that Beaver was not the top yielding variety in any region of Scotland during the period unlike the situation in England and Wales where it was the highest yielding variety in each region. The highest yielding variety was different in each region, being Haven in the North, Riband in the South, and, unusually, Galahad in the West, although this latter variety was not significantly different in yield from eight of the nine other varieties.

4.3.6 Effect of soil type

Results from different soil types are given in Tables 10 and 11. The types based on soil texture are grouped according to the ADAS soil classification. Organic soils are those containing more than 20% organic matter.

Of the 11 soil types in the classification two were not represented, sands and silty clays, which are at either end of the classification range. The number of trials on certain soil types was limited and hence the data from these should be treated with caution. Yields, as could be expected, were lowest on the sandy soils and highest on the clays.

Table 10: Yield as % control according to soil type

Varieties	All Sites and Years	TEXTURE GROUP	SAND	LIGHT LOAM		LIGHT SILT	MEDIUM LOAM		MED SILT	CLAY		
		TEXTURE CLASS	LOAMY SAND	SANDY LOAM	SANDY SILT LOAM	SILT LOAM	SANDY CLAY LOAM	CLAY LOAM	SILTY CLAY LOAM	SANDY CLAY	CLAY	ORGANIC SOILS
Beaver	106		97	105	113	107	106	107	109	105	104	111
Haven	105		92	106	111	105	104	106	105	102	105	108
Riband	105		106	104	105	104	107	105	106	105	108	100
Hornet	100		97	99	98	101	101	100	99	104	106	105
Apollo	100		104	99	105	101	99	100	99	101	99	99
Brock	99		96	100	97	101	100	97	99	104	101	99
Slejpner	99		90	98	96	97	102	98	96	104	104	107
Norman	97		104	97	95	97	98	99	96	97	101	94
Galahad	95		101	94	90	96	95	95	96	94	96	99
Mercia	95		97	96	89	93	95	95	94	97	92	93
Pastiche	90		86	91	90	90	90	89	89	90	91	88
Avalon	89		92	89	84	90	89	90	87	89	95	88
Control yield (t/ha)	8.75		6.33	8.73	8.39	8.59	9.38	8.74	8.42	10.15	8.92	8.41
S.E. (Average)	0.50		5.21	1.28	4.68	1.68	1.10	1.15	0.98	1.71	2.43	2.38
L.S.D.	1.4		17.0	3.6	14.0	4.7	3.1	3.2	2.7	4.9	7.2	7.6
No. of sites	138		2	30	3	12	23	25	30	5	3	2

Table 11: Ranking order according to soil type

Varieties	All sites and years	TEXTURE GROUP	SAND	LIGHT LOAM		LIGHT SILT	MEDIUM LOAM		MED SILT	CLAY		
		TEXTURE CLASS	LOAMY SAND	SANDY LOAM	SANDY SILT LOAM	SILT LOAM	SANDY CLAY LOAM	CLAY LOAM	SILTY CLAY LOAM	SANDY CLAY	CLAY	ORGANIC SOILS
Beaver	1		5=	2	1	1	2	1	1	1=	4=	1
Haven	2=		9=	1	2	2	3	2	3	6	3	2
Riband	2=		1	3	3=	3	1	3	2	1=	1	5
Hornet	4=		5=	5=	5	4=	5	4=	4=	3=	2	4
Apollo	4=		2=	5=	3=	4=	7	4=	4=	7	8	6=
Brock	6=		8	4	6	4=	6	8	4=	3=	6=	6=
Slejpner	6=		11	7	7	7=	4	7	7=	3=	4=	3
Norman	8		2=	8	8	7=	8	6	7=	8=	6=	9
Galahad	9=		4	10	9=	9	9=	9=	7=	10	9	6=
Mercia	9=		5=	9	11	10	9=	9=	10	8=	11	10
Pastiche	11		12	11	9=	11=	11	12	11	11	12	11
Avalon	12		9=	12	12	11=	12	11	12	12	10	12

Taking into account the variable numbers of trials on each soil type there was not a large interaction between variety and soil type, with most varieties maintaining their relative yield position. There were indications that Apollo performed slightly better on the lighter soils whilst Slejpner did slightly better on the heavier soils. Possibly this was due to the differences in straw height and standing ability.

4.3.7 Effect of rotational position

Results of trials from three rotational positions are given in Tables 12 and 13. First wheats are those where the wheat trial was following a break crop ie any crop other than cereals. Second wheats were those with a cereal, usually winter wheat, as the previous crop and third or more wheats were those with two or more previous cereal crops. It should be noted that only nine of the trials were third or more wheats therefore these data should be treated with caution. The ratio of first to second wheats was approximately 3 to 1.

Table 12: Yield as % control according to rotational position

Varieties	All sites and years	1st wheats	2nd wheats	3rd wheats or more
Beaver	106	106	106	108
Haven	105	105	105	108
Riband	105	106	103	103
Hornet	100	101	97	99
Apollo	100	100	101	100
Brock	99	100	97	96
Slejpner	99	100	96	93
Norman	97	98	96	95
Galahad	95	95	95	95
Mercia	95	94	96	94
Pastiche	90	90	90	87
Avalon	89	90	87	89
Control yield (t/ha)	8.75	8.92	8.57	7.76
S.E. (Average)	0.50	0.61	1.10	1.79
L.S.D.	1.4	1.7	3.1	5.0
No of sites	138	93	27	9

Table 13: Ranking order according to rotational position

Variety	All sites and years	1st Wheats	2nd Wheats	3rd Wheats or more
Beaver	1	1=	1	1=
Haven	2=	3	2	1=
Riband	2=	1=	3	3
Hornet	4=	4	5=	5
Apollo	4=	5=	4	4
Brock	6=	5=	5=	6
Slejpner	6=	5=	7=	10
Norman	8	8	7=	7=
Galahad	9=	9	10	7=
Mercia	9=	10	7=	9
Pastiche	11	11=	11	12
Avalon	12	11=	12	11

As is usual yield levels were reduced with each move away from the break, by approximately half a tonne per hectare, indicating the value of a break in maintaining high yields.

There was very little varietal interaction with rotational position but since the principal cause of any effect would be eyespot susceptibility this would have been negated by the fungicide treatment. Arguably the dry years of 1989 and 1990 did not produce good conditions for root stem base diseases to cause maximum problems. Brock and Slejpner appear to perform relatively better as first wheats than second or third. In the case of Brock experience has shown this is because of susceptibility to take-all.

4.3.8 Effect of yield level

Results from sites of different yield levels are given in Tables 14 and 15. Sites have been classified as those yielding less than 6 t/ha, increasing by 1 t/ha up to those yielding more than 11 t/ha. As would be expected yields showed a normal pattern of distribution with the largest proportion of trials lying in the 7 to 10 t/ha range.

Table 14: Yield as % control at different yield levels

Varieties	All Sites and Years	Yield bands (t/ha)						
		<6.00	6.00 to 6.99	7.00 to 7.99	8.00 to 8.99	9.00 to 9.99	10.00 to 10.99	>11.00
Beaver	106	106	104	107	106	106	106	106
Haven	105	98	104	108	105	105	104	104
Riband	105	108	103	104	105	106	106	108
Hornet	100	96	96	98	101	100	104	104
Apollo	100	96	99	99	101	100	100	96
Brock	99	98	97	100	98	100	101	101
Slejpner	99	93	91	97	99	100	102	105
Norman	97	95	94	97	96	99	99	105
Galahad	95	101	97	94	95	95	96	98
Mercia	95	97	97	96	94	94	94	94
Pastiche	90	91	90	90	90	90	88	91
Avalon	89	92	87	90	87	89	91	92
Control yield (t/ha)	8.75	5.97	6.79	7.80	8.87	9.66	10.51	11.33
S.E. (Average)	0.50	3.58	1.75	1.29	0.83	0.93	1.11	2.45
L.S.D.	1.4	10.3	4.9	3.6	2.3	2.6	3.1	7.1
No. of sites	138	5	12	31	42	31	13	4

Table 15: Ranking order at different yield levels

Varieties	All Sites and Years	Yield bands (t/ha)						
		<6.00	6.00 to 6.99	7.00 to 7.99	8.00 to 8.99	9.00 to 9.99	10.00 to 10.99	>11.00
Beaver	1	2	1=	2	1	1=	1=	2
Haven	2=	4=	1=	1	2=	3	3=	5=
Riband	2=	1	3	3	2=	1=	1=	1
Hornet	4=	7=	8	6	4=	4=	3=	5=
Apollo	4=	7=	4	5	4=	4=	7	9
Brock	6=	4=	5=	4	7	4=	6	7
Slejpner	6=	10	10	7=	6	4=	5	3=
Norman	8	9	9	7=	8	8	8	3=
Galahad	9=	3	5=	10	9	9	9	8
Mercia	9=	6	5=	9	10	10	10	10
Pastiche	11	11	11	11=	11	11	12	12
Avalon	12	12	12	11=	12	12	11	11

There were no large variety interactions apparent, with most varieties maintaining their relative yield positions. Beaver, Haven and Riband remained the highest yielding varieties at most yield levels. Hornet and Slejpner peformed relatively better at the higher yield levels whereas Galahad and Mercia did relatively better at lower yield levels.

4.3.9 Effect of nitrogen application level

Results from sites which received high or low levels of applied nitrogen (more than 225 kg/ha and less than 125 kg/ha respectively) are given in Tables 16 and 17.

Table 16: Yield as % control at high and low nitrogen application levels

Varieties	All sites and years	High N. >225 Kg/ha	Low N. <125 Kg/ha
Beaver	106	106	108
Haven	105	107	108
Riband	105	104	107
Hornet	100	100	101
Apollo	100	100	99
Brock	99	99	102
Slejpner	99	99	102
Norman	97	97	95
Galahad	95	95	94
Mercia	95	94	92
Pastiche	90	90	90
Avalon	89	91	87
Control yield (t/ha)	8.75	9.04	8.77
S.E. (Average)	0.50	1.12	1.81
L.S.D.	1.4	3.1	5.1
No. of sites	138	24	10

Table 17: Ranking order at high and low nitrogen levels

Varieties	All sites and years	High N >225 Kg/ha	Low N <125 Kg/ha
Beaver	1	2	1=
Haven	2=	1	1=
Riband	2=	3	3
Hornet	4=	4=	6
Apollo	4=	4=	7
Brock	6=	6=	4=
Slejpner	6=	6=	4=
Norman	8	8	8
Galahad	9=	9	9
Mercia	9=	10	10
Pastiche	11	12	11
Avalon	12	11	12

Average yields at the low nitrogen sites were little different from the average yield at all sites, indicating that the low levels of nitrogen applied had not had a deleterious effect on yield. This is not suprising

since the nitrogen applied at each site is according to advisory service guidelines which take into account previous cropping, soil type and yield expectation and hence the most appropriate levels would have been used. The yield level at the high nitrogen sites was around 0.3t/ha more than average.

There were very few effects of nitrogen level on variety performance at the levels of nitrogen application in these trials with only Brock and Slejpner showing a change in relative ranking order. Most varieties appear unaffected by level of nitrogen application.

4.3.10 Effect of time of sowing

Results from sites sown early and late are given in Tables 18 and 19. The early sown sites were all sown before the end of September whilst the late sown sites were all sown after the end of October.

Table 18: Yield as % control at early and late sown sites

Varieties	All sites and years	Early sown	Late sown
Beaver	106	104	106
Haven	105	103	102
Riband	105	107	104
Hornet	100	98	101
Apollo	100	101	100
Brock	99	95	99
Slejpner	99	97	102
Norman	97	99	97
Galahad	95	96	97
Mercia	95	94	97
Pastiche	90	87	92
Avalon	89	88	90
Control yield (t/ha)	8.75	9.24	8.34
SE (Average)	0.50	1.52	1.47
LSD	1.4	4.3	4.1
No. of sites	138	11	16

Table 19: Ranking order at early and late sown sites

Varieties	All sites and years	Early sown	Late sown
Beaver	1	2	1
Haven	2=	3	3=
Riband	2=	1	2
Hornet	4=	6	5
Apollo	4=	4	6
Brock	6=	9	7
Slejpner	6=	7	3=
Norman	8	5	8=
Galahad	9=	8	8=
Mercia	9=	10	8=
Pastiche	11	12	11
Avalon	12	11	12

As expected yields were increased by early sowing and reduced by delayed sowing. Riband and Norman appeared to perform relatively better when sown early than late. Conversely Slejpner and Brock performed relatively better late sown than early. These findings would agree with previous work done on this aspect.

4.3.11 Effect of fungicide treatment

Results from trials with and without fungicide treatment are given in Tables 20, 21, 22 and 23. The trials from which these results were taken were the NIAB Recommended List/Fungicide trials in England and Wales which consist of untreated and treated plots in one trial. The treated plots receive a comprehensive fungicide programme intended to keep disease absent or below 5% in these plots. In this way the effect of diseases and their control on yield can be ascertained. Results are presented for all sites together, of which there were 40 and for the four regions in England and Wales, North, South, East and West in which there were 9, 8, 12 and 11 sites respectively.

Table 20: Untreated yield as % control at all sites and by region (England and Wales)

Varieties	England and Wales	Region			
	All Sites and years	North	South	East	West
Beaver	111	110	108	113	112
Haven	109	108	106	113	109
Riband	100	105	101	96	101
Hornet	90	91	90	88	88
Apollo	100	98	99	101	100
Brock	99	99	100	98	100
Slejpner	78	81	79	75	80
Norman	95	97	96	95	94
Galahad	98	97	101	97	97
Mercia	93	92	94	93	93
Pastiche	94	93	92	95	94
Avalon	90	92	88	90	89
Control yield (t/ha)	7.49	8.44	6.98	7.37	7.21
S.E. (Average)	1.31	1.68	2.96	2.84	2.72
L.S.D	3.6	4.7	8.4	8.0	7.6
No of sites	40	9	8	12	11

Table 21: Ranking order of untreated yields at all sites and by region

Varieties	England and Wales	Region			
	All Sites and years	North	South	East	West
Beaver	1	1	1	1=	1
Haven	2	2	2	1=	2
Riband	3=	3	3=	6	3
Hornet	10=	11	10	11	11
Apollo	3=	5	6	3	4=
Brock	5	4	5	4	4=
Slejpner	12	12	12	12	12
Norman	7	6=	7	7=	7=
Galahad	6	6=	3=	5	6
Mercia	9	9=	8	9	9
Pastiche	8	8	9	7=	7=
Avalon	10=	9=	11	10	10

Table 22: Treated yield as % control at all sites and by region (England and Wales)

Varieties	England and Wales	Region			
	All sites and years	North	South	East	West
Beaver	108	108	108	107	108
Haven	107	107	103	108	107
Riband	106	107	106	104	107
Hornet	101	101	99	102	100
Apollo	100	99	99	101	101
Brock	100	99	101	100	100
Slejpner	101	100	98	102	102
Norman	95	93	97	96	95
Galahad	94	93	97	94	93
Mercia	94	93	95	93	93
Pastiche	88	90	89	89	87
Avalon	87	88	89	86	86
Control yield (t/ha)	8.98	9.95	8.07	8.95	8.86
S.E. (Average)	0.76	1.45	1.55	1.50	1.48
L.S.D	2.1	4.1	4.4	4.2	4.2
No of sites	40	9	8	12	11

Table 23: Ranking order of treated yields at all sites and by region

Varieties	England and Wales	Region			
	All Sites	North	South	East	West
Beaver	1	1	1	2	1
Haven	2	2=	3	1	2=
Riband	3	2=	2	3	2=
Hornet	4=	4	5=	4=	6=
Apollo	6=	6=	5=	6	5
Brock	6=	6=	4	7	6=
Slejpner	4=	5	7	4=	4
Norman	8	8=	8=	8	8
Galahad	9=	8=	8=	9	9=
Mercia	9=	8=	10	10	9=
Pastiche	11	11	11=	11	11=
Avalon	12	12	11=	12	12

As expected all sites gave an increase in yield due to fungicide treatment, with an average 20% increase over all sites. There was a range of 16% response in the South to 23% in the West, indicating the greater disease pressure in the wetter west than the drier south.

There were some very large variety interactions with fungicide treatment, particularly for Hornet and Slejpner which moved from 10= and 12 rankings respectively in untreated trials to 4= for both varieties in treated trials. This large interaction is due to the effect on yield of controlling disease in these very susceptible varieties. Although Riband retained third ranking overall at all sites whether treated or untreated its relative yield compared to Beaver and Haven was much poorer in the untreated than the treated trials, again indicating the effect of controlling disease in this very susceptible variety.

There were some interactions with varieties between regions. Riband performed relatively worse in the untreated trials in the East whilst Galahad did relatively better untreated in the South, however the effect of fungicide treatment was to negate these variations, again due to the absence of disease.

The incidence of disease, and hence disease pressure, varies from year to year. The years of study were ones of low incidence of Septoria and therefore different results may have been obtained in other circumstances. Nevertheless the big influence of disease on variety performance is still seen.

5. DISCUSSION

5.1 The data collected

Even though 138 trials were used in this investigation this was not the total number which could have been made available. At the initial stages of the project many organisations expressed an interest in supplying trials data and yet several did not submit any. This could have been due to a variety of reasons.

Certainly, since the project was conceived, there has been a strengthening of commercial attitudes from those bodies suffering the withdrawal of government funds. Trials data is valuable and will not be lightly given away and this is likely to have been the major limiting factor. Probably some other organisations fully intended to send off trials data, but, despite prompting, failed to do so under pressure of work.

5.2 New analysis techniques

The Calinski method would appear to be the most promising way of looking at interactions although further work is needed to see if it can be modified to cope with the type of data received in this project, particularly with regard to incomplete data sets. In addition Calinski's original work was looking at variety x regional effects and yet more work will be needed before it can be adapted to deal with other environmental factors, such as rotational position, soil type or husbandry practices.

5.3 Investigation using existing methods

Investigation of the data using existing methods enabled the performance of the varieties to be assessed over many different environments. Occasionally suggestions of variety x environment effects were seen but unfortunately because no statistical significance could be assigned to them it was not known whether the effects were real or the result of experimental error. Therefore such effects can only be regarded as interactive trends.

On the whole most varieties were relatively stable in performance over most environments. This indicates that current wheat varieties are well suited to most environments found within the United Kingdom and should perform as predicted using mean data. This confirms that most wheat breeders are meeting their objective of producing good, generally adaptable varieties which will have a wide market appeal.

The only large variety x environment interactions were seen in the plus and minus fungicide trials which demonstrates the large effect that varietal disease resistance can have on performance and the high degree to which growers depend on fungicides to get the best results from the majority of commercially grown varieties. Disease resistance is clearly the major contributor in any variety x environment interaction.

6. CONCLUSION

Although some disappointments were experienced with regard to the quantity of data received and the lack of a suitable statistical analysis technique the project was valuable in achieving the following findings:-

1. Currently available wheat varieties are widely adaptable to many different environments.

2. There is a large body of data available nationally which could be used to form the basis of national and regional recommendations.

3. The collecting of data by a central organisation makes best available uses of scarce UK resources.

4. A suitable technique needs to be developed which will enable statistical significances to be assigned to any variety x environment interactions.

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Scottish Agricultural College

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SITE DATA

Key

TRIAL-KEY	Trial identifier
CR	Crop
YR	Year
RE	Region
ID	Number
TT	Trial type
SI	Site name
NG	National grid reference
AL	Altitude
MS	Nearest Metereological station
DS	Date of sowing
P1	Previous crop - last year
P2	Previous crop - 2 years ago
P3	Previous crop - 3 years ago
P4	Previous crop - 4 years ago
P5	Previous crop - 5 years ago
ST	Soil texture
SD	Soil drainage
OM	Organic matter %
PH	pH
PS	Phosphorous status
PO	Potassium status
MG	Magnesium status
NI	Total nitrogen applied
YO	Untreated control yield
YI	Treated control yield
SC	Soil classification
GR	Growth regulator application

Site Data Information 1988

TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW88EE10	WW	88	EE	10	RF	MORLEY	TM058003	050	MORLEY	87.10.14	*	WW	SBT	WB	SB	SBT	SL	F	*	*	*	*	*	188	04.79	07.31	L	Y
WW88S31	WW	88	S	31	RF	ADAS OXON (GLYMPTON)	SP435206	*	*	87.10.23	210	GPS	WB	WB	*	*	ZCL	F	05.5	08.0	3	3	2	196	05.57	07.08	M	Y
WW88EE31	WW	88	EE	31	RF	ADAS CAMBS (STONEA)	TL458924	000	MEPAL	87.11.18	*	SBT	WW	POT	WW	SBT	PTY	L	F	*	*	*	*	*	053	06.38	07.68	0	Y
WW88WC31	WW	88	WC	31	RF	ADAS CHESHIRE (RIXTON)	SJ672894	020	MANCHESTER AIRPORT	87.10.13	188	WOR	WW	GPS	WW	POT	SZL		F	03.8	06.6	3	1	0	151	06.61	08.27	L	Y
WW88EE32	WW	88	EE	32	RF	GESTINGTHORPE	TL829394	*	*	87.10.23	*	WOR	WW	WW	*	*	ZCL		I	23.0	*	*	*	*	150	06.34	08.89	M	Y
WW88SW7	WW	88	SW	7	RF	SEALE HAYNE	SY818723	060	SEALE HAYNE COLLEGE	87.10.23	174	G	G	SB	WB	WW	CL		I	*	06.3	4	2	*	153	06.96	08.05	H	Y
WW88S7	WW	88	S	7	RF	BRIDGETS	SU526347	107	MARTYR WORTHY	87.10.26	180	WW	G	G	G	SB	ZL		F	*	07.7	2	2	2	240	05.79	08.73	L	Y
WW88EE7	WW	88	EE	7	RF	CAMBRIDGE	TL440610	020	NIAB CAMBRIDGE	87.10.29	*	WBN	WW	WBN	WW	SB	SL		F	02.9	07.0	5	4	2	200	05.26	08.67	L	Y
WW88WC7	WW	88	WC	7	RF	HARPER ADAMS	SJ712204	062	HARPER ADAMS	87.10.25	*	G	G	G	G	G	SL		I	04.5	06.3	3	1	3	125	04.62	08.32	L	N
WW88N7	WW	88	N	7	RF	COCKLE PARK	NZ203912	099	COCKLE PARK	87.10.13	*	G	G	G	WB	WW	CL		I	*	*	*	*	*	145	07.79	09.55	H	Y
WW88EC7	WW	88	EC	7	RF	HEADLEY HALL	SE443414	050	HEADLEY HALL	87.11.05	174	SBT	WW	WW	POT	G	ZCL		F	*	07.9	4	1	6	217	08.19	08.68	H	Y
WW88EE8	WW	88	EE	8	RF	SUTTON BONINGTON	SK500275	040	SUTTON BONINGTON	87.10.14	160	POT	WW	SBT	WB	POT	SCL		F	*	06.1	5	3	2	180	06.43	08.15	H	Y
WW88WC8	WW	88	WC	8	RF	ROSEMAUND	SO560486	090	PRESTON WYNNE	87.10.23	160	WOR	WB	WB	WW	WW	ZCL		I	02.7	06.9	3	2	3	169	05.32	08.74	M	Y
WW88EC8	WW	88	EC	8	RF	HEADLEY HALL (HORNCASTLE)	SE236729	050	RAF CONINGSBY	87.10.13	193	WW	GPS	G	W	*	SL		F	*	08.2	2	2	2	237	05.98	08.78	L	Y
WW88EE9	WW	88	EE	9	RF	TERRINGTON	TF547177	002	TERRINGTON	87.10.28	*	SB	SBT	WW	GPS	WB	ZCL		F	*	08.0	2	3	5	200	06.54	08.45	M	Y
WW88WC99	WW	88	WC	99	RF	MYERCOUGH	SD510400	050	*	87.10.26	*	POT	WW	G	G	SB	SCL		F	*	*	*	*	*	140	07.75	09.26	H	Y
WW88EE81	WW	88	EE	81	0	SUTTON BONINGTON O.C	SK473977	091	CAYTHORPE	87.10.30	*	GPS	WW	WW	WOR	*	C		F	*	*	3	2	2	174	*	07.9	H	Y
WW88EC81	WW	88	EC	81	0	HEADLEY HALL O.C	SE417542	*	*	87.10.19	173	POT	*	*	*	*	SZL		F	02.3	07.2	3	1	4	212	*	06.22	L	N
WW88S81	WW	88	S	81	0	BRIDGETS (CONT. WHEAT)	SU527342	107	MARTYR WORTHY	87.10.18	180	WW	WW	WW	WW	WW	ZCL		F	*	0.80	3	2	1	204	*	05.49	M	Y
WW88SW81	WW	88	SW	81	0	ADAS SOMERSET (DURSTON)	ST284279	045	*	87.10.87	160	WW	SOR	WB	WW	GPS	CL		*	04.3	07.5	3	2	2	*	*	07.39	H	Y
WW88WC82	WW	88	WC	82	0	ROSEMAUND O.C	SO610270	090	ROSS-ON-WYE	87.10.23	160	GPS	TRI	WW	*	*	LS		F	*	*	*	*	*	218	*	06.24	S	N
WW88EC82	WW	88	EC	82	0	HEADLEY HALL O.C	TA275329	*	*	87.11.04	173	WW	POT	WW	*	*	ZCL		*	*	*	*	*	*	225	*	08.18	M	N
WW88S84	WW	88	S	84	0	ARC (CIRENCESTER)	SO983005	140	*	87.10.12	180	SW	FBT	WW	WW	*	ZCL		F	*	*	*	*	*	200	*	09.59	M	Y
WW88S86	WW	88	S	86	0	CCG (BAPTON), WILTS	ST994371	140	CODFORD, WILTSHIRE	87.11.03	140	WW	WW	G	G	WB	ZCL		F	03.7	08.3	2	1	0	200	8	06.56	M	N
WW88S87	WW	88	S	87	0	CCG (LECKFORD), HANTS	SU384366	090	LECKFORD, HAMPSHIRE	87.10.23	140	WW	GPS	G	WW	WW	ZCL		F	04.5	08.1	2	2	1	200	*	06.75	M	N
WW88EE82	WW	88	EE	82	0	ARC (SUFFOLK)	TM******	*	RAF WATTISHAM	87.10.26	200	WW	WW	WW	WW	WW	ZCL		*	*	07.5	1	1	2	260	*	08.96	M	Y
WW88S82	WW	88	S	82	0	BRIDGETS (FIRST WHEAT)	SU519332	076	MARTYR WORTHY	87.10.18	180	G	G	G	G	G	ZL		F	4.97	08.0	1	1	1	150	*	07.33	L	Y
WW88EC83	WW	88	EC	83	0	HEADLEY HALL OC (NOTTS)	SK716636	081	GLEADTHORPE EHF	87.11.17	174	G	G	G	G	G	SCL		F	*	06.2	2	2	6	073	*	07.86	H	Y
WW88NI61	WW	88	NI	61	HG	N.IRELAND(CROSSNACREEVY)	J417617	80	CROSSNACREEVY	87.11.03	189	SB	SB	G	G	SB	SCL		F	*	6.5	3	1	2	173	*	08.47	M	N
WW88EE61	WW	88	EE	61	HG	NORFOLK (GREAT BRICETT)	TM045487	76	WATTISHAM	87.10.28	*	WW	WW	WW	WW	WW	CL		F	1.7	7.9	1	2	1	240	*	07.16	M	N
WW88ES61	WW	88	ES	61	HG	SCOTLAND (GLENHORNIE)	NT592833	30	*	87.10.14	200	*	SB	WW	WW	*	CL		I	*	6.5	5	5	5	170	*	10.22	H	*
WW88NS61	WW	88	NS	61	HG	SCOTLAND (INVERNESS)	NH790523	15	*	87.10.13	250	SB	G	G	G	G	SL		F	*	6.3	6	1	3	246	*	07.89	L	*

1988 Continued

TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW88WC61	WW	88	WC	61	HG	NORTHANTS (CHARLTON)	SP533374	134	*	87.10.18	180	WW	SOR	WB	WB	WW	CL	F	*	*	*	*	*	200	*	06.03	H	Y
WW88S61	WW	88	S	61	HG	GLOS (CIRENCESTER)	SO994008	140	*	87.09.30	*	SW	FBT	WW	WW	*	ZCL	F	*	*	*	*	*	200	*	09.17	M	Y
WW88EC61	WW	88	EC	61	HG	YORKS (HORNSEA)	TA183486	15	*	87.10.05	*	WOR	WB	WW	WBN	WW	C	*	*	7.3	1	2	3	215	*	10.03	H	Y
WW88NI62	WW	88	NI	62	HG	N.IRELAND (LISBURN)	J238643	43	CROSSNACREEVY	87.10.19	189	WOR	WB	WW	WW	WB	SL	F	*	6.7	3	2	1	178	*	09.11	L	N
WW88EE62	WW	88	EE	62	HG	BEDS (CARDINGTON)	TL101460	30	RAF BEDFORD	87.10.26	*	GPS	WW	WW	WOR	*	CL	F	*	7.5	1	2	2	210	*	08.71	M	Y
WW88EC62	WW	88	EC	62	HG	LINCS (MAIDENWELL)	TF298789	100	CONINGSBY	87.10.24	*	WOR	WB	WW	WW	*	ZCL	F	*	7.7	2	2	1	210	*	09.45	M	Y
WW88S62	WW	88	S	62	HG	WILTS (BAPTON)	ST994371	140	CODFORD WILTSHIRE	87.09.30	140	WW	WW	G	G	WB	ZCL	F	3.7	8.3	2	1	0	200	*	05.61	M	N
WW88ES62	WW	66	ES	62	HG	SCOTLAND (MIDDLESTOTS)	NT822504	80	*	87.10.01	200	SB	SB	SB	SB	*	CL	I	*	6.6	5	5	7	220	*	07.08	H	*
WW88S63	WW	88	S	63	HG	HANTS (LECKFORD)	SU384366	90	LECKFORD (HAMPSHIRE)	87.09.29	140	WW	GPS	G	WW	WW	ZCL	F	4.5	8.1	2	2	1	200	*	06.90	M	N
WW88EE63	WW	88	EE	63	HG	BEDS (CARDINGTON 2)	TL113450	80	RAF BEDFORD	87.10.26	*	WW	WOR	WW	WW	*	CL	F	*	7.7	0	2	2	240	*	07.45	M	Y
WW88NI63	WW	88	NI	63	HG	N.IRELAND (LIMAVADY)	*	10	LIMAVADY	87.10.13	189	WW	POT	WW	WOR	SB	CL	I	*	6.9	4	2	2	215	*	08.89	M	N
WW88ES63	WW	88	ES	63	HG	SCOTLAND (CARSLOGIE)	NO346143	20	*	87.10.02	200	*	WW	WW	GPS	SB	CL	I	*	6.2	6	5	5	150	*	08.99	H	*
WW88EE64	WW	88	EE	64	HG	ESSEX (ROYSTON)	TL644104	60	WRITTLE AGRIC COLLEGE	87.10.23	*	WOR	WW	WW	POT	WW	CL	F	*	8.1	2	3	1	163	*	08.70	M	N
WW88EE65	WW	88	EE	65	HG	LINCS (SURFLEET 1)	TF288315	000	KIRTON E.H.S	87.11.03	150	POT	WW	VEG	WW	VEG	ZL	F	2.6	8.0	5	4	3	138	*	09.04	L	Y
WW88EE66	WW	88	EE	66	HG	LINCS (SURFLEET 2)	TF288315	000	KIRTON E.H.S	87.11.03	150	POT	WWG	VEG	WW	VEG	ZL	F	2.6	8.0	5	4	3	197	*	09.22	L	Y
WW88EE67	WW	88	EE	67	HG	HERTS (ROYSTON)	TL442458	028	NIAB CAMBRIDGE	87.10.13	140	GPS	WB	WB	*	*	SCL	F	*	*	*	*	*	125	*	07.54	M	N
WW88EE68	WW	88	EE	68	HG	NORFOLK (MORLEY 1)	TG061994	048	MORLEY	87.12.02	180	SBT	WB	SB	SBT	WW	SL	F	1.7	8.3	3	2	2	260	*	07.55	L	Y
WW88EE69	WW	88	EE	69	HG	NORFOLK (MORLEY 2)	TG060002	048	MORLEY	87.09.29	160	WW	SBT	WB	SB	SBT	SL	F	1.5	8.1	4	1	2	260	*	09.44	L	Y
WW88EE70	WW	88	EE	70	HG	SUFFOLK (DEBENHAM)	TM192625	050	WATTISHAM	87.10.21	180	WOR	WW	WW	WBN	WW	SC	F	*	7.8	2	2	2	260	*	10.06	H	Y
WW88EE71	WW	88	EE	71	HG	SUFFOLK (DEBENHAM 2)	TM189628	047	WATTISHAM	87.10.02	160	WW	WOR	WW	WW	WBN	SC	F	*	7.8	2	2	2	240	*	10.07	H	Y

Site Data Information 1989

TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW89EE8	WW	89	EE	8	RF	MORLEY	TM057991	054	MORLEY ST BOTOLPH	88.10.14	184	WW	SBT	WW	WW	SBT	SL	F	*	*	*	*	*	202		09.26	L	Y
WW89S31	WW	89	S	31	RF	ADAS [OXON GLYMPTON]	SP231437	122	SHIPTON ON CHERWELL	88.10.18	180	GPS	WB	WB	*	*	ZL	F	05.6	08.1	4	4	2	193		06.66	L	Y
WW89EE31	WW	89	EE	31	RF	ADAS CAMBS (STONEA)	TL456909	000	MEPAL	88.11.02	*	POT	*	*	*	*	PL	F	24	06.1	3	1	3	085		09.00	O	Y
WW89WC31	WW	89	WC	31	RF	ADAS STAFFS	SK228101	077	BIRMINGHAM AIRPORT	88.10.14	188	WOR	WB	WW	WW	*	SCL	F	*	06.1	3	2	2	150		08.36	H	Y
WW89EE32	WW	89	EE	32	RF	ADAS ESSEX (GESTINGTHORPE)	TL825395	050	HONINGTON	88.10.19	175	WW	WW	WW	WW	WOR	SCL	F	01.8	07.8	2	3	2	218		07.97	H	Y
WW89WC7	WW	89	WC	7	RF	HARPER ADAMS	SJ712204	062	HARPER ADAMS	88.10.15	*	POT	SBT	WW	WW	POT	SL	F	02.1	06.9	5	3	3	125		08.60	L	Y
WW89EE7	WW	89	EE	7	RF	CAMBRIDGE	TL440610	020	NIAB CAMBRIDGE	88.10.17	*	GPS	SBT	WW	SB	SBT	SL	F	*	07.2	5	3	2	100		09.47	L	Y
WW89S7	WW	89	S	7	RF	BRIDGETS	SU518345	107	MARTYR WORTHY	88.10.22	180	SW	FMZ	SW	G	G	ZCL	F	04.8	08.2	4	3	3	240		08.42	M	Y
WW89N7	WW	89	N	7	RF	COCKLE PARK	NZ203912	099	COCKLE PARK	89.10.17	*	G	G	G	G	WB	CL	I	*	*	*	*	*	153		09.84	H	Y
WW89EC7	WW	89	EC	7	RF	HEADLEY HALL	SE443414	050	HEADLEY HALL	88.10.15	*	POT	WW	G	SB	SBT	SCL	F	*	08.2	2	1	6	181		09.74	H	Y
WW89WC8	WW	89	WC	8	RF	ROSEMAUND	SO556486	090	PRESTON WYNNE	88.10.17	158	WOR	WB	WB	WW	WW	ZCL	I	02.9	07.2	2	2	3	115		07.89	M	Y
WW89EC9	WW	89	EC	9	RF	SUTTON BONINGTON	SK10270	040	SUTTON BONINGTON	88.10.15	*	POT	WW	SBT	WB	WW	SL	F	*	05.0	3	3	*	130		08.09	L	Y
WW89WC9	WW	89	WC	9	RF	MYERSCOUGH	SD510400	025	*	88.10.14	*	POT	G	G	G	G	SCL	F	*	06.2	2	2	2	144		08.04	H	Y
WW89EE9	WW	89	EE	9	RF	TERRINGTON	TF552178	08	TERRINGTON	88.10.11	184	WW	POT	GPS	WW	WW	ZCL	F	02.1	07.5	3	2	5	210		08.99	M	Y
WW89EC98	WW	89	EC	98	RF	HEADLEY HALL (HORNCASTLE)	TF236729	050	CONINGSBY	88.10.11		WW	SB	G	WW	WW	SL	F	*	07.3	2	1	2	254		08.90	L	Y
WW89EC81	WW	89	EC	81	0	HEADLEY HALL (N.YORKS)	SE345798	030	*	88.10.17	174	WW	WW	WW	POT	*	SCL	F	02.5	07.5	4	1	5	237		08.34	H	Y
WW89WC81	WW	89	WC	81	0	HARPER ADAMS O.C.	SJ711204	084	HARPER ADAMS	88.10.17	*	WW	WO	*	*	*	SL	F	*	*	*	*	*	170		07.87	L	N
WW89S82	WW	89	S	82	0	BRIDGETS (FIRST WHEAT)	SU529333	076	MATYR WORTHY	88.10.16	180	G	G	WB	WW	WW	ZL	F	04.5	08.4	3	1	1	200		10.82	C	Y
WW89WC82	WW	89	WC	82	0	ROSEMAUND OC ROSS-ON-WYE	SO615271	090	ROSS-ON-WYE	88.10.24	158	GPS	WO	WW	*	*	SL	F	*	06.1	2	1	1	217		06.23	L	Y
WW89EC83	WW	89	EC	83	0	H. HALL OC [HUMBERSIDE]	TA271333	010	*	88.10.16	174	WW	WW	WB	WW	WW	ZCL	F	03.7	07.0	3	3	3	214		09.03	M	Y
WW89S4	WW	89	S	84	0	ARC CIRENCESTER	SO994008	140	*	88.10.27	180	WB	WW	SB	FBT	WW	ZCL	F	*	*	*	*	*	200		09.50	H	Y
WW89S85	WW	89	S	85	0	CCG1 WILTS [F. BISHOP]	ST944335	150	CODFORD, WARMINSTER	88.10.24	140	WW	LIN	WW	WW	G	CL	F	05.3	07.9	3	2	1	200		07.69	H	Y
WW89S86	WW	89	S	86	0	CCG2 LECKFORD	SU368359	090	*	88.10.28	140	SW	G	G	WW	WW	ZCL	F	04.7	07.2	1	1	2	190		07.17	M	Y
WW89S87	WW	89	S	87	0	CCG3 BISHOPSTONE, WILTS	SU063274	130	*	88.10.26	140	WOR	*	*	*	*	CL	F	04.6	07.9	2	2	0	200		08.66	H	Y
WW89EE61	WW	89	EE	61	HG	SUFFOLK (DEBENHAM)	TM188628	047	WATTISHAM	88.10.17	175	WOR	WW	WW	WBN	WW	SC	*	*	07.8	2	2	2	260	*	10.82	H	Y
WW89NS61	WW	89	NS	61	HG	SCOTLAND (INVERNESS)	NH787521	015	*	88.10.17	250	WB	*	G	G	G	SL	F	*	06.3	3	1	3	230	*	07.67	L	*
WW89WS61	WW	89	WS	61	HG	SCOTLAND (CRICHTON)	NX987733	045	*	88.10.15	240	WB	WO	G	G	WOR	SL	F	*	05.7	5	0	*	155	*	09.70	L	*
WW89ES61	WW	89	ES	61	HG	SCOTLAND (GLENHORNIE)	NT582831	035	*	88.10.17	200	*	WW	WW	WW	WW	CL	I	*	06.3	5	5	7	170	*	10.68	H	*
WW89EC61	WW	89	EC	61	HG	YORKS (HORNSEA)	*	*	*	89.10.03	*	WOR	WB	WW	WO	WW	SC	*	*	*	*	*	*	170	*	10.83	H	Y
WW89NI61	WW	89	NI	61	HG	N.IRELAND (CROSSNACREEVY)	*	*	*	88.11.25	*	SB	POT	SB	G	G	CL	*	*	*	*	*	*	152	*	08.61	H	N
WW89SW61	WW	89	SW	61	HG	SOMERSET	ST290283	030	*	88.10.21	188	WOR	WW	GPS	*	*	CL	F	*	07.0	1	1	2	151	*	07.55	H	Y
WW89NI62	WW	89	NI	62	HG	N.IRELAND (LISBURN)	*	*	*	88.11.01	*	WOR	SB	SB	SB	SB	*	*	*	*	*	*	*	163	*	07.50	*	N
WW89ES62	WW	89	ES	62	HG	SCOTLAND (MIDDLESSTOTS)	NT803500	80	*	88.10.18	200	WB	WW	GPS	WB	*	CL	I	*	06.5	5	5	7	200	*	05.81	H	*

1989 Continued

TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW89EC62	WW	89	EC	62	HG	YORKS (HAYWOLD)	*	*	*	88.10.04	*	WB	WOR	WB	SB	SB	CL	*	*	*	*	*	*	175	*	08.70	H	Y
WW89EE62	WW	89	EE	62	HG	SUFFOLK (DEBENHAM 2)	TN185617	056	WATTISHAM	88.10.17	175	WW	WBN	WW	WW	WOR	SC	F	*	07.8	2	2	2	280	*	09.72	H	Y
WW89ES63	WW	89	ES	63	HG	SCOTLAND (UPPER CAIRNIE)	NO025193	105	*	88.10.11	200	*	WB	*	*	*	SL	I	*	06.7	*	5	6	150	*	07.14	L	*
WW89EE63	WW	89	EE	63	HG	NORFOLK (MORLEY 1)	TM061998	050	MORLEY	88.11.04	188	SBT	WW	WW	SBT	WW	SL	F	01.6	08.0	3	1	1	240	*	09.16	L	Y
WW89EE64	WW	89	EE	64	HG	NORFOLK (MORLEY 2)	TM062996	048	MORLEY	88.09.30	160	WW	SBT	WB	WW	SBT	SL	F	*	08.3	3	2	2	220	*	09.40	L	Y
WW89EE65	WW	89	EE	65	HG	CAMBS (MADINGLEY)	*	*	*	88.10.16	*	WOR	WW	WW	WW	*	C	*	*	*	*	*	*	116	*	08.89	H	N
WW89EE66	WW	89	EE	66	HG	SUFFOLK (TANNINGTON)	*	*	*	88.09.30	*	WOR	WW	SBT	WW	GPS	SCL	*	*	*	*	*	*	180	*	11.06	H	Y
WW89EE67	WW	89	EE	67	HG	CAMBS (SHELFORD 1)	*	*	*	88.10.07	*	WO	WW	WBN	WW	WW	SCL	*	*	*	*	*	*	282	*	07.54	H	Y
WW89EE68	WW	89	EE	68	HG	CAMBS (SHELFORD 2)	*	*	*	88.11.02	*	WO	WW	WBN	WW	WW	SCL	*	*	*	*	*	*	282	*	07.33	H	Y
WW89EE69	WW	89	EE	69	HG	CAMBS (MELBOURN)	*	*	*	88.09.24	*	GPS	WB	SB	WW	WW	SZL	*	*	*	*	*	*	241	*	08.66	C	Y
WW89EE70	WW	89	EE	70	HG	CAMBS (BAR HILL)	*	*	*	88.10.24	*	WW	MUS	WW	WW	WOR	CL	*	*	*	*	*	*	272	*	07.40	H	Y
WW89EE71	WW	89	EE	71	HG	CAMBS (EARITH)	*	*	*	88.10.19	*	GPS	WW	WW	WW	GPS	CL	*		*	*	*	*	175	*	07.57	H	Y

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TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW90WC8	WW	90	WC	8	RF	ROSEMAUND	SO556483	085	PRESTON WYNNE	89.10.12	158	G	G	WB	SB	SB	ZCL	I	03.0	07.0	5	4	3	138	08.04	08.65	M	Y
WW90EC9	WW	90	EC	9	RF	HEADLEY HALL OC. NEWARK	SK725623	070	NOTTINGHAM	89.10.12	169	G	G	WB	WW	WW	ZCL	F	*	07.0	3	3	*	168	08.87	09.61	M	Y
WW90S31	WW	90	S	31	RF	ADAS OXON (GLYMPTON)	SP420210	122	SHIPTON ON CHERWELL	89.10.10	190	WW	GPS	WB	WW	WOR	ZL	F	05.1	08.0	4	4	2	193	05.85	05.93	L	Y
WW90EE32	WW	90	EE	32	RF	ADAS ESSEX (FORDHAM)	TM926286	050	WATTISHAM	89.10.11	*	*	WW	SBT	WW	*	ZL	F	01.8	07.9	4	2	1	212	08.49	08.91	L	Y
WW90S8	WW	90	S	8	RF	WYE	TR072452	055	WYE COLLEGE	89.10.12	197	SW	FMZ	WW	WW	WOR	ZCL	I	*	08.4	2	2	2	200	08.20	08.92	M	Y
WW90SW7	WW	90	SW	7	RF	SEALE HAYNE	SX888998	045	EXETER UNIVERSITY	89.10.08	145	WW	G	G	*	*	SCL	I	*	06.5	3	2	2	195	07.20	08.01	H	Y
WW90EE7	WW	90	EE	7	RF	CAMBRIDGE	TL440610	020	NIAB CAMBRIDGE	89.10.09	180	FPS	VEG	WW	WB	WBN	SCL	F	*	07.3	5	5	3	120	08.14	09.20	H	Y
WW90N7	WW	90	N	7	RF	COCKLE PARK	N2203912	099	COCKLE PARK	89.10.23	*	G	G	G	WB	WB	CL	I	*	*	*	*	*	131	09.73	10.96	H	Y
WW90WC31	WW	90	WC	31	RF	ADAS STAFFS (TAMWORTH)	SK275100	080	*	89.09.29	180	WOR	WB	WW	GPS	WW	SL	F	02.7	07.0	0	2	2	151	07.78	08.45	L	Y
WW90EC8	WW	90	EC	8	RF	H.HALL OC (HORNCASTLE)	TF238730	050	CONINGSBY	89.10.09	188	WW	SBT	X	WW	WW	SCL	F	*	07.5	3	1	1	260	08.40	09.76	H	Y
WW90EC7	WW	90	EC	7	RF	HEADLEY HALL	SE443414	050	HEADLEY HALL	89.10.10	169	POT	SB	SBT	SO	WW	SCL	F	*	07.4	4	2	5	128	09.35	11.28	H	Y
WW90S7	WW	90	S	7	RF	BRIDGETS	SU530333	076	MARTYR WORTHY	89.10.10	180	WW	G	G	WB	WW	ZL	F	4.56	08.4	3	1	1	200	09.12	10.27	L	Y
WW90WC7	WW	90	WC	7	RF	HARPER ADAMS	SJ712204	062	HARPER ADAMS	89.10.11	*	POT	SBT	WT	SB	SBT	SL	F	02.0	06.7	6	3	3	125	08.56	09.46	L	Y
WW90EE9	WW	90	EE	9	RF	MORLEY OC HOLBEACH	TF369283	000	TERRINGTON	89.10.27	184	POT	*	*	*	*	ZL	I	*	*	*	*	*	120	08.28	09.65	L	Y
WW90EE8	WW	90	EE	8	RF	MORLEY	TM061992	052	MORLEY ST BOTOLPH	89.10.09	184	GPS	WW	SBT	WB	SB	SL	F	*	*	*	*	*	182	08.09	10.45	L	Y
WW90S86	WW	90	S	86	0	CCG 2 CHITTERNE	ST967430	150	CODFORD WILTS	89.10.09	140	WW	*	*	*	*	ZCL	F	*	07.6	2	1	2	190	*	06.92	M	Y
WW90WC81	WW	90	WC	81	0	HARPER ADAMS O.C.	SJ710204	062	HARPER ADAMS	89.10.14	*	WW	WOR	*	*	*	SL	F	*	*	*	*	*	178	*	06.79	L	Y
WW90WC82	WW	90	WC	82	0	ROSEMAUND OC ROSS-ON-WYE	SO620273	110	ROSS-ON-WYE	89.10.12	158	GPS	X	WW	*	*	LS	I	*	06.0	3	2	3	217	*	06.20	S	Y
WW90EC81	WW	90	EC	81	0	H. HALL OC SICKLINGTON	SE355464	030	LEEDS	89.10.09	174	GPS	SWE	WB	WB	*	SL	F	04.0	06.0	1	2	4	157	*	07.77	L	Y
WW90EC83	WW	90	EC	83	0	H. HALL OC (OWSTWICK)	TA272322	010	*	89.10.10	174	WOR	WB	WW	WW	WOR	SCL	F	03.5	06.2	3	2	3	186	*	09.87	H	Y
WW90EC84	WW	90	EC	84	0	H. HALL OC (YORKSWOLD)	SE931617	155	HIGH MOWTHORPE	89.10.09	190	WB	G	G	G	G	SCL	F	*	07.0	0	1	3	180	*	11.12	H	Y
WW90N81	WW	90	N	81	0	COCKLE PARK OC. SALTHOLME	N2510235	010	*	89.10.04	*	WW	*	*	*	*	SCL	I	*	*	*	*	*	213	*	09.31	H	Y
WW90S85	WW	90	S	85	0	CCG 1 STAPLEFORD	SU064380	110	CODFORD WILTS	89.10.04	140	X	*	*	*	*	ZCL	F	04.6	07.9	3	2	2	180	*	07.84	M	Y
WW90S87	WW	90	S	87	0	CCG 1 LECKFORD	SU386368	090	*	89.10.07	140	WW	*	*	*	*	ZCL	F	05.7	08.1	2	2	0	140	*	05.85	M	Y
WW90S82	WW	90	S	82	0	BRIDGETS 1 WHEAT NEVADA	SU514343	107	MARTYR WORTHY	89.10.09	180	G	G	WB	WW	G	ZCL	F	*	07.9	3	2	1	180	*	09.08	M	Y
WW90S81	WW	90	S	81	0	BRIDGETS NEW HANTS	SU527334	091	MARTYR WORTHY	89.10.09	180	WW	WW	WOR	WB	WW	ZL	F	4.49	08.3	2	2	1	180	*	06.87	L	Y
WW90ES64	WW	90	ES	64	HG	SCOTLAND (TREATON)	NO324024	090	LEUCHARS	89.10.04	200	SB	SB	WW	POT	*	SL	F	07.0	06.2	2	2	5	230	*	08.87	L	Y
WW90ES63	WW	90	ES	63	HG	SCOTLAND (PLOUGHLANDS)	NT630307	076	*	89.10.06	200	SB	WOR	SB	SB	*	SCL	I	*	06.4	4	1	3	230	*	10.83	H	Y
WW90ES62	WW	90	ES	62	HG	SCOTLAND (LUGGATE)	NT600749	090	HADDINGTON	89.10.09	200	GPS	WW	WW	G	*	SCL	F	07.0	06.4	5	1	4	160	*	11.71	H	Y
WW90ES65	WW	90	ES	65	HG	SCOTLAND (BUSH)	NT246648	190	TURNHOUSE	89.10.10	200	WB	WB	WB	SB	WW	ZL	I	07.0	06.3	5	0	5	180	*	07.41	L	Y
WW90NS63	WW	90	NS	63	HG	SCOTLAND (INVERNESS)	NH589510	060	ALLANGRANAGE HOUSE	89.10.22	250	SB	WW	WOR	WB	WB	SL	F	04.2	06.6	4	1	4	217	*	08.95	L	Y
WW90WS62	WW	90	WS	62	HG	SCOTLAND (DUMFRIES)	*	050	*	89.10.22	240	SB	SB	SB	SB	FBT	SL	F	06.2	06.5	6	3	*	180	*	07.80	L	Y
WW90NI63	WW	90	NI	63	HG	N. IRELAND (LIMVADY)	C643253	010	LONDONDERRY	89.10.05	189	WW	POT	WW	*	*	*	P	*	06.1	2	2	2	*	*	07.71	*	Y

1990 Continued

TRIAL-KEY	CR	YR	RE	ID	TT	SI	NG	AL	MS	DS	SR	P1	P2	P3	P4	P5	ST	SD	OM	PH	PS	PO	MG	NI	YO	Y1	SC	GR
WW90NI62	WW	90	NI	62	HG	N.IRELAND (LISBURN)	J238643	043	CROSSNACREEVY	89.11.14	189	POT	WW	*	WB	WW	SL	F	*	06.0	3	2	3	0	*	08.70	L	Y
WW90NI61	WW	90	NI	61	HG	N.IRELAND (CROSSNACREEVY)	J397687	080	CROSSNACREEVY	89.10.16	189	G	G	G	G	G	*	F	*	06.0	2	0	1	019	*	08.39	*	Y
WW90EC63	WW	90	EC	63	HG	YORKS (HORNSEA)	*	*	*	89.09.25	*	WOR	WB	*	*	*	CL	*	*	*	*	*	*	175	*	10.53	H	Y
WW90EC62	WW	90	EC	62	HG	YORKS (HAYWOLD)	*	*	*	89.09.29	*	WW	GPS	*	*	*	CL	F	*	*	*	*	*	175	*	08.10	H	Y
WW90EC61	WW	90	EC	61	HG	YORKS (ESCRICK PARK)	*	*	*	89.09.27	*	OSR	WB	*	*	*	SCL	*	*	*	*	*	*	175	*	09.75	H	Y
WW90NS62	WW	90	NS	62	HG	SCOTLAND (OLD MELDRUN)	NJ792258	097	INVERURIE	89.10.10	235	WB	WW	POT	WW	G	SL	F	11.0	06.0	2	1	2	219	*	09.73	L	Y

Appendix II

VARIETIES IN TRIALS 1988,89,90

ALEXANDRIA
ANGLER
APOLLO
APOSTLE
AQUILA
AVALON
AXIAL
AXONA
BEAVER
BOXER
BRIGAND
BRIMSTONE
BROCK
CAMP REMY
CAROLUS
CLARION
COLONEL
COPAIN
CUTLASS
CREST
DEAN
DEPOT
DRUID
EKLA
FENMAN
FEUVERT
FLINT
FLORIDA
FOCUS
FOREMAN
FORTRESS
FRESCO
FUTUR
GALAHAD
GAMBIT
GAWAIN
HAVEN
HEREWARD
HORNET
LONGBOW
MANDATE
MERCIA
MISSION
NORMAN
ORESTIS
PARADE
PASTICHE
PRESIDENT
REKTOR
RENDEZVOUS
RIBAND
RIFLE
ROCKET
SLEJPNER
SNIPER
SOLEIL
SPERBER
TALON
TARA
TOKEN
TONIC
TORFRIDA
URBAN
WASP

Map of United Kingdom showing regions