Crop Monitoring 2007-08

Adopt A Crop is funded by RERAD as part of the advisory activity into Crop health

Summary

An unusual outbreak of fungicide resistance to *Microdochium nivale* was reported. This pathogen causes a disease commonly known as “Microdochium head blight”. The cold winter temperatures had a negative impact on winter sown crops following on from a slow start in the wet autumn. The cold weather also had some positive effect and helped to keep some pest species at low levels (i.e. aphids).

Dry mild weather conditions in the spring resulted in good conditions to sow spring barley. The cool weather also delayed the wheat bulb fly hatch, leading to potential damage to spring barley as well as winter wheat. Despite the dry spring, local coastal haars (fogs) meant crops were wet, leading to reports of both yellow rust in winter wheat and rhynchosporium in winter barley.

Historic Adopt A crop information is a useful tool to understand changes in crop development pests and diseases associated with seasonal variation compared to longer term changes associated with climate change.

10 May 2009

AA314 Crop Health

Spring 2009

The weather conditions in the first two months of 2009 have been some of coldest for many years with temperatures dropping to -10C in February. In terms of snow cover there was a north south split. Areas south of Kincardine to the Lothians had relatively little snow with more in the Borders regions. Following on from a cold winter, the dry and mild weather conditions in March were ideal for spring cereal sowing and the planting of potatoes.

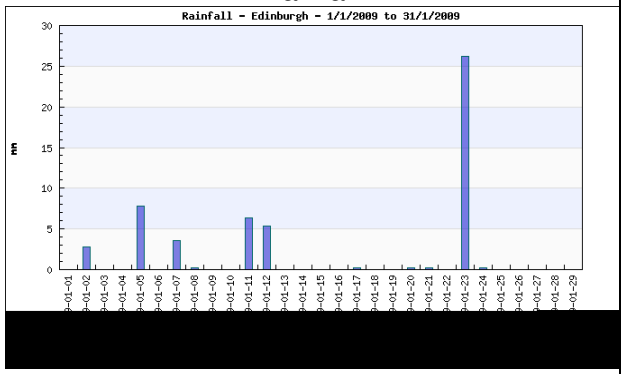
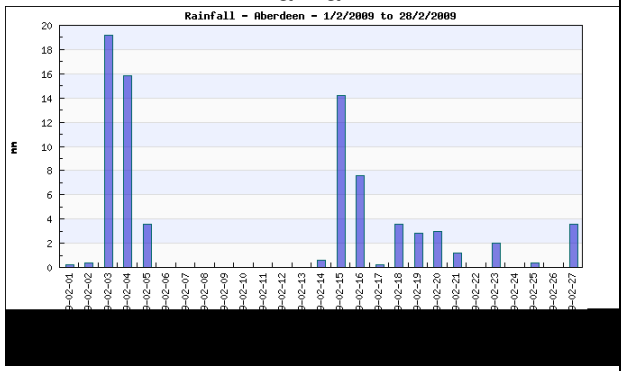
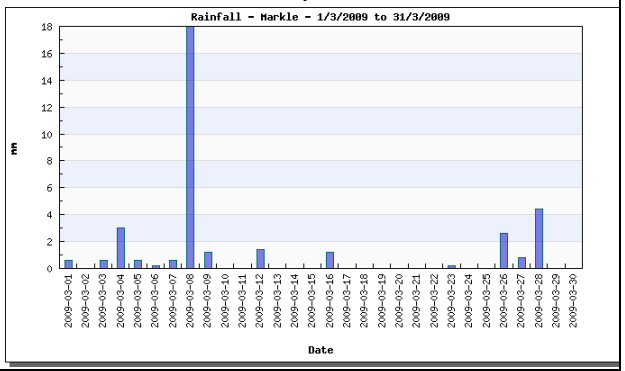
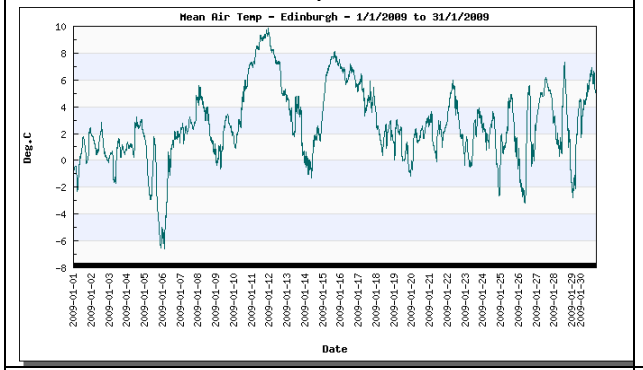
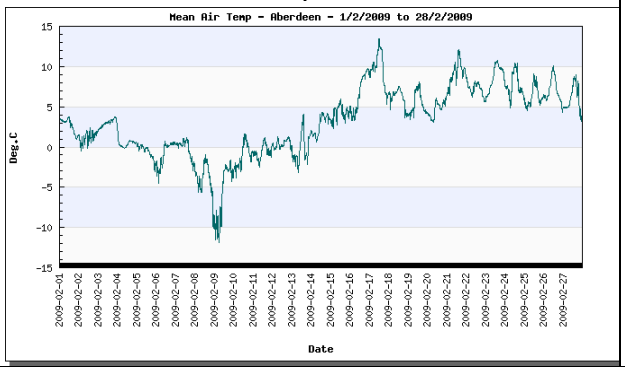
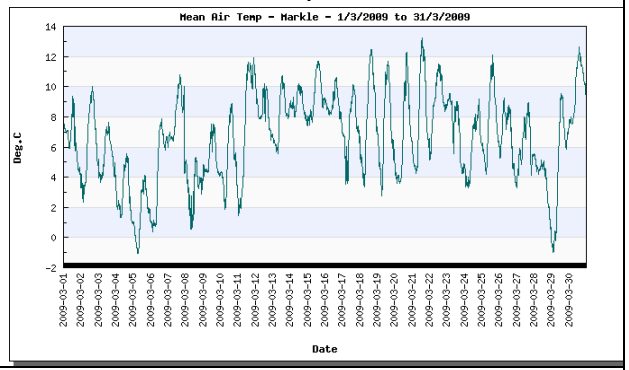
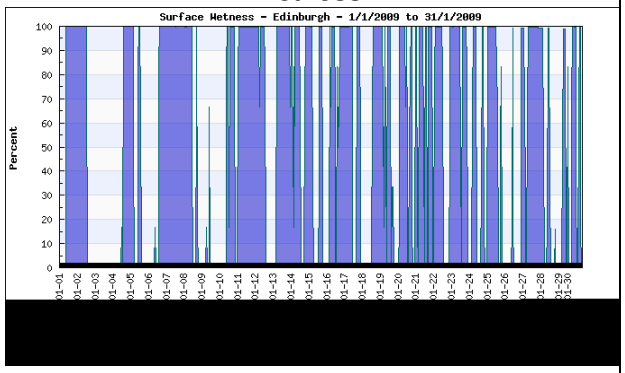
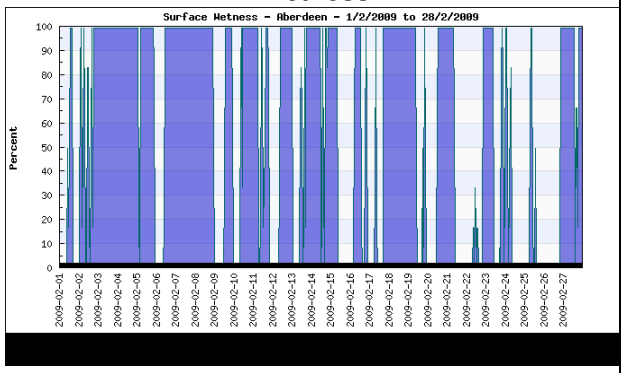
Despite the lack of rain, coastal haars meant cereal leaves were wet for prolonged periods. This meant weather conditions around the crop were suitable for yellow rust in wheat and rhynchosporium in barley.

Wheat bulb fly egg hatch was prolonged this season, with eggs still hatching in towards the end of March which caused problems for a few spring barley crops One crop of winter wheat near Stonehaven suffered from wheat shoot beetle damage in January/February followed by wheat bulb fly in March resulting in severe crop damage.

There has been an increase in reported problems from wireworm damage to cereal crops this season, with some cases of significant problems in spring barley crops. Leatherjacket populations have also been increasing compared to last season, and this was translated into some problems in spring barley crops sown after grass this season.

As a result of the winter weather and the late sown nature of winter crops weed growth, (Annual meadow grass and broad leaved weeds), remains low in untreated crops. It is predicted germination of pernicious weeds such as Brome species will be low this year. Low weed pressure has allowed low rates of residual herbicides to be applied.

Figure 1 Weather January - March 2008

January	February	March
.Rainfall  .	Rainfall  .	.Rainfall . 
Temperature .  	Temperature. .  	Temperature. . 
Wetness  .	. Wetness  .	. Wetness No data

Unusual outbreaks 2008-09

Fungicide resistance to Microdochium nivale

In France, there have been reports of strobilurin resistance in the wheat disease Microdochium nivale. Samples were sent from the UK to France to be tested.

The following text was used by RERAD to publicise the outbreak.

Fungicide-resistance detected in two fungi which cause Microdochium seedling blight

SAC have reported that two fungi responsible for causing Microdochium seedling blight in wheat and barley, *Microdochium nivale and Microdochium majus,* have become more prevalent over the last two years. *Microdochium nivale* and *Microdochium majus* are fungi which will colonise the heads of cereals in cool wet summers. These fungi are primarily a threat to winter wheat seed since they can reduce germination and cause seedling blight in winter wheat. They are not known to produce mycotoxins, unlike other fungi known as Fusariums which can be present on cereals.

The Intstitut National de la Recherche Agronomique (INRA) (French National Institute for Agricultural Research) have previously reported that these fungi may be resistance to the strobilurin fungicides in France. UK samples of these fungi have now been sent to INRA to be tested for resistance to strobilurin. This analysis has shown that strobilurin-resistance was detected in 16 of the 20 fungal samples from Scottish seed samples.

Farmers need to be aware of this development, so that they can modify late spraying programmes for wheat and barley. Farmers are advised to use an appropriate fungicide, to which the fungi are not resistant, to protect wheat and barley crops from this disease.

The results are shown below;
M nivale(12 samples) 8 resistant, 4 susceptible
M majus (8 samples) all resistant

Fungicide resistance to rhynchosporium

The strobilurin fungicides remain an important group to manage rhynchosporium in barley. In 2008, isolates of rhynchosporium resistant to these fungicides were detected in France. The implications are that if this resistance is widespread, this group of fungicides will no longer have any activity against the disease.

As part of SAC research programmes (Workpackage 1.4 Barley Pathology & HGCA funded research), we are able to monitor isolates taken from the 2008 season and also seed samples for the presence of this resistance. Since the research has highlighted seed to be an important

source of the disease, it is also possible seed is an important method to spread resistance isolates from one region to another. This hypothesis is currently under test in new HGCA research. If it is proven to be the case, it will put a greater emphasis on seed health to minimise the disease. Since some foliar and seed treatment fungicides are under threat as a consequence of a review of EU regulation 91/414, seed health will become of greater importance for foliar diseases in the future. A similar situation has also been highlighted with seed-borne infection of barley with Ramularia. One method which requires further research is the application of heat treatments for seed. New molecular techniques will make it easier to understand the impact these treatments have on seed borne diseases. A concept note was submitted to the HGCA.

Two fly pests have increased their presence and distribution this year. The yellow cereal fly (see picture) (*Opomyza*, florum) and gout fly (*Chlorops pumilionis*) have been seen before, but only as curiosities. This season their distribution and incidence has been reported from a wider area, stretching from the Borders up to Aberdeenshire for *Opomyza*, and Fife, Perth, Lothians and Borders for gout fly.
Both pests are primarily pests in the south east of England, although reports of gout fly damaging crops in Yorkshire have increased over the last few years.

Early sown crops are at risk as the flies need plants to lay their eggs on emerged plants in September/October. However, in Scotland this season we have confirmed *Opomyza* in wheat crops that did not emerge until early November, suggesting that the period of egg laying by *Opomyza* in Scotland may be stretched into November. This may be an example of the Scottish climate changing to suit the pest or the pest becoming adapted to our current climate. Awareness of the pests and action growers need to take has all been done through the Crop Health Advisory Activity.

Cephalosporium leaf stripe

Cephalosporium leaf stripe is another unusual disease which has been more widespread this season. Text books describe it of little interest, but the 0.5 t/ha yield loss experienced by some growers mean that things have changed. The disease is caused by a fungus (*Cephalosporium graminearum*) which is a slow growing fungus in the soil but it is favoured by wet soil conditions and continuous cereal cropping. A move to straw incorporation and short rotations for wheat mean this disease is becoming an increasing economic problem.

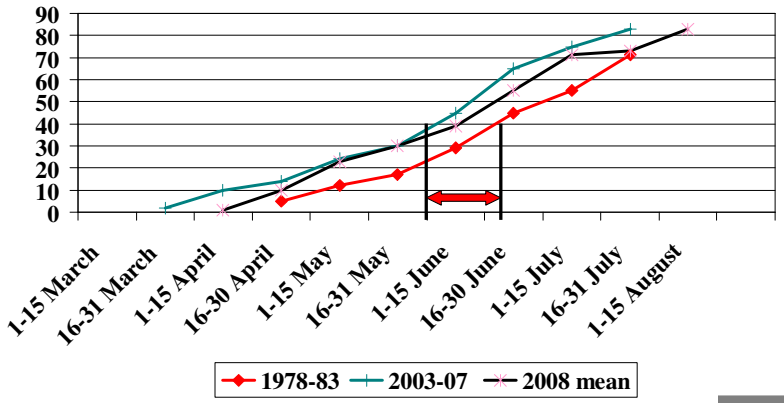
We have highlighted the problem and followed its progress on commercial farms. Making others aware of the disease is the first step to ensure it does not remain ignored until yield losses become significant. A Technical Note was published to ensure greater awareness of the problem and a research proposal has been submitted to the HGCA for further research.

Future threats in light of climate change

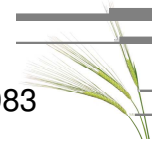
New threats associated with changes in crop development

Adopt A Crop data has shown a shift in crop development over the past 30 years in cereal crops The figure below shows spring barley development in 2008 (a late year by our standards) was more advanced compared to average crop development in 1978-1983. Ramularia is an example of a new disease outbreak which started to become an economic threat to barley in Scotland ten years ago. Since the disease attacks the upper leaves and requires sunlight stresses to show symptoms, this is an example of a disease which was unheard of in the recent past and which has now become one of the major economic diseases to affect barley.

Spring barley growth stages (30 years)



2008 season started late due to cold spring,
but crops still more advanced compared to 1978-1983



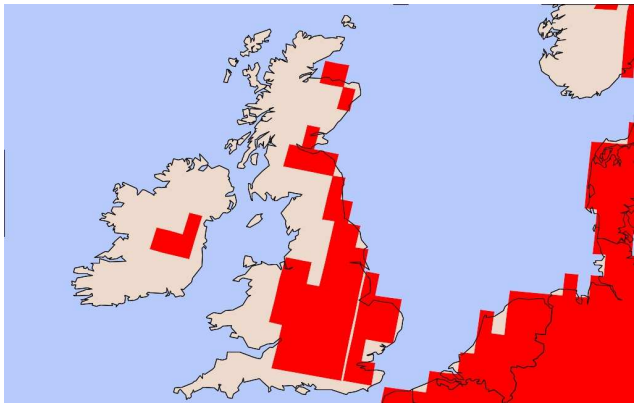
New threats associated with Toxin producing fungi

Another future threat to Scottish crops is Fusarium. This group of fungi produce toxins in the grain. They are a threat to animal and human health and show biological effects at low concentrations. Scotland is currently a low risk region for the causal fungus, but changes in the Scottish climate to warmer and drier summers will lead to an increase in these fungi. The biggest increase in risk will occur if maize becomes a popular crop in the rotation as it is the major risk factor for fusarium in cereals including wheat, barley and oats – the latter being an important component of baby food.

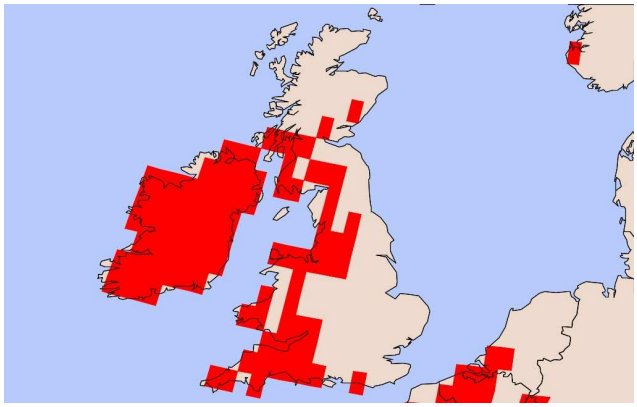
Examples of Fusarium mycotoxins include HT2, T-2 which causes nausea, vomiting, necrotic lesions in the mouth and throat making it difficult to eat, severe haemorrhaging and diarrhoea. Deoxynivalenol (DON) also known as vomitoxin can supress resistance to bacterial infections including Salmonella and Listeria
Zearalenone - causes reproductive disorder in pigs

There is a threat of an increase not only from changes in climate, but also through changes in the fungi. Fusarium species adapted to new Zealand would cause extensive damage to cereals grown in the west of Scotland if they became established.

The red area indicates regions conducive to toxin forming Fusarium species in 2050



Red areas indicate regions at risk from toxin forming Fusarium species from new Zealand in 2009

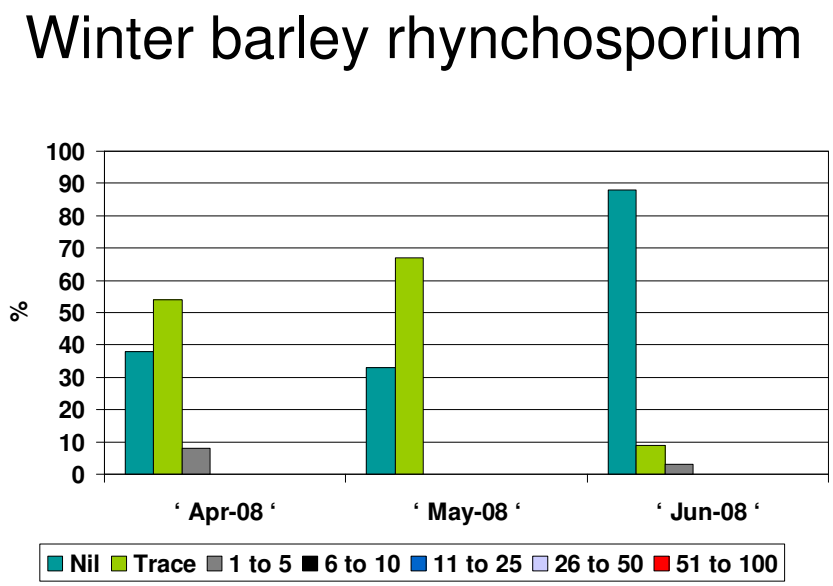


New threats from changes in seasonal weather

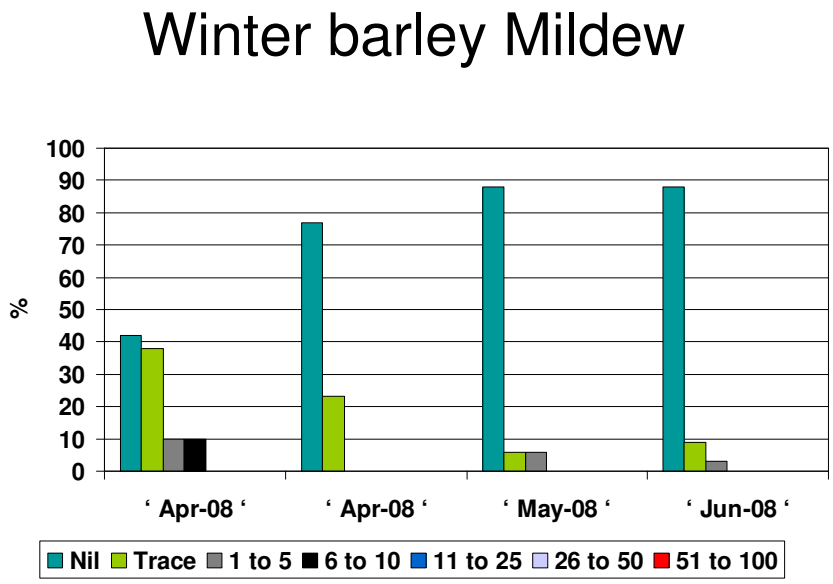
The recent wet autumn encountered in Scotland follows predictions of more rainfall in the autumn and winter under moderate climate change scenarios. We are already seeing crops suffer from stress in the dry spring as a consequence of poor rooting during the winter as a consequence of the wet conditions. Poor yields will be the result of this. Dry summers are another likely climate change scenario. Crop health issues associated with poor rooting in the wet autumn and winter will make the effects of drier summers more significant than initially anticipated. The ultimate consequence from this risk of poor crop health is a crop failure. This has implications at a local level whereby a grower will lose out financially. At a Scottish level, a substantial drop in yield will affect the viability of all cereal and animal enterprises, since a greater amount of food for animal and human consumption will have to be imported.

Comments on specific crops

Winter barley

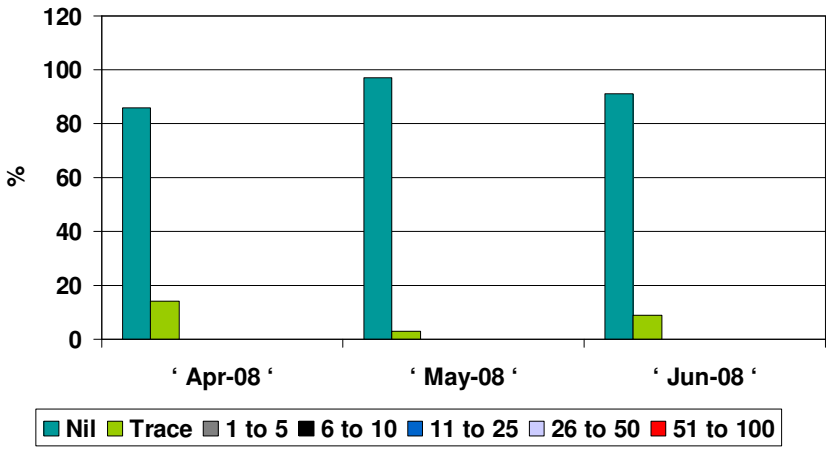


Rhynchosporium remains the most common disease of barley. Despite the dry spring, it was present in 70% of monitored crops in May. To date resistance to strobilurin fungicides (1st detected in France in 2008) has not been detected in Scotland.



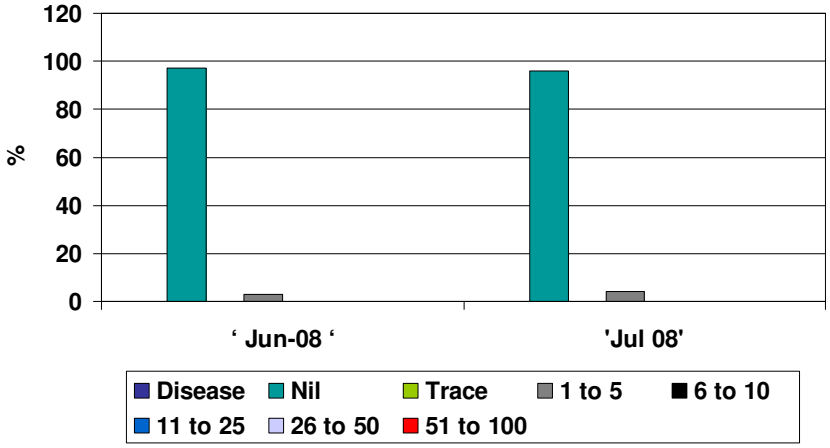
Powdery mildew was common in crops in April, but the number of cases was lower in May and June. In the current season, disease levels are low. The cold spring appears to have reduced the disease.

Winter barley net blotch



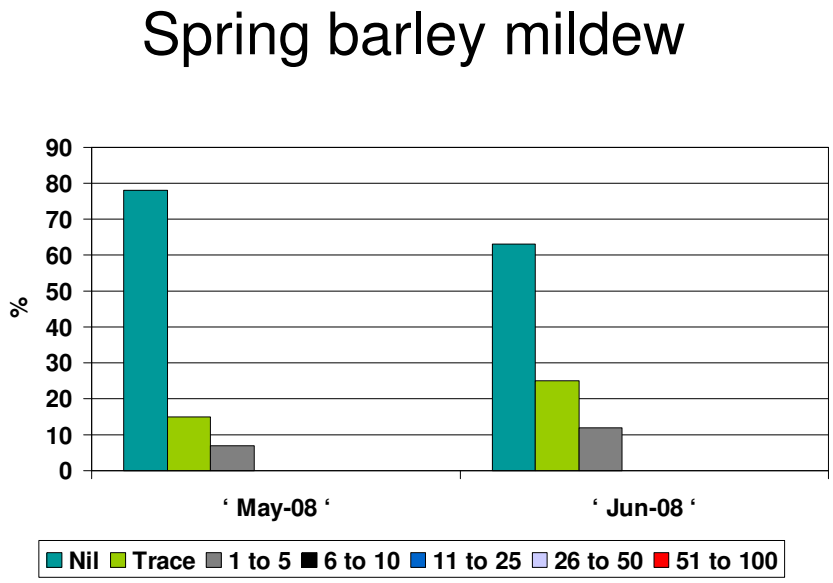
Net blotch remained at low levels. The increase in fungicide resistance to strobilurin fungicides may lead to an increase, but this has not yet been seen.

Winter barley aphids

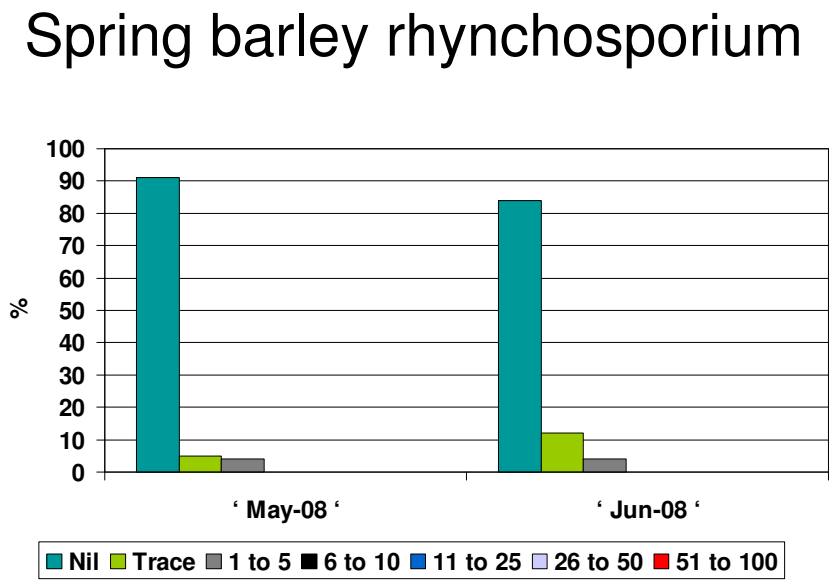


Aphids were reported, but the wet summer was not conducive to the pest. Levels of aphids will also be lower coming into the new season following on from a cold winter.

Spring barley

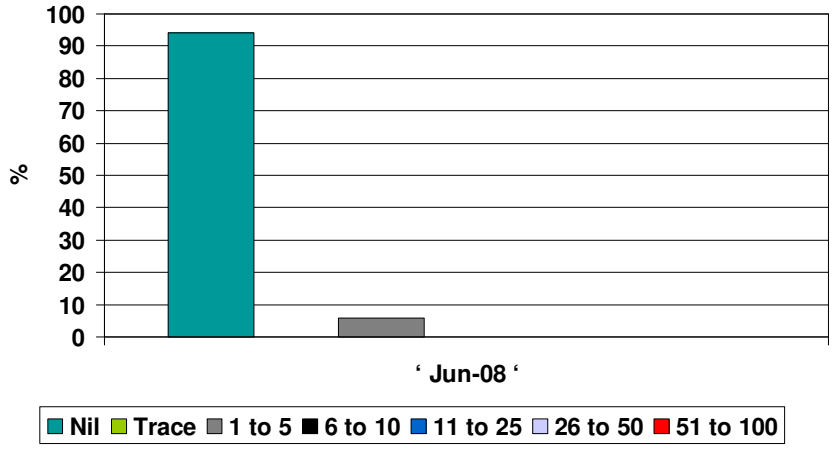


Powdery mildew levels were high in the early part of the season. The reliance on a few susceptible varieties for malting barley means there is little scope at present to make better use of resistant varieties.



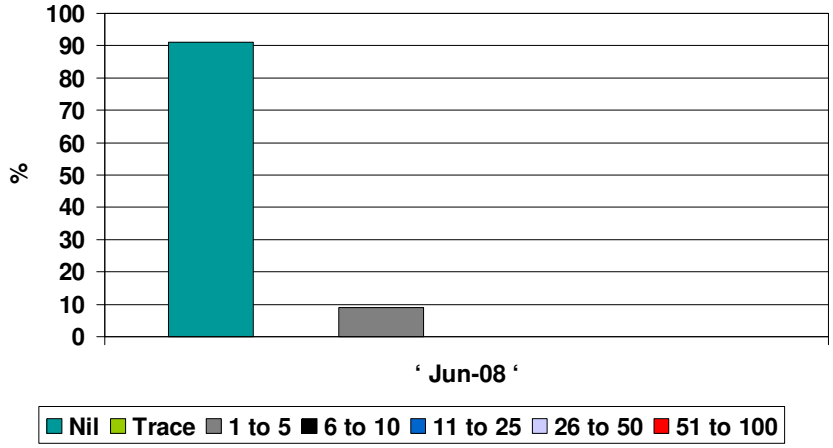
Rhynchosporium levels started to increase at the end of the season following on from the wet summer. The disease occurred too late to be a major issue.

Spring barley aphids



Aphid numbers were low as a consequence of the wet summer.

Spring barley cereal leaf beetle

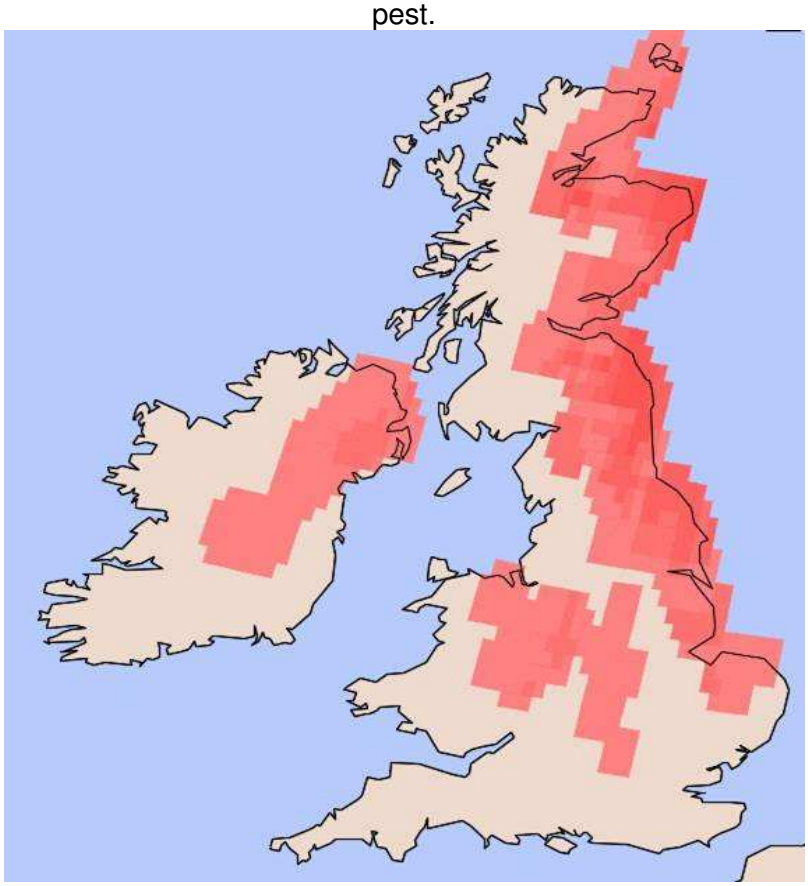


Cereal leaf beetle

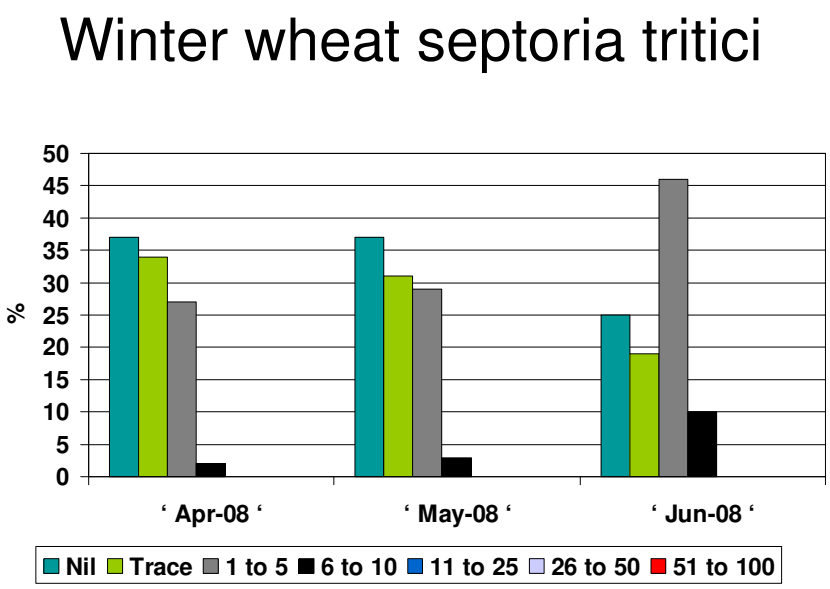
Cereal leaf beetle is an example of a relatively new pest in Scotland. Monitoring and use of weather climate models suggest this is a pest which will increase in importance in the future.

Cereal leaf beetle on barley plant

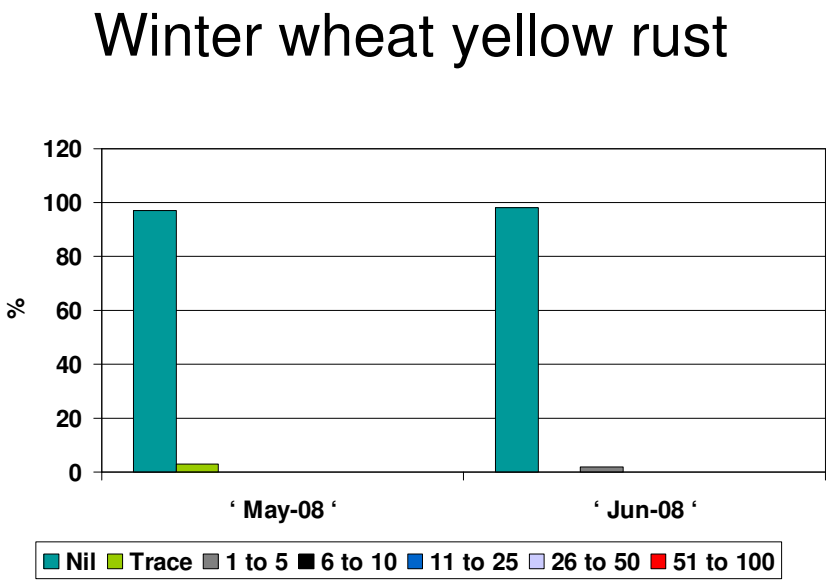
Climex model map (below) showing regions at risk for Cereal leaf Beetle in 2050 (in red). This model uses current crop intelligence from Adopt A Crop to determine the current incidence of the pest.



Winter wheat

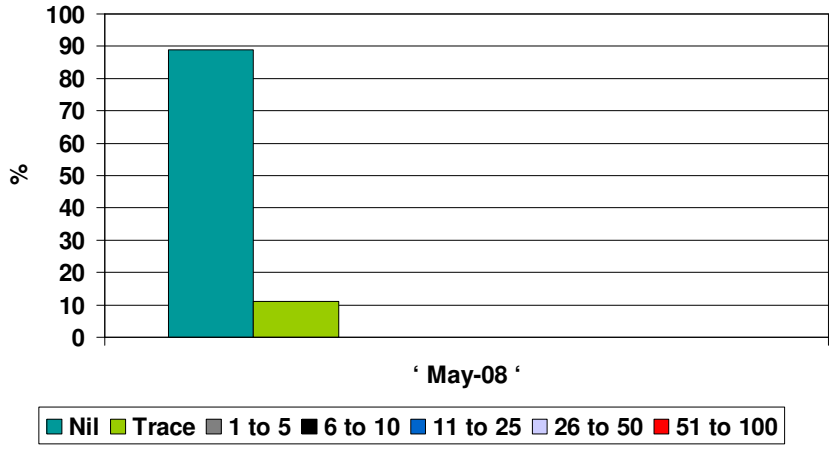


Septoria tritici remains the major disease threat of wheat. There are reports of strains less sensitive to fungicides in Eire in the December 2008. It is not clear if these are common in Scotland, but we will monitor the situation.



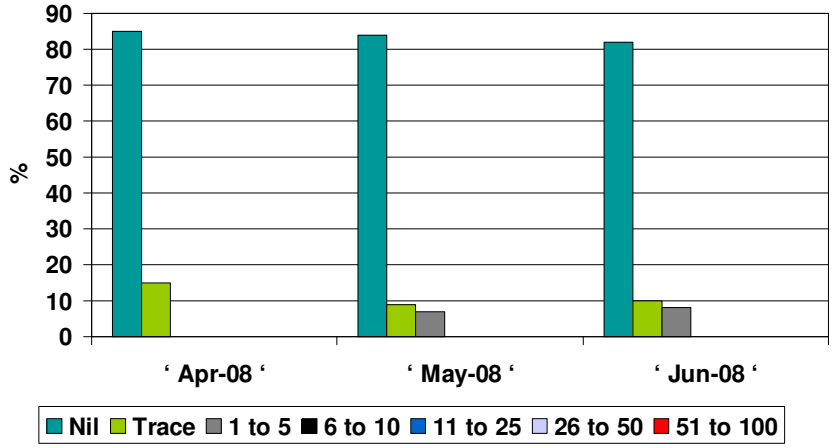
Yellow rust caused most damage in the susceptible variety Robigus early in the season. This variety is losing popularity due to its susceptibility to this disease.

Winter wheat brown rust



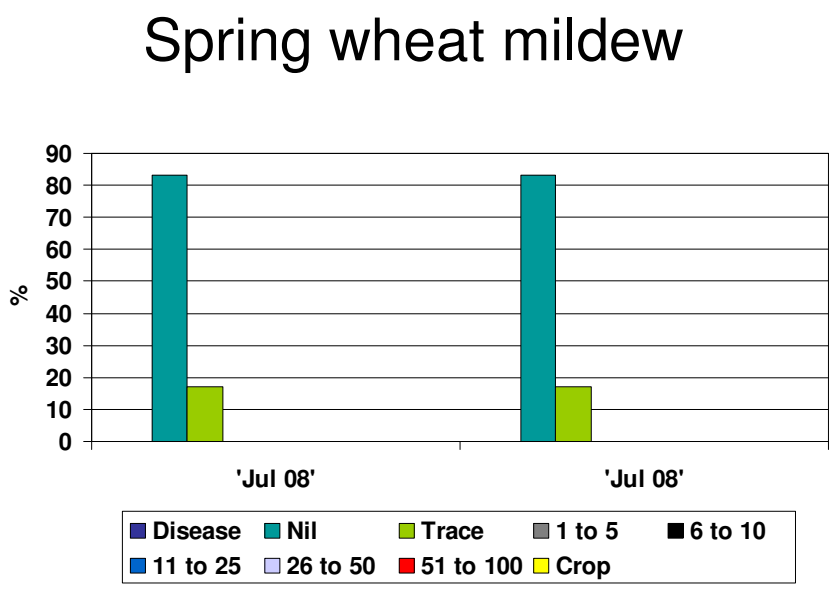
Brown rust levels remain low. This disease will become a greater threat if hot dry summers occur in the future. This has implications for the choice of varieties used in Scotland.

Winter wheat mildew



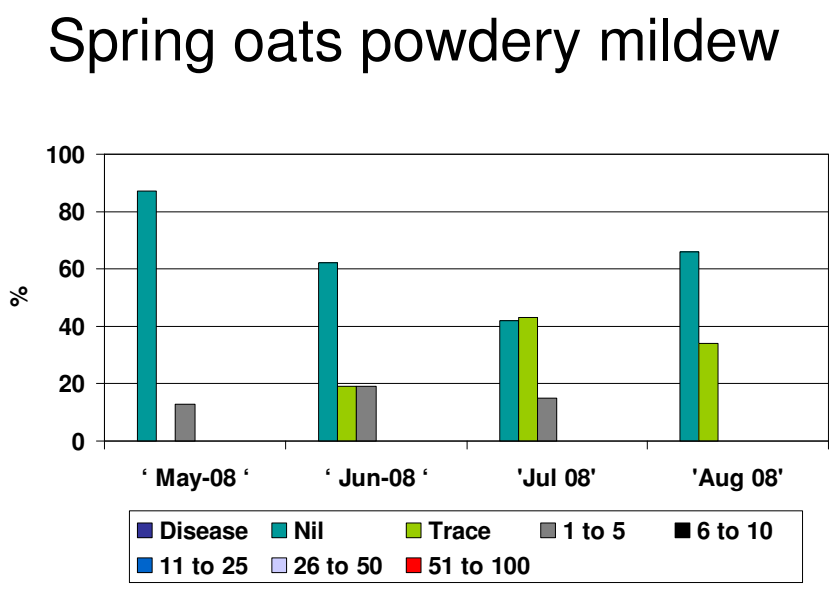
Mildew was present in 20% of crops in 2008. Levels remain highest in the Inverness region.

Spring wheat



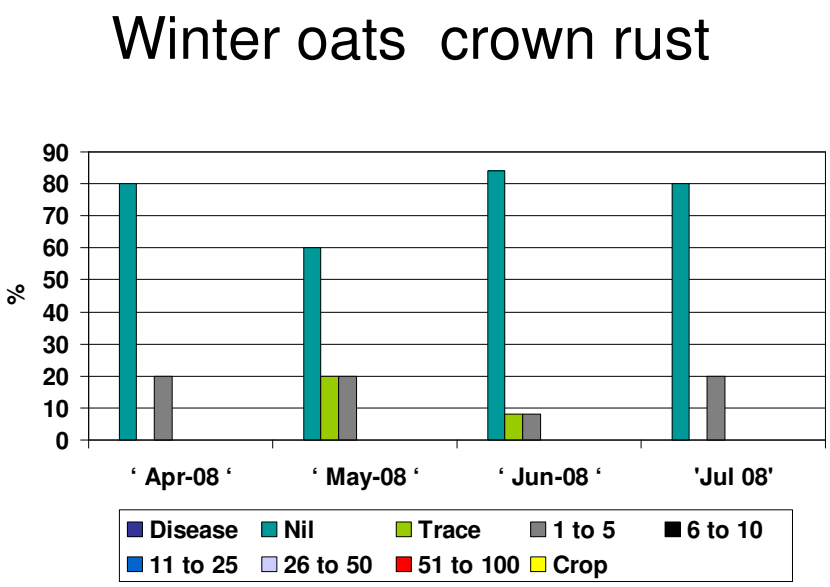
The most common disease in spring wheat was mildew

Spring oats



In spring oats, mildew is the most common disease which affected 60% of crops in July.

Winter oats



Crown rust was present in 20% of crops in June. Typically mildew is the most common disease to affect oats.

Cereal pests

Wheat bulb fly egg hatch was prolonged this season, with eggs still hatching in towards the end of March which caused problems for a few spring barley crops and also hit some winter wheat crops that had struggled throughout the winter. One crop of winter wheat near Stonehaven suffered from wheat shoot beetle damage in January/February followed by wheat bulb fly in March resulting in severe crop damage.

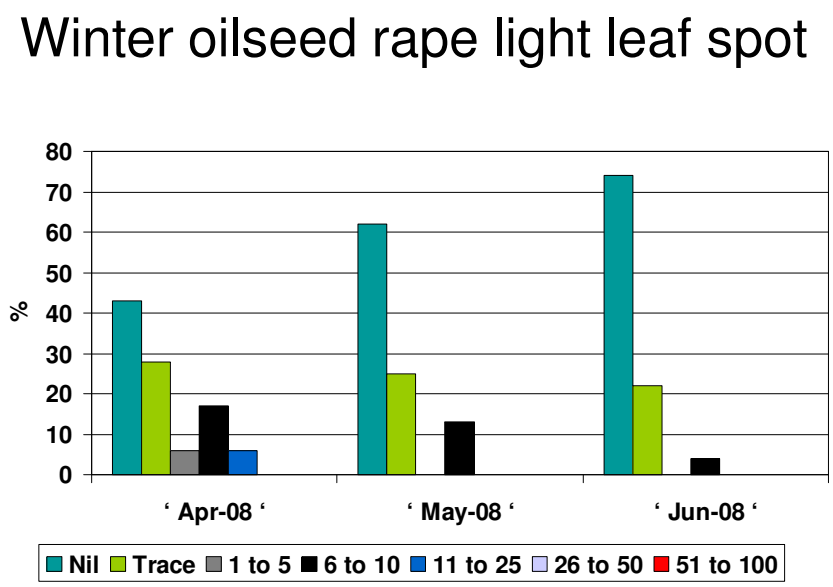
Free-living nematode damage was apparent in some crops of winter wheat and winter barley in February/March.

There has been an increase in reported problems from wireworm damage to cereal crops this season, with some cases of significant problems in spring barley crops. In at least two cases wireworms have been damaging crops where there has not been a history of grass being sown, suggesting that the so called 'arable' wireworm is not just a problem in England.

Leatherjacket populations have been increasing compared to last season, and this was translated into some problems in spring barley crops sown after grass this season.

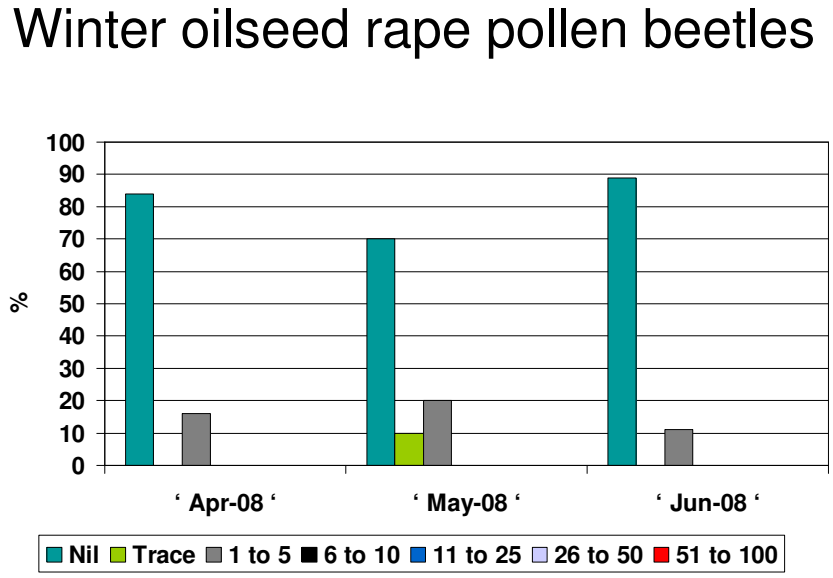
Slug damage continued from the autumn up to early spring in winter wheat crops, as the weather was favourable for slugs throughout the season. Issues regarding the stewardship of metaldehyde slug pellets and the potential for problems in water has led to many growers switching to methiocarb-based products.

Winter oilseed rape

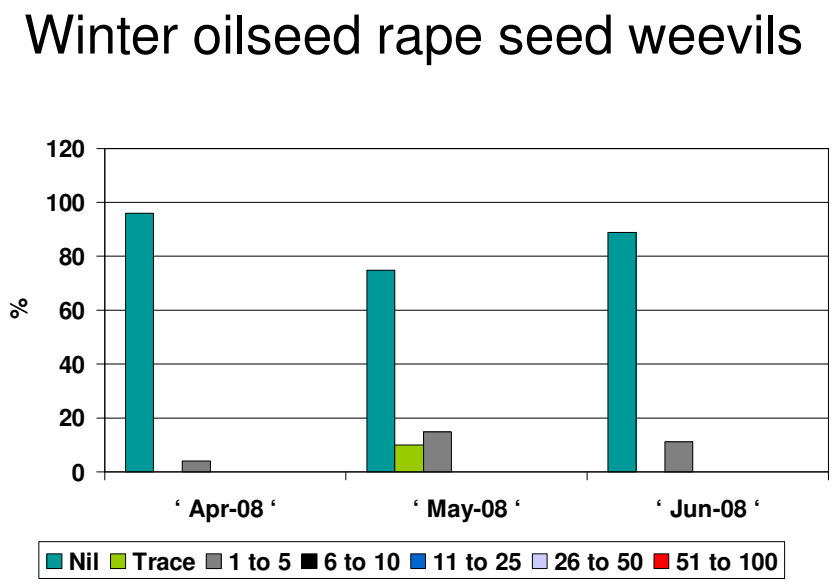


Light leaf spot was the main disease to affect winter oilseed rape. Controlling this disease with fungicides is becoming a greater challenge. Research using elicitors on cereals as part of the workpackage in barley diseases will be investigated on oilseed rape to see if it provides a way forward on disease control.

Oilseed rape pests

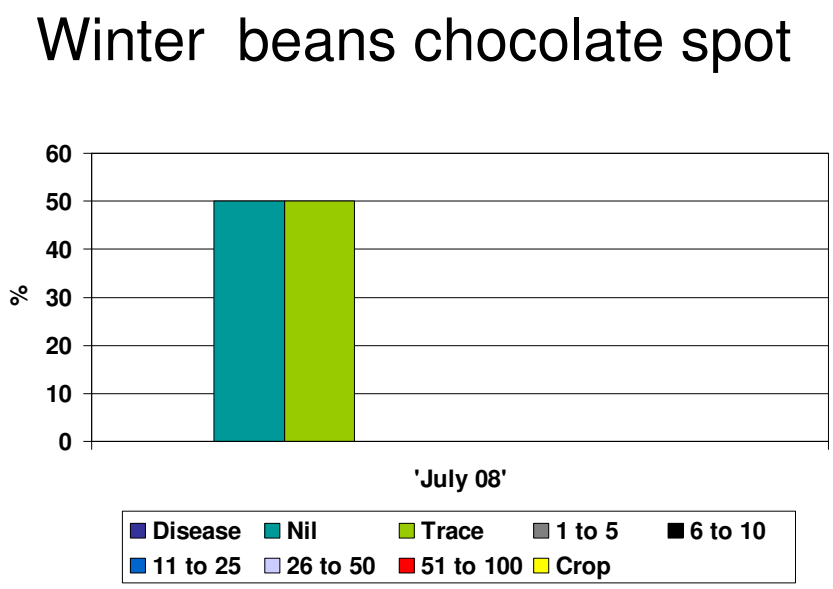


Pollen beetle numbers in winter oilseed rape have been relatively low, but will pose a threat to spring rape crops once they move off after flowering has ended on the winter crop. Advice given to growers and advisers on the potential threat of insecticide resistant pollen beetle seems to be heeded to date.



Rape winter stem weevil damage was down on previous seasons, as many growers are now applying an insecticide in the autumn to prevent egg laying. Whilst some untreated crops did show symptoms of damage, plant losses were not severe.

Winter beans



Chocolate spot remains the most common disease to affected beans. This disease is most common in a wet and humid season. For conventional cops a protectant fungicide is advised at the start of flowering. For organic crops, there is currently no approved fungicides. There is concern however that organic growers apply copper and sulphur in the hope this has some impact.

Example page of new website

Information on crop monitoring, technical notes and integrated crop management is available on the site. New information arising from HGCA research and workpackage 1.4 Barley pathology research is also available here.

Use of Adopt A Crop

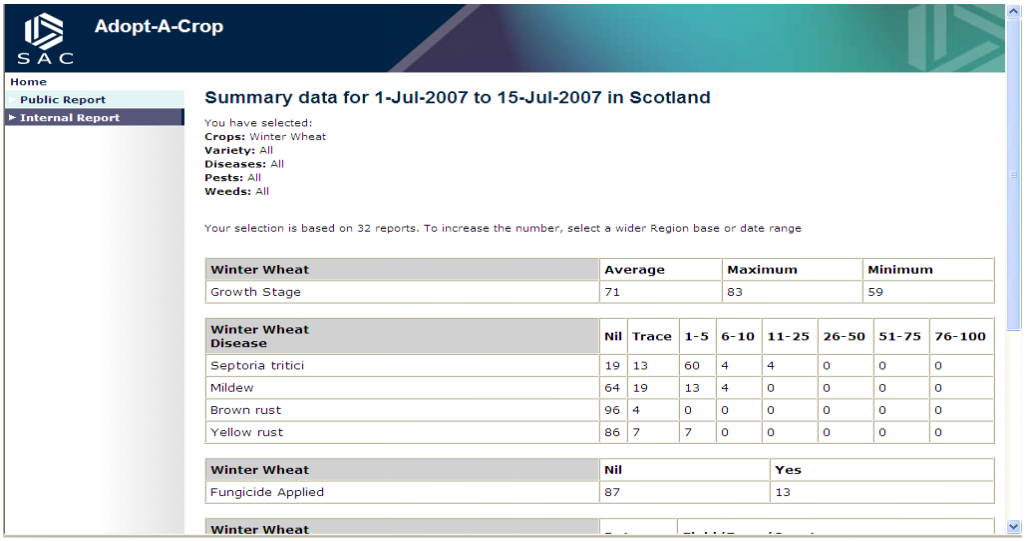
Adopt A Crop Data leading the way for climate change research

The current use of Adopt A Crop is to provide immediate risk warnings and to monitor new events. In this quarterly report, examples include fungicide resistance to rhynchosporium and Microdochium nivale.

The impact of pesticide changes as a consequence of changes to EU regulation 91/414 will also be monitored by Adopt A Crop. Information may provide evidence of situations where derogation will be required to prevent a potential outbreak of a pest.

The Crop Heath Advisory Activity is sitting on a gold mine of information to help forecast the impact of climate change on pests and diseases. Information on the growth and health of crops is collected and used immediately to keep the farming community aware of pest and disease outbreaks. The new pest and disease outbreaks always make the headlines, but over the years we have kept the information and developed the database and included information from treated and untreated field trials.

We now have a valuable resource for climate change research stretching back to 1983 which is already delivering some interesting insights into how crop development has changed over the past 25 years.



Winter Wheat	Average	Maximum	Minimum
Growth Stage	71	83	59

Winter Wheat Disease	Nil	Trace	1-5	6-10	11-25	26-50	51-75	76-100
Septoria tritici	19	13	60	4	4	0	0	0
Mildew	64	19	13	4	0	0	0	0
Brown rust	96	4	0	0	0	0	0	0
Yellow rust	86	7	7	0	0	0	0	0

Winter Wheat	Nil	Yes
Fungicide Applied	87	13

Adopt A Crop Database

The new database enables us to select years, regions and crops and compare crop growth and diseases. The beauty of the information is that each season is different, but we now have the tool to compare changes in the 1980s, 90s and the 21st century. It is also a key component of Workpackage research (1.4) on Barley Pathology and an integral component of risk forecasts being developed to minimise the use of pesticides.

This is a unique dataset in the UK. By having its roots as an advisory activity, Adopt A Crop continues to be a valuable tool to warn and advise on immediate pest and disease issues. As a future research tool and through linkages with weather data past, present and future, it will be integral to our understanding into how climate change is affecting cropping practices.

Changes in Crop development

The graph below shows crop development in spring barley on 21st June. Seasonal variation is demonstrated by the change in growth stage from one year to another. The trend is for crops to be more advanced now compared to crops grown over twenty years ago.

Yearly advance of 0.2 decimal units per year over the period 1983-2006
Based on data for 21 June