



Cereals in Practice

4pm-8pm 2012
Tuesday 3 July

Programme



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Welcome to Cereals in Practice 2012

Cereals in Practice (CiP) is a unique event, bringing variety trials and research together in one place. It combines the James Hutton Institute's former cereals event, Cereal Solutions, with the SAC Angus/Perthshire Agronomy Centre wheat and barley variety and management trials, to create a must-attend event for anyone interested in cereal farming and associated industries.

CiP attracts a wide range of visitors including farmers, agronomists, cereals industry representatives and scientists working with cereals.

With arable farmers coming under pressures from both home and abroad it is important the industry takes advantage of all the new technologies to remain competitive. Cereals in Practice aims to be the premier knowledge transfer event in the North of the UK combining scientific innovation with practical take home messages.

We would like to welcome you to the fourth Cereals in Practice event. We are convinced you will find much to enlighten and inform you and this will lead to improved performance in your business.

Please note that many of the demonstrations and plots on show today are research in progress.

Programme

- 4.00pm** Welcome and introductory talks.
- 4.30-7.30pm** Guided Tours of the plots.
- 7.30pm** Prize draw for a bottle of whisky kindly donated by SSCR.

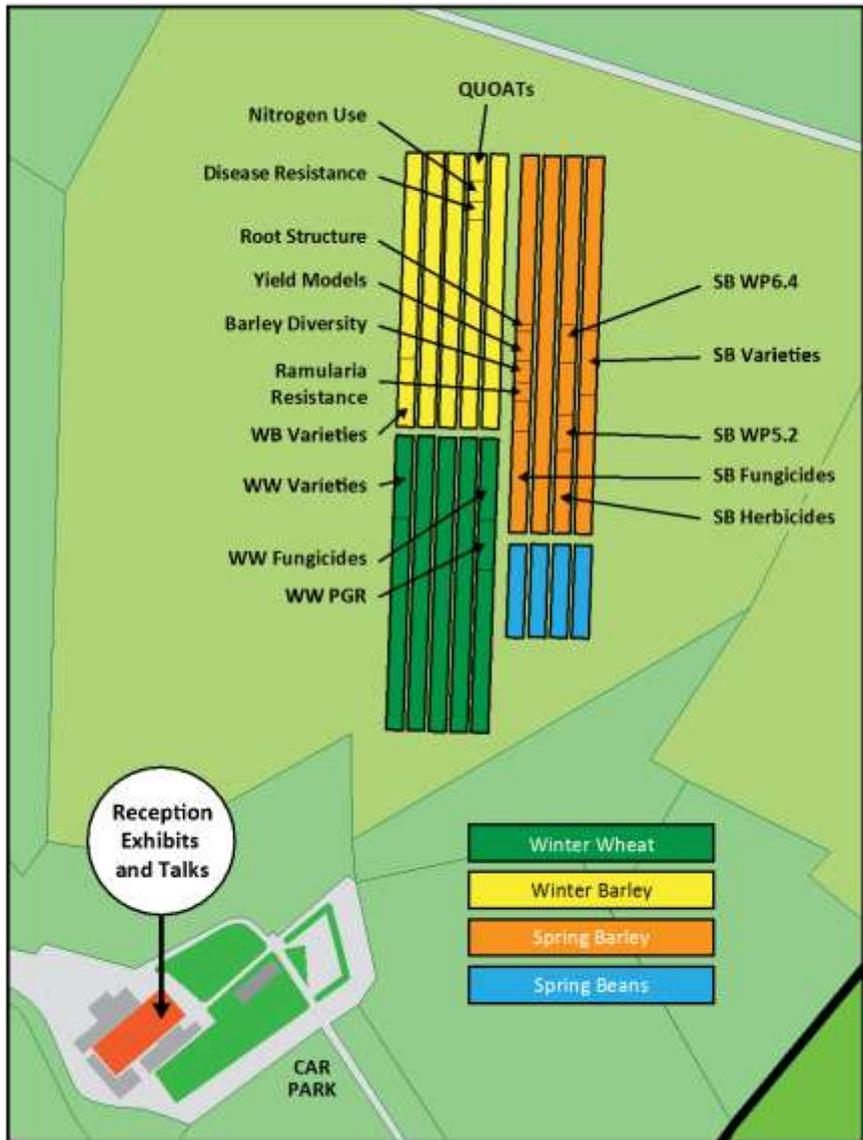
Tours will be run as required from the reception area and will last approximately 1-1.5 hours.

The final complete tour will begin no later than 6.30pm.

Exhibits will be open in the reception area from 4.00-8.00 pm

Refreshments will be available, free of charge, in the exhibitor area from 6.30-8.00pm.

Field Map



The James Hutton Institute

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The James Hutton Institute was formed in 2011 by the Macaulay Land Use Research Institute in Aberdeen and SCRI, the Scottish Crop Research Institute based in Invergowrie near Dundee, Scotland. The Institute encompasses a distinctive range of integrated, world-class strengths in land, crop, water, environmental and socio-economic science. It undertakes research for customers including the Scottish and UK Governments, the EU and other organisations worldwide. The institute has a staff of nearly 600 and 125 PhD students.

The Institute organises its research through seven principal themes: Safeguarding Natural Capital, Enhancing Crop Productivity and Utilisation, Delivering Sustainable Production Systems, Controlling Weeds, Pests and Diseases, Managing Catchments and Coasts, Realising Land's Potential and Nurturing Vibrant and Low Carbon Communities.

The James Hutton Institute operates commercial subsidiaries. Macaulay Scientific Consulting (MSC) Ltd is a leading environmental consultancy centre offering unparalleled experience in soil and water consultancy, and land evaluation. Mylnefield Research Services (MRS) Ltd undertakes contract research, especially plant breeding, licenses plant varieties internationally and delivers analytical services.

The Institute takes its name from the 18th century Scottish Enlightenment scientist, James Hutton, who is widely regarded as the founder of modern geology and who was also an experimental farmer and agronomist.

SAC (Scottish Agricultural College)

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SAC Consulting provides leading edge, independent and impartial advice to the rural sector and associated industries. Across Scotland and the north of England we have 27 consultancy offices (24 regional and three campus based) and eight veterinary disease surveillance centres. With over 400 staff we are the 'local provider' of consultancy services to the land based and related sectors.

We service over 12,000 clients annually across the UK, providing advice on a comprehensive range of technical and business topics, from farm related issues to food and the environment.

Our international clients include the European Commission and the World Bank. We help these organisations support the development of rural areas, communities and enterprises abroad, as well as providing independent international companies with technical consultancy.

We are the key support provider to the land-based industries across Scotland. Our clients benefit from our multi-functional activities where leading-edge research feeds into the provision of consultancy addressing ever changing industry needs.

As the pre-eminent provider of consultancy to the rural sector we channel new ideas into practice. Knowledge of the latest developments and ideas, from SAC's own research and other sources, is transferred to our clients to keep them at the forefront of market opportunities. Technical advice and expertise is of the highest professional standard and our service is customer focused and valued by our clients as making a real difference to their business. Market research has shown that our customer satisfaction rates are in excess of 90%. We make use of the latest technology ensuring efficient service delivery, whilst offering best value for money with well trained and developed personnel.

Scottish Society for Crop Research (SSCR)

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The Society was founded in 1981 by an amalgamation of the Scottish Society for Research in Plant Breeding (est. 1921) and the Scottish Horticultural Research Association (est. 1951) and currently has over 300 members. The Society is administered by a Committee of Management representing various crop interests. The specific interests of the members are channelled through three crop sub-committees; Combinable Crops, Potatoes and Soft Fruit. The Society administers a number of legacies and other funds, which were provided for crop improvement in northern Britain. The income is used in the following ways.

1. Organise field walks and meetings for ‘technology transfer’.
2. Fund research at the James Hutton Institute which is either ‘pump-priming’ to initiate new research, or work on minority crops the large funding bodies would not support.
3. Finance science-based publications for the benefit of the membership.

The Society collaborates with other bodies, especially SAC, to demonstrate new varieties, current research findings on pests and diseases, and best agronomic practice. Cereals in Practice is the latest example of this, substantially aided by input from the HGCA, commercial plant breeding, seed and machinery companies, and researchers, processors and end users.

The Society supports a range of research including ‘the response to soil physical constraints in winter and spring barley’, having previously funded work on the malting quality of wheat, the benefits of cereal mixtures and the effects of adverse weather on distilling quality, etc.

HGCA

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HGCA provides high quality information and cost-effective services, designed to meet the needs of levy-payers, whilst taking account of both the consumer and environmental requirements. Working closely with the James Hutton Institute, SAC and the Scottish Government, HGCA funds R&D and provides market data relevant to Scottish growers and advisors. More information on all our activities can be found at www.hgca.com.

Field trials and demonstrations

The James Hutton Institute

The James Hutton Institute, Invergowrie, Dundee DD2 5DA / Craigiebuckler, Aberdeen AB15 8QH

Nutrient use efficiency in cereals

Contact Details:

Luke Ramsay, Joanne Russell, James Hutton Institute

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We have grown 166 winter barley varieties in trials at three sites over two years with three different fertiliser levels in each trial to investigate varietal differences in nitrogen use efficiency. The varieties comprised recent and older 2 and 6 row winter barleys grown in Western Europe and also represented malting and feed types to cover a range of possible nitrogen usage characteristics.

We detected strong genetic effects for most of the characters that we measured, including yield where 25% of the variation was genetic. The interaction of varieties with fertiliser level was, however, much less and accounted for less than 5% of the variation and was much less than the three way interaction of varieties with fertiliser level and trial site, which reached 16% for yield. These results suggest that the prospects of using older or newer adapted varieties to breed for a consistent more efficient response to fertiliser is very limited for yield unless efforts are targeted to specific environments.

We are currently exploring the nitrogen partitioning data to determine what the prospects are for breeding for more specific characteristics that might improve nitrogen utilisation. We are also combing these data with genetic fingerprints of each variety to try and identify genes that are associated with each of the characters that we have measured.

Barley landraces

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We have assembled a collection of 130 barley landraces that have been grown in various parts of the British Isles over the past 200 years. Amongst these are old Scottish lines such as Scotch Annat and Scots Bere. We have generated DNA fingerprints of each of the landrace lines and used multi-variate analysis to compare the diversity that exists within the landraces compared to that of current recommended cultivars. Six row types such as Scots Bere tend to group together and are genetically distant from the two rows.

We have analysed a number of different Scots Bere lines that have different geographic origins within Scotland. Some tend to group with Scandinavian spring 6 row types, suggesting that they were imported from there rather than from England. There are some Scots Bere accessions that form a separate group within the 6 rows but their origin is not clear. There is considerable diversity within the 2 row landraces, with some evidence of separation of some English lines. When compared to current and older spring types, it is clear that breeding has changed the character of barley but that there is also still considerable diversity within the current elite cultivars.

Root traits for efficient resource use

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The main challenges for cereal breeding are: to stabilise yield as environmental conditions change; to reduce dependence on limited resources (particularly mineral fertilisers); and to reduce environmental impacts. However, limited availability of key resources like nutrients and water can severely reduce crop yield. There is an urgent need for alternative crop management strategies to allow food production to keep pace with population growth without exhausting global resources. Identifying cereal varieties which use nutrients and water efficiently is one option for maximising yields when resources are limited.

Until recently above ground characteristics have been the main focus of studies to identify traits relating to cereal yield. In contrast, the contribution of root traits to resource use efficiency and yield is less well understood, and root traits have rarely been used as selection criteria in breeding programmes. A more directed search for root traits that underpin resource use efficiency is now imperative. We will demonstrate some of our recent work to assess root traits for improved resource use by cereals.

Disease resistance in barley

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By looking directly for the fungus that causes Rhynchosporium (rather than simply the symptoms), we have found that even resistant barley and susceptible varieties without symptoms can be heavily infected. Therefore, even resistant cultivars can be a source of inoculum (spores) and pathogenic variation (new races). This may have an effect on yield and contaminate seed stocks increasing epidemic risk in subsequent crops. We do not yet know what triggers change to symptomatic state (disease). We also need to find out whether such infection is damaging to yield depending on the variety, and therefore how fungicides such as T0 sprays should be targeted. We have been able to map a genetic effect for controlling infection that is different from those that also control symptoms which could be important for durable resistance breeding.

This work is sponsored by RESAS and the Technology Strategy Board 'SIBLINGS' project (The James Hutton Institute, University of Hertfordshire, DuPont and KWS-UK).

CORACLE – Breeding for resistance to Ramularia in barley

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CORACLE is a multi-faceted LINK project exploring Ramularia on barley with research on the pathogen, host plant resistance, epidemiology and fungicidal control. Here we will present some of the work aimed at identifying sources of resistance that breeders can use to improve the overall resistance of the barley crop. Unlike diseases such as mildew or yellow rust, no major resistance genes for Ramularia have been identified and resistance appears to be more due to the accumulation of a number of relatively minor factors where each on its own does not have a major effect upon disease control but when combined with others can provide an effective level of resistance. Such forms of resistance have hitherto been difficult to resolve into component factors. We are making use of high throughput DNA fingerprinting techniques combined with detailed phenotyping of Ramularia development on several different barley populations, one of which is a cross between Power (resistant) and Braemar (susceptible). By combining all this information, we expect to localise some of the genetic factors controlling resistance and identify genetic markers that can then be used by barley breeders to select new varieties with increased resistance.

Yield architecture in barley

Contact Details:

Arnis Druka, James Hutton Institute, Dundee

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Barley is at a yield disadvantage compared to wheat as it possesses single-floreted spikelets whereas wheat has multi-floreted spikelets that generally form 4 grain. Barley does possess three spikelets at each rachis internode but, in the 2 row form, only the central spikelet is fertile. All three are fertile in the 6 row form and thus this form represents a potential means of bridging the yield gap, especially if the climate change predictions of warmer and dryer summers are correct. In such a scenario, 6 rows have an advantage as the increasing grain number strategy is an effective mechanism to avoid late season drought effects. The breeding of 6 row varieties in the UK has been far less intensive than that of 2 rows and what there is, is confined to the winter crop. We are using a wide cross between Golden Promise and Morex to investigate the formation of yield in 2 and 6 row backgrounds to determine if it is feasible to develop higher yielding types through the deployment of the six row ear in UK spring barleys.

QuOats

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This five year (14 September 2009 - 13 September 2014) LINK research project (LK09124) will develop and apply state-of-the-art genomic and metabolomic tools for oat genetic improvement. Its focus is on the understanding and manipulation of key traits that will enhance the value of oats in human health improvement, capitalise on the value of oats as a low input cereal, increase the environmental and economic sustainability of cereal based rotations, realise the potential of oats as a high value animal feed and develop new opportunities for using oats through advanced fractionation.

It comprises four work packages, with the first of these developing the powerful enabling technologies for the identification of specific genes and markers to drive the development of breeder-friendly tools accelerating the production of improved oat varieties that will be marketed by industrial partners. This underpins three further work packages focussing on: developing oats for human consumption and utilising high throughput chemical techniques to quantify grain composition; the development of oats for ruminant feed and how these can be developed to provide sustainable high quality feedstuff with low environmental footprint; oat agronomy including identification of traits associated with nitrogen use efficiency of oats enabling breeding of oat varieties better able to use nitrogen and further minimise their environmental foot print.

This multi-disciplinary programme which combines modern high throughput phenotyping methodologies with the expertise of genomics researchers, oat breeders and end-users, will also address long term breeding goals by developing experimental populations which are polymorphic for agronomically important traits but more amenable to mapping and forward genetic approaches than conventional agronomic lines.

SAC

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Autumn winter wheat herbicide trial

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SAC have done extensive work on timing, product evaluation and the economic control of herbicides for control of annual meadow grass in winter cereals. The key message from this work on winter wheat is to apply a residual herbicide as early as you can pre or peri-emergence, (one-two true leaves) of the crop and before the annual meadow grass has started to tiller. The same messages apply to winter barley. This and previous studies have shown that if you get the timing right and there is sufficient soil moisture, all autumn residual herbicides will control annual meadow grass. This trial work confirms that product choice principally relies on choosing the most effective active ingredient, then the most appropriate cost effective application rate, which is also ultimately related to the degree of persistence of weed control. The trial shows that it is worth spending more on a higher application rate to avoid the requirement to over-spray in the spring. This message will be demonstrated at the 2012 Cereals in Practice event. The work will show that if the optimum timing is missed, for example, a late drilled winter wheat crop has not been treated, there are effective herbicide solutions to control annual meadow grass in the early spring, on winter wheat crop at least.

Spring barley herbicide trial

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There have been more recorded incidences of resistant chickweed to sulfonylurea herbicides in Scotland than officially recognised. There is also anecdotal evidence that there may also be resistant mayweed populations to the sulfonylurea herbicides in Scotland. There have been recorded incidences in Northumberland. At Cereals in Practice we are demonstrating weed control in spring barley using herbicides that offer an alternative to the sulfonylureas. The weed spectrum at Burnside Farm is typical of that found in spring barley.

Crop protection trials

Contact Details:

Dr Fiona Burnett, SAC, West Mains Road, Edinburgh, EH9 3JG

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There are a series of crop protection trials on winter wheat and winter and spring barley looking at new fungicides and different spray programmes on a range of varieties. Compare some of the new chemistry with the more established products and note the differences in disease control and green leaf retention. We also have work on fungicide resistance management for *Septoria tritici*. Disease pressure is and crop growth stages are variable this year and accurate spray timings have been hard to achieve in commercial practice so we will discuss which products have performed best under these challenging conditions.

Scottish Government work package trials

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We have trials demonstrating some of the work funded by Scottish Government. Alternative methods of managing crop disease, which reduce reliance on pesticides, are part of this programme. We are working with elicitors which are products which switch on the crop's own natural defences. Come and see how this approach works compared to using conventional fungicides and discuss with us whether you would try these alternative in commercial practice.

Exhibitors

The James Hutton Institute

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The Centre for Sustainable Cropping: a long-term facility for research on arable cropping systems

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The long-term viability of farming in Scotland depends on the sustainable management of our agricultural habitats. We need to achieve a balance between maximising crop production, conserving arable biodiversity and maintaining ecosystem functions. The Centre for Sustainable Cropping (CSC) is an experimental research platform at Balruddery Farm near Dundee. It is the first of its scale in the UK and will provide a test-bed for new sustainable management practices and crop varieties, designed to: maintain yield quality and yield stability at lower levels of agrochemical inputs; reduce GHG emissions and nutrient leaching from the system, and; enhance soil quality and arable biodiversity.

SAC (The Scottish Agricultural College)

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SAC is an innovative, knowledge-based organisation, supporting the development of land-based industries and communities through our

- specialist research and development resources
- education and training provision
- expert advisory and consultancy services

Our work is wide ranging but there is a particular emphasis on agriculture and related sciences, rural business development and management, food chain quality and safety, and rural resource and environmental management.

Through our associate company, SAC Commercial Ltd, we can provide a wide range of services to individuals, small and medium size enterprises, corporate clients, local and regional authorities, and government agencies and departments.

Certain of our services in Scotland are assisted by the Scottish Government through its Grant-in-aid programme as part of the national provision for research and rural advisory services.

Our three main campuses are at Aberdeen, Ayr and Edinburgh, and there are 23 local advisory offices, eight veterinary centres and five research farms.

Much of our work is in partnership with government departments, levy boards, other academic and research organisations, and local authorities. We are committed to providing the highest levels of service to all of our clients.

The Scotch Whisky Research Institute

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The Scotch Whisky Research Institute provides a centre of scientific excellence dedicated to the needs of the distilled beverage industry. Its aim is to assist its member companies (Scotch whisky distillers) in improving the sustainability of their products and processes and to maintain the position of Scotch Whisky and other spirits in world markets. The Institute carries out joint pre-competitive research on behalf of all its members as well as specific projects for single companies.

The aims of the Institute can be summarised as follows:

- maintaining and improving product quality
- safeguarding product integrity
- adding value by enhancing the use of raw materials and improving manufacturing processes
- providing the understanding to facilitate beneficial changes in manufacturing processes
-

Cereals Research

Cereals research is primarily focused on ensuring a continuing, sustainable, supply of cereal raw materials, suitable for the production of Scotch malt and grain whisky. One of our major roles is to provide essential input to the selection processes for new distilling wheat and barley varieties. An important aspect of this is close involvement in the supply chain networks for both wheat and barley, and the development of research collaborations which have resulted in substantial benefits for stakeholders throughout the supply chain, from plant breeders, growers and maltsters to distilling companies.

Dow AgroSciences

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Dow AgroSciences has a range of innovative weed control products for Scotland's cereal growers.

Principal organisers

The James Hutton Institute

Sharon Neilson (Events Coordinator)

Bill Thomas (Research Scientist)

Adrian Newton (Research Scientist)

Stuart Swanston (Research Scientist)

Scottish Agricultural College

Mark Ballingall (Senior Weeds Consultant)

Steve Hoad (Researcher (Cereals))

Scottish Society for Crop Research

Bill Macfarlane Smith (SSCR Honorary Secretary)

Acknowledgements

We would like to thank HGCA for their support for this event.

A special thank you goes to Mr Kerr Currie, Burnside Farm for providing the site for this year's event.

DISCLAIMER

The views stated in individual sections of this booklet are not necessarily the views held by all partners.

Neither the James Hutton Institute, SAC, SSCR, nor others involved in the production and publication of this guide will be liable for any omissions or inaccuracies therein, nor for any costs, loss, damage or injury resulting from interpretation of, or decisions based on, the information provided.

