DEFRA WHEAT PROJECTS

List of Projects: click on the title to get further information on the project

Information on these projects can also be found on the Defra Science Search website:
http://randd.defra.gov.uk/Default.aspx?Location=None&Module=FilterSearchNewLook&Completed=0

FO0301: Monitoring risks of mycotoxin contamination caused by Fusarium headblight pathogens of winter wheat

Objectives:
1. To measure the seasonal and regional incidence and severity of fusarium head blight (FHB)/stem base pathogens likely to cause mycotoxin contamination in conventionally grown winter wheat and to monitor the influence of crop protection practices on annual disease levels.
2. To identify the toxigenic potential of the Fusarium species responsible for disease symptoms and to monitor seasonal and regional distribution.
3. To investigate annual build-up of FHB pathogen inoculum through additional monitoring at selected survey sites.
4. To facilitate sampling of surveyed fields at harvest to supply grain samples for the FSA fusarium mycotoxin investigation.
5. To quantify the potential risks from FHB in causing mycotoxin contamination of grain.
WEBSITE: none

LK0958: Identification of genetic markers for lodging resistance in wheat:

Scope for continuing to reduce lodging risk by further shortening wheat crops will be limited because the more extreme dwarfing genes appear to be incompatible with high yields. Exploiting the wide genetic variation in stem and anchorage strength would significantly increase lodging resistance, but breeders have not improved these characters because they are very time-consuming to measure. Therefore selection for improved strength would be greatly assisted by the use of DNA markers; however, the genetic basis of these traits has never been investigated in elite UK winter wheat. This project will identify genetic markers for the traits that underlie stem strength and anchorage strength in two doubled haploid populations, derived from crosses involving elite UK winter wheat varieties.
WEBSITE: none

LK0959: Genetic Reduction of Energy use and Emissions of Nitrogen in cereal production, GREEN grain

GREEN grain (2004-2009) is a large LINK project sponsored by Defra and SEERAD in collaboration with HGCA, Syngenta, Scottish Crop Research Institute, Scotch Whisky Research Institute, Wessex Grain, Grampian Country Foods Group, FOSS UK Ltd and Nottingham University. The project has the combined aims of genetically reducing the nitrogen emissions and growing costs of wheat production whilst enhancing the value of wheat grain for the bioethanol and grain distilling industries, for pigs and poultry and for other markets. The project seeks to achieve these goals by identifying wheat genotypes with minimal nitrogen storage in the stems, and reduced gliadin protein in the grain.
WEBSITE: http://www.adas.co.uk/projects/green_grain.html

LK0969: Assessment of wheat blossom midge risk and exploitation of resistant and tolerant varieties

The preceding LINK project (LK0924) "Integrated control of wheat blossom midge" exceeded expectations by identifying pest resistance and several sources of tolerance within elite UK plant breeding lines. In addition, pheromone traps were developed with the potential to identify fields at risk from the pest. This resistant material is currently restricted to feed wheat varieties and will not be available in the short-term due to the need to scale up stocks. To satisfy demand, particularly for higher quality markets, tolerant and susceptible varieties will still be grown by many farmers. Orange wheat blossom midge, which caused widespread damage and insecticide use in 2004, continues to be a major and repeated threat, although risks vary between season, locality and individual crop
The aim of the new LINK project (LK0969) is to develop robust IPM strategies for farmers using varieties resistant, tolerant or susceptible to wheat blossom midge, by establishing new technologies for risk assessment and the use of pheromone traps to determine need for and timing of insecticide treatment, and to identify genes for resistance/ tolerance for further breeding.
Building on LK0924 will provide a basis for plant breeders to combat the wheat blossom midge problem, for milling as well as feed varieties, in the longer term. A short to medium term solution is also required as wheat blossom midge is considered a recurrent and destructive pest against which insecticides are routinely used. This can be achieved by developing IPM strategies based on pest

monitoring and rational pesticide use for the susceptible varieties still needed to meet market demands. Addressing both long and short term solutions to the wheat blossom midge problem will involve determining the mechanisms that confer tolerance/resistance and the differential attractiveness between varieties; an understanding of wheat blossom midge behaviour, host selection, movement within the landscape; and an investigation of optimal number and placement of pheromone traps.
WEBSITE: http://www.rothamsted.bbsrc.ac.uk/bch/CEGroup/wheatBlossomMidge.html

LK0970: Sustainable Production of Organic Wheat
The main aim of the project is to use an ecological approach to analyse the interactions of a range of key variables in organic wheat production (wheat genotype, spatial arrangement of seed, seed density, wheat/white clover inter-cropping and weeding), so as to determine an optimal approach to improved and stabilised production.
WEBSITE: http://www.efrc.com/?i=articles.php&art_id=147&go=Articles

LK0973: Development and evaluation of low-phytate wheat germplasm to reduce diffuse phosphate pollution from pig and poultry production units
Development of UK adapted wheat lines and tools for marker assisted breeding of Low-Phytate Wheat, which will have the potential to significantly reduce diffuse phosphate pollution from pig and poultry production units. In addition, the effect of P fertiliser treatment on the P metabolism within the wheat plant and grain and on the grain composition of other important nutrients and micronutrients, will also be determined.
WEBSITE: none

LK0974: Biofortification of wheat with selenium to increase human dietary intake
This project tests the hypothesis that the Selenium levels of UK wheat can be increased through agronomic biofortification and plant genotype selection.
Selenium biofortified wheat will add value to UK grain, bread products and morning goods thereby providing the potential to significantly increase the dietary intake of selenium and hence improve human health.
WEBSITE: none

LK0975: An Integrated Approach to Stabilising HFN in Wheat: Screens, Genes & Understanding
The Hagberg Falling Number (HFN), a measure of the á-amylase content of flour made from harvested grain, is a major quality trait in wheat. HFN is currently sensitive to a number of environmental conditions that reduce the quality of grain and make it unsuitable for bread-making, resulting in severe financial losses: in 2004, only 27% of the wheat crop grown for bread-making was of acceptable quality [1], with an estimated loss to farmers of £100 per acre of wheat grown [2]. The increased unpredictability of weather conditions associated with global climate change suggests that low HFN will be an even greater problem in the future. Consistency in HFN values under a range of climatic conditions is therefore a primary target for the improvement of wheat varieties used in the UK: at meetings of the Defra Wheat Genetic Improvement Network (WGIN), British wheat breeders identified the 'Hagberg problem' as their top priority for research.
WEBSITE: none

LK0980: Reduction in diffuse pollution of poultry operations through selection of wheat cultivars of high and consistent nutritional quality.
The UK poultry industry produces 100,000 tonnes of Nitrogen and 90,000 tonnes of phosphate per year. A 3 percentage unit improvement in diet digestibility would reduce this amount by 7000 tonnes of Nitrogen and 6000 tonnes of phosphate. This equates to a reduced land requirement of 28000 hectares for Nitrogen disposal (assumes maximum Nitrogen application of 250 Kg total N per ha.). Associated with this is the production of ammonia-N by the poultry sector amounting to some 43.7 kT

per annum. Therefore, improved nutritional value of wheat will, by definition, lead to reduced excreta output and lowered environmental impact. Wheat quality, or more specifically its metabolisable energy (ME) value and starch digestibility, is far from constant, and has been reported to vary by as much as 5MJ/kg (from 10 to 15MJ ME/kg) for poultry. This variation is unacceptable and is transferred into variation in bird performance, increasing the proportion of birds that fall outside the weight range that attracts a premium price, the net result of which is a reduction in profitability. Such variability mitigates against the continued use of high levels of wheat in UK broiler diets and the feed industry is actively seeking alternative, more reliable raw materials.
WEBSITE: none

LK0986: Improving water use efficiency and drought tolerance in UK winter wheats

Project Objectives:
1)   Evaluation of the relative drought tolerance of current varieties using multi-location variety trial data (breeders' trials and Recommended List [RL] Official variety trials).
2)   Assessment of genetic diversity for water use efficiency (WUE), drought tolerance and drought-related physiological and morphological traits in a large panel of diverse UK lines grown under controlled field drought conditions.
3)   Genotype lines that contrast in responsiveness to water supply using markers for key targets that may affect drought tolerance and WUE.
WEBSITE to be launched in 2009

LK0990: Predicting grain protein to meet market requirements for breadmaking and minimise diffuse pollution from wheat production

This project aims to improve the efficiency of decision making with respect to applications of fertiliser N to wheat. It will use a crop modelling approach, combined with NIR sensing of crop N content between GS 61-73, to predict final grain protein and yield. This will allow growers to target inputs of late applied foliar urea to crops. The aim will be to identify those crops not requiring FU, thereby saving costs; and similarly, those crops where application of FU would be advantageous in meeting the market requirements of 13% protein. The project will test the prediction system with 60 commercial growers over three seasons. Samples will be collected by growers and delivered to two central locations (grain cooperatives) equipped with NIR machines. Specific experimentation will be carried out to test the underlying hypotheses used in the model regarding physiological aspects of nitrogen partitioning within the crops. Field experiments will generate reference samples to improve the underlying NIR calibrations for N and moisture in immature material, developed during the previous MALNA LINK project.
WEBSITE: none

LK0992: Adapting wheat to global warming

ERYCC (2007-2011) is addressing the threat of global warming to UK wheat production. The consortium is typing wheat germplasm for sources of earliness and other yield resilience traits. They are then creating three publicly available mapping populations to enable tests (in subsequent research) of how these traits can best be combined through future plant breeding. Yield-determining traits are being identified in current varieties and inter-related quantitatively, to indicate to breeders and the industry how to adapt UK wheat.
WEBSITE: http://www.adas.co.uk/projects/erycc.html

LK0999: Adaptive winter wheat populations: development, genetic characterization and application

Significant markets for low-input cereals are emerging to satisfy demands for more environmentally friendly food and achieving government targets that require a 20% reduction in CO_2 emissions. Over recent years there has been a 30% increase in organic grain consumption, but the organic arable land area has remained relatively static over the same period. The major shortfalls in low input production are in both yield (4 to 5 t/ha modal range) and quality, and are principally the result of a lack of

appropriate varieties. Current inbred line wheat cultivars have not been selected for low-input conditions, which are often highly variable and likely to become more so with climate change. Greater stability and improved wheat crop performance can be achieved by increasing the genetic diversity of the crop. A possible effective solution is to use Composite Cross Populations (CCPs) of segregating offspring from a wide range of parents specifically selected for mixed performance. By exposing populations in successive years to different environments, it is possible to select for effective buffering against variation in performance. This project will build on previous work which exploits wheat populations developed for low-input conditions (Defra funded project AR 0914) which have performed well under both organic and non-organic trial conditions, demonstrating a greater ability than their parents to yield well in both low and high yielding environments. This proposal aims to further quantify the degree and processes of adaptation in these wheat populations, using a combination of genetic analyses and field experiments, to direct and deliver the concept through participatory interactions among scientists, farmers and processors.

WEBSITE: http://www.efrc.com/?i=articles.php&art_id=321&highlight=wheat