PLANTS POINT WAY TO COPE WITH CLIMATE CHANGE

Roses flowering in December and snow-free ski resorts this winter suggest that climate change is already with us and that our farmers and growers need ways of adapting.

Scientists funded by two United Kingdom research councils are studying how plants have naturally evolved to cope with the changing seasons of temperate climates and have made a discovery that could help us to breed new varieties of crops, able to thrive in a changing climate.

The importance of the discovery is that it reveals how a species has developed different responses to various climates in a short period.

Researchers at the John Innes Centre have been examining how plants use the cold of winter to time their flowering for the relative warmth of spring. This process, called vernalisation, varies even within the same plant species, depending on local climate. In Scandinavia, where winter temperatures can vary widely, the model plant, Arabidopsis has a slow vernalisation response to prevent plants from being "fooled" into flowering by a short mid-winter thaw.

One particular gene, named FLC, delays flowering over the winter, and the research team discovered how cold turns off FLC and what keeps it off during growth in spring. In the UK, plants only need four weeks of cold to inactivate FLC, allowing plants to start their spring flowering early.

Arabidopsis plants in Sweden have a mechanism that requires 14 constant weeks of winter cold before FLC is stably inactivated. This prevents the plants flowering only to be hit with another month of harsh winter weather.

The research leader at the John Innes Centre (JIC), Professor Caroline Dean, said: "We studied levels of the FLC gene in Arabidopsis plants from different parts of the world expecting to find regional variations that correlated with how much cold was required to switch off FLC. We discovered that FLC levels in autumn and the rate of reduction during the early phases of cold were quite similar in Arabidopsis plants from Edinburgh and northern Scandinavia.

"However, we found big variations in how much cold was required to achieve stable inactivation of FLC. FLC was stably silenced much faster in Edinburgh than it was in northern Scandinavia and a genetic analysis showed that differences in the FLC gene contributed to this variation."

Professor Dean added: "It looks like the variation in this mechanism to adapt the timing of flowering to different winter conditions has evolved extremely quickly. We hope that by understanding how plants have adapted to different climates will give us a head-start in breeding crops able to cope with global warming."

The JIC scientists worked in collaboration with a team at the University of Southern California and were funded by the UK's main public funders of biological and environmental sciences, the Biotechnology & Biological Sciences Research Council (BBSRC) and the Natural Environment Research Council.

Professor Julia Goodfellow, BBSRC chief executive, commented: "As well as working to prevent climate change we need to be able to harness natural methods to adapt food crops to cope with changed and hostile climates around the world. This is an example of how basic science can make a practical difference."

This research features in a recent issue of BBSRC Business, the quarterly research highlights magazine from the Biotechnology & Biological Sciences Research Council.

The John Innes Centre in Norwich, eastern England, is an independent, world-leading research centre in plant and microbial sciences with more than 800 staff.

JIC is based on Norwich Research Park and carries out high quality fundamental, strategic and applied research to understand how plants and microbes work at the molecular, cellular and genetic