

**FACT SHEET**

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# Climate Change and Crop Pests, Weeds and Disease: A Concern for Today and Tomorrow?



Cranfa Amaethyddol Ewrop ar gyfer  
Datblygu Gwledig Ewrop yn Buddsoddi  
mewn Ardaloesoddi Gwledig.  
The European Agricultural  
Fund for Rural Development  
Europe Investing in Rural Areas



Llywodraeth Cymru  
Welsh Government

## Summary

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- The Welsh climate is predicted to get warmer, with wetter winters and drier summers.
  - There is great uncertainty over the effect of predicted changes in climate on the pest, weed and disease burden in Welsh crops. Some will increase and some will become less of a problem.
  - New 'alien' pests, weeds and diseases from outside of the country, could arrive and establish themselves.
  - Many familiar pests, weeds and diseases will become more problematic over the next 50 years due to localised climate change. However, some will become less of a problem.
  - There will be a need to increase pest, weed and disease forecasting and monitoring to detect and eradicate any sporadic introductions of new problems and to manage problems already present.
  - Changes in pest, weed and disease management will be required.
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# Climate change in Wales

Climate change is now an accepted phenomenon and its impact on Welsh agriculture will become more noticeable over the next 50 years. Wales is predicted to get warmer winters and summers, with an increase in winter rainfall but a decrease in summer rainfall, and with more extreme weather events. These changes in temperature and rainfall coupled with increases in carbon dioxide concentration will affect crops as well as the pests, weeds and diseases that live on or in them. Crop growth and yields may increase.

In addition to these predicted long-term trends it is also likely that there will be more examples of extremes of weather, and growing crops will be particularly vulnerable. Protracted drought is one example but another example is the prolonged and heavy rainfall of 2012, which brought particular difficulties to cropping operations and caused large reductions in yields. Wetter autumns are part of the longer term predictions so autumn planting operations could be particularly affected.



This fact sheet summarises how climate change is likely to affect the pests, weeds and diseases we currently see on Welsh crops such as aphids, rusts and grass weeds, and identifies the potential 'new' threats that can take advantage of the changed Welsh climate.

It uses predictions and forecasts for the Welsh climate in 2050 as the basis for the fact sheet. This information is derived from scenarios produced by the UK Climate Impacts Programme (UKCIP), the Intergovernmental Panel on Climate Change (IPCC) and the Climate Change Risk Assessment for Wales 2012.

Table 1: The likely changes in Welsh climate by 2050

Climatic variable	Likely change (UKCP09 Medium emission scenario)
Temperature	Warming of between 1.4-3.5°C. There will be more extremes of temperature in the summer and autumn, with fewer very cold days, especially in the winter.
Rainfall	Winter rainfall will increase by 2-31%. Summer rainfall will decrease by 17-36% although there is a small probability of a 6% rise at the highest end of projections.
Flooding	The area of land that floods once every three years will increase 3-4 fold.
Soil moisture	There will be a reduction in soil moisture with the soil moisture deficit projected to double.
Thermal growing season	This will increase in all areas allowing earlier sowing of crops to occur along with earlier harvests and increased potential for novel crops to be grown.

# Impact of climate change on crops

The change in climate over the next 50 years will see improvements in yield for some crops, but losses in others and opportunities for novel crops to be grown. Winter wheat yields are projected to increase by 6-20% by 2050 compared to the 1961-90 baseline. The crop may require more nitrogen as the crop canopies will be larger, and soil moisture will be an issue during the drier summer months.

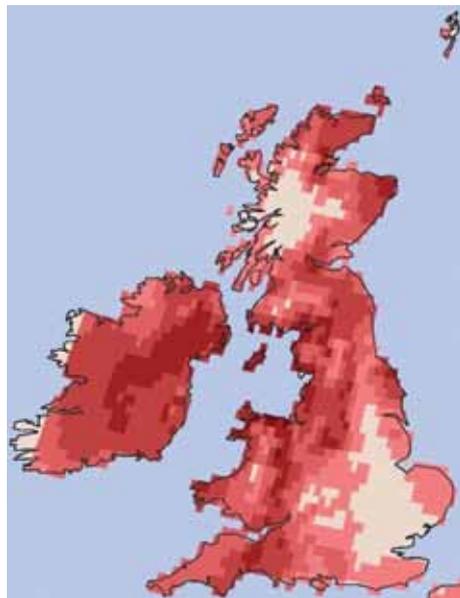
Warmer springs will lead to earlier sowings and potentially higher yields of potatoes (up to 13-16%), and even the possibility of double cropping. However, crops will need more irrigation and potato blight could be a problem earlier in the season if crops are sown earlier. Without irrigation, crop yields are projected to decrease by 2% by 2050.

There is likely to be an increase in many pest and disease problems including those not currently present in Wales (aliens) due to less 'winter kill', earlier appearance in the spring and summer, and more generations in a season. However, some pests and diseases will become less of a problem. Drought stressed crops will be more at risk from pests and diseases, and irrigation to thwart this will encourage some soil pests and diseases. Pesticides, crop adaptation and plant breeding may circumvent problems to some extent, but pests, weeds and diseases are very resilient and will adapt to new climatic niches. There will be changes in use of pesticides on crops through earlier use, and the dry summer and wet autumn conditions will limit their efficacy to some extent.

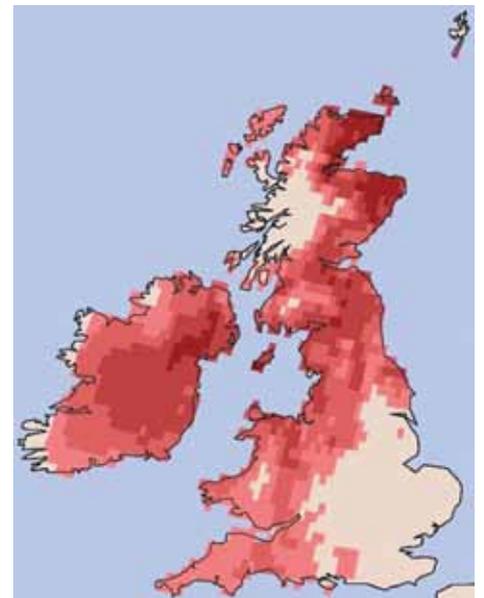
# Diseases

There is much uncertainty over the likely impact of climate change on crop pathogens. Changing crop practices, for example, the introduction of new crops or switches between spring and winter cropping are likely to have more influence than climate change as such. By looking at pathogens that are already problems in warmer climates we can make some predictions about likely problems in Welsh crops.

Fig. 1: Distribution of Brown Rust currently (left) and predicted climate in 2050 (right).



Brown Rust currently



Brown Rust 2050

### Wheat brown rust

Wheat brown rust (*Puccinia recondita*) is an example of a common pathogen of a major crop which is favoured by warm conditions. It is a major disease threat to crops in East Anglia, but until recently, has caused minimal economic damage in Wales. Although it is projected to move northwards into cooler climates, detailed modelling shows that it will actually decrease slightly in Wales. Agronomic factors could override this relatively subtle effect of temperature in decreasing the brown rust pressure. Early sowing as may happen in a warmer climate with early harvests means there is no gap between cropping seasons, providing the fungus with a green bridge to survive from one season to another.

### Fusariums

Head blights including *Fusarium* species are not uncommon in Wales today. They reduce seedling emergence and are additionally problematic as some produce mycotoxins. *Fusarium graminearum* poses the greatest threat as a mycotoxin producer in mainland Europe, but is currently not common in Wales. A future forecast shows a greater risk in the future throughout the east of Wales.

A change in climate may also allow different crop species to be grown and this may increase the probability of the sowing of crops which are more susceptible hosts. For example, growing maize in the rotation is a known risk factor for *Fusarium* production in cereals, and a change to milder weather will increase the chances of more maize being grown in Wales, and hence increase the risk of *Fusarium graminearum* and the mycotoxins associated.

Fusarium on barley



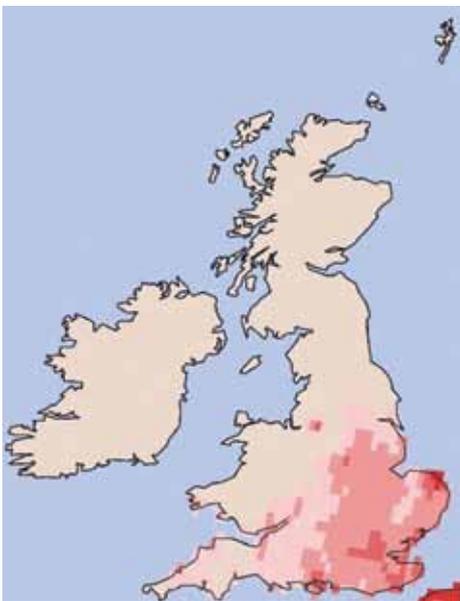
## Pests

The impact of climate change on pests of crops is driven by the response of insects to temperature and carbon dioxide. Some pests such as cereal aphids will reproduce more rapidly at the elevated carbon dioxide levels forecast for 2050, and temperature increases will accelerate the rate of multiplication even further, allowing more generations per season (up from 18 to 23 for some aphid species) and earlier infestation of crops in the spring and autumn. This inevitably has consequences for the crops that aphids infest, particularly for crops such as seed potatoes and cereals where virus transmission by aphids is a potential threat. Increases in the rate of reproduction and the number of generations a season will also increase the risk of certain pests becoming resistant to insecticides.

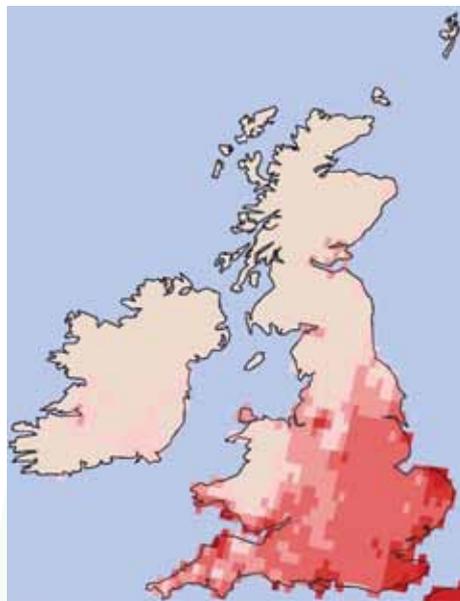
We are already seeing 'new' pest problems arising in Welsh crops which are, in part, in response to climatic changes: cabbage stem flea beetle in winter oilseed rape and gout fly in cereals for example. Some pests such as wheat bulb fly will decrease in severity, as the wetter winters will lead to a higher level of winter kill, making areas where the pest is currently endemic unsuitable for its survival. This increase in winter rainfall will make Wales more favourable for the survival of grey field slugs, however; the predicted reduction in summer rainfall will mitigate this to some extent.

The threat from 'alien' pests not yet in the UK is increased as the Welsh climate will become more suitable for these pests to survive and breed. For example, the climate in wide areas of Wales will be suitable for Colorado beetle survival by 2050 should it be introduced.

Fig. 2: Potential distribution of Colorado beetle under average climate for the last 30 years (left) and predicted climate in 2050 (right).



Colorado Beetle in Wales currently



Colorado Beetle in Wales 2050

The darker the shade of red, the more suitable the climate will be for Colorado beetle survival and reproduction.

## Weeds

Black-grass

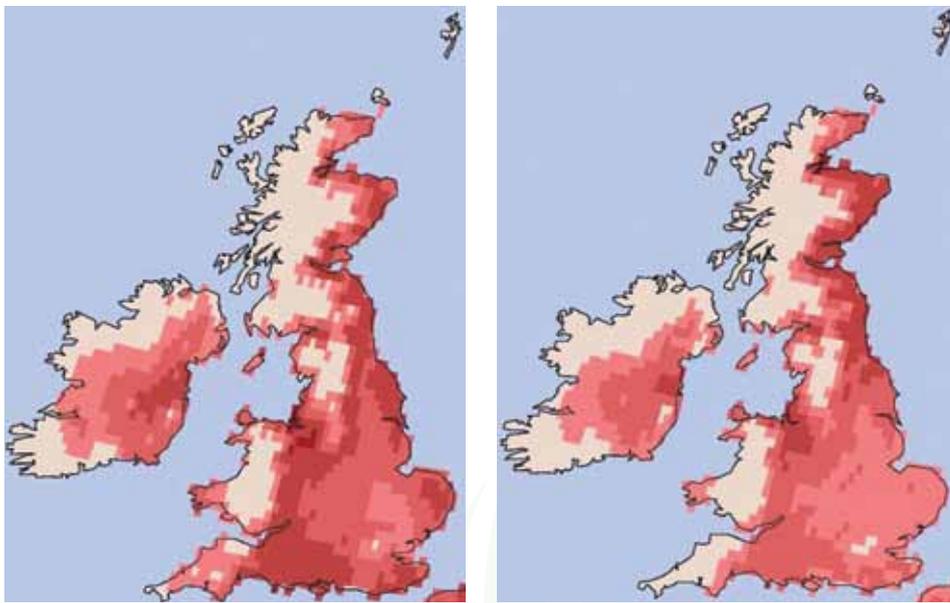


In this section we examine the potential changes in weed populations related to predicted climatic changes up to 2050 using known differences in weed species and populations between south-east England and western European mainland and arable areas of Wales.

There is an increasing trend in winter-based rotations towards grass weed problems such as sterile/barren brome (*Anisantha* or *Bromus sterilis*), and meadow-brome (*Bromus hordeaceus*). This would be particularly evident on heavier soils. Black-grass is very problematic in England and is currently present in Wales in the Vale of Glamorgan. Surprisingly, the climate model, suggests a reduction in black-grass (*Alopecurus myosuroides*) in Wales by 2050 (Fig. 3). It is unclear why this should happen, but may be related to dry summer predictions. Some of the brome species are warmer, drier climate species, and may be expected to increase: these include meadow brome, rye-brome (*Bromus secalinus*) and soft brome (*Bromus mollis*).

Examining grass weeds from warmer zones of Europe there are suggestions that barnyard grass (*Echinochloa crus-galli*) and crab-grass (*Digitaria sanguinalis*) could become important in the UK as well as annual rye-grass (*Lolium annua*) in the longer term. These weeds are more likely to cause problems in spring-sown crops such as maize, and certainly more extensive maize growing could be possible in Wales by 2050. Other grass weeds that are problems in south western France, which currently has a warm, moist climate, could also become problems.

Fig. 3: Potential distribution of black-grass under average climate for the last 30 years (left) and predicted climate in 2050 (right).



Black-grass currently

Black-grass 2050

Some weeds currently problematic in Welsh winter crops, such as annual meadow-grass (*Poa annua*), common chickweed (*Stellaria media*) and ivy-leaved speedwell (*Veronica hederifolia*), may not survive long into warm dry springs. On the other hand, cleavers (*Galium aparine*) would still be a problem and poppies (*Papaver species*) and various umbellifers and weedy crucifers may become more serious, even in the medium term.

In spring crops, more field bind-weed (*Convolvulus arvensis*), scarlet pimpernel (*Anagallis arvensis*) and various composite species (*Compositae*) would be expected to increase. Some species such as pigweeds (*Amaranthus species*), already seen in south eastern England as new species, may become important. Other species, common in parts of continental Europe, such as thornapple (*Datura stramonium*) and black nightshade (*Solanum nigrum*), are serious and poisonous weeds in grain, vegetable and salad crops, and may become important.

# How can we prepare for the effects of climate change?

- Growers should monitor crops carefully for novel and endemic crop problems.
- Both the incidence and severity of crop problems should be used to customise control programmes.
- Growers should consider the impact of management decisions across the whole rotation and not just within a cropping year – for example an increase in winter cereals may impact on the expense of grass weed control over the longer term. Similarly introducing maize may increase the risk of ear diseases in other cereal crops.
- Great care should be taken when moving either soil or plants (either as whole plants, cuttings or seeds) to reduce the chances of introducing species not currently present. Use certified stock where possible and ask for information on the provenance of the parent or mother stock.

**Authors:** Mark Ballingall, Andy Evans and Fiona Burnett, SAC

## Contact

For more information on Farming Connect services and events, contact us:

### PHONE

01970 636565

### E-MAIL

farmingconnect@  
menterabusnes.co.uk

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