

Minutes of the WGIN Traits Meeting 10th June 2004

Mike Holdsworth – Hagberg and pre-harvest sprouting

Questions:

It was asked if the pre-harvest sprouting phenotype was mainly seen in the top of the ear. This is not the case; the sprouting is stochastic. PMAA is easier to study as it is only seen in a single developmental state.

It is felt that breeding companies need to have access to robust physiological screens for this disease. Also, by carrying out this research, academics may be able to increase their fundamental understanding of the phenomenon. This approach certainly seems to hold true where it is investigated outside the UK (University of Melbourne).

It was confirmed that in this case characterised genes do underlay traits, and again research conducted elsewhere (e.g. Australia, Japan) suggests there is merit in mapping pathway components even when phenotype mapping is intended.

It is currently unknown how many genes may need manipulating for these traits, but Japanese research currently suggests only a few QTLs are involved, or at least only a few have very strong effects. It was suggested that if this was the case, these traits would have been found by now, though it is possible they would not be found in normal physiological screens.

The research conducted in Australia is considered to be unlikely to be applicable to the UK as the conditions are too different. The basis of the Australian assay is considered to be grains and yield.

The question was raised as to whether BBSRC/LINK funding may be available for research in this area.

Questions then arose as to whether it is most appropriate in this case to use list varieties or mapping populations to study these traits. Though the traits can be more easily identified in the mapping population, any research will have to be tested eventually against the list varieties.

It was noted that Spark was used for tests rather than Cadenza as there exists already 69 lines screened and showing variation.

Debbie Spark and Pete Berry – Lodging

Questions:

It is considered that height is not as important as strength as a trait – height comes out in QTL measures due to the large variation between heights of list varieties.

Wetness of soil was taken into account in the wind tunnel trials, but didn't seem to have a large affect other than its' effect on other parameters such as strength.

It would be helpful if gene expression patterns for stem elongation were known in arabidopsis, but currently there are none known.

It was discussed whether the current growth regulators used to control lodging could be used to find useful genes by studying the interactions. Though it is known they inhibit gibberellins expression, it would not be easy to use this information for anything helpful at this time.

There was concern that certain things may be missed as trials were carried out on List varieties only.

Overall, it was considered at least by some participants that it would be possible to make a “lodging-proof” wheat.

There is no difference between first and second wheat and takeall with regard to lodging, other than the differences in root structure, plant weight etc.

It is difficult to assess the best sowing time as factors like canopy height and root depth balance each other out.

It is known that crops are more prone to lodging as harvest approaches because stem strength has fallen. It is not known whether this is due entirely to a fall in turgidity or if some relocation of structural carbohydrates occurs.

In general in the UK as height increases, so does yield (? Correct) , so there is some criticism that all attempts to control lodging don't result in overall gains as the yield falls. However it may still be possible to develop a high yield, lodging-proof variety.

Neil Paveley, John Snape and Darren Lovell – Septoria disease control by modifying canopy architecture and the response of diploid *T. monococcum* accessions

Questions:

It was raised if there may be systemic acquired or reduced systemic resistance to this pathogen in some lines in the Avalon x Cadenza mapping population under evaluation. Currently, this possibility was not being explored experimentally. .

There is some concern if one major gene is found for *Septoria spp.* resistance that resistance will break down before it can be exploited. But there seems to be no evidence to suggest this would occur any faster than in any other equivalent major resistance gene.

Some consultants are concerned that fungicides are not as effective as it was – growers are less confident they can keep crops clean.

The population in Britain of *Septoria* is unlikely to be monomorphic as this is a mitochondrial mutation can be moved by gene transfer leading to significant variation across the country.

It is difficult to predict the likelihood of a new fungicide being developed, but there are currently no rumours of such an expensive project being in the pipeline at the major chemical companies. Also no new mode of action group are known, so other non-chemical solutions may have to be found.

John Foulkes – Nitrogen use efficiency scoping study

Questions:

In general, the trend in British agriculture is that Nitrogen use efficiency and uptake have both risen in the last 15-20 years in line with rising yields over the same period of time.

A minimum of 270 kg N / ha was used as the threshold for the trial selected for further analysis. This application rate was deemed acceptable whilst 50/60 kg N/ ha was considered to be the bare minimum.

It is noted some older manure trials may have valuable results for studies of this nature.

Though uptake in general rises, it is worth noting a fall general in autumn and winter, around the time N leaching into water courses is at its peak.

Bill Hollins and Paul Nicholson – “second wheat” syndrome

Questions:

It is suggested that there may be some differing tolerance to take all disease involved – it is unlikely however this is a heritable trait and more likely to be the result of differing ability to root and respond to disease. It is known that wheat has a low ability to regenerate roots upon early damage compared with rye and barley. A general point of note is that there is a great deal of variation between different list varieties for the different factors involved such as root density and biomass or response to fungicide. There are guidelines available for growers that recommend various rotation systems etc. that may minimise problems, but there should still be some caution shown.

Simon Kerr – Sustainability desk study

Questions:

Due to the vast amount of data sources, data was not included from the canopy studies, as organic research was sufficient.

It is not felt that sustainability is a waste of time to study as a good indication of environmental impact can be gained, and breeders should be encouraged to grow varieties that take into account this issue.

It is felt this research should be publicly funded by either BBSRC or Defra as industry does not have the ability to fund research into these important characters at this stage. Scoping studies are funded to see if the variation exists to make it worthwhile funding further research in the public sector.

The eco-impact factor involved in the study takes into account affects on other non-target organisms and nearness to waterways as well as more obvious measures such as toxicity and hectares treated. Fungicides are included in the study as they have often been seen as environmentally benign when this is not in fact the case.

BYDV and other insects – Jon Oakley

Questions:

Concerns about Green bug are well founded, because this is now breeding in Southern England. But it is unlikely to have a major impact on Agriculture until it moves a little further north.

There is also concern about the encroaching distribution of Russian Wheat Aphid which will occur when average temperatures rise a further 3-4 C.

There is some resistance to BCV (what is this?) occurring though that is very low at the moment.

DISCUSSION

Defra's rationale is to fund research to inform policy and research which is required but which is not fundable by industry, which is how the Genetic Improvement Networks came to be funded.

Rather than identifying and then funding individual issues, as was done in the past, the Networks will collate information and provide lists of relevant ongoing research.

They will also generate useful discussion groups that will be able to identify possible opportunities.

In addition, there will be some scope for them to generate broad spectrum tools for genetic analysis. Only the genotyping work required to identify and locate diversity will be funded by the core project.

The purpose of this traits workshop is for wider discussion of a range of important wheat traits and to identify traits that researchers wish to study but which there is no scope or ability for industry to fund this.

While it is true that work undertaken in LINK projects does not involve all breeding companies, the government will not fund research into areas already being industrially funded. There may be exceptions made – for instance if a non-durable trait is found and exploited, research may be funded to locate a durable alternative.

There are many challenges to policy at the moment; environmental impact of agriculture must be considered by Defra as the department contains environmental protection groups, and the budget from these groups is now allocated as part of Defra sponsored research. This will continue in the future leading to even greater integration between food and environmental affairs. For this reason, research addressing issues such as pollution from agriculture and input levels is important to Defra, though some traits such as Nitrogen efficiency are obviously less important to breeders. However, there are some areas (such as resistance to insect pests) that are overlapping and of interest to both groups.

VCU trials are unlikely to change, however there is legislation forthcoming that will affect land use and inputs. This will generate different farmer requirement scenario (e.g. the water requirement framework). Issues like this will be linked in with the WGIN website.

It is agreed that Defra (Bruno Viegas) will attempt to compile information on these likely changes, such as the proposed legislation that will affect nitrates and distribute these to the Breeders and WGIN management team in the first instance.

In general, in the andfuture there will be be fewer, larger studies informed by more scoping studies before research into possible measures is funded affect land use and inputs. This will generate a series of different farmer requirement scenario (e.g. the water requirement framework). Issues like this will be linked in with the WGIN website.

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Currently, nitrogen practises do not really affect the market, and there will be other measures taken that do not necessarily affect breeders. For some crops there will be clearer solutions that other, and there will have to be more scoping studies before research into possible measures is funded. (POSSIBLE DUPLICATION)

In general, in the future there will be fewer, larger studies informed by more, small scoping studies funded by Defra

Based on this traits meeting, the breeders have assembled a ranking of possible priority traits, with reasons. The summary below is provided by Peter Jack of Monsanto:-

Traits Meeting Discussion on Project prioritization. Breeders ranking on economic importance (synthesis of Monsanto, Nickerson, Elsoms, Advanta & Semundo recommendations; CPB & Syngenta were absent).

1. HFN (including sprouting). Very important. Feasible. Little current UK activity. This is Priority Number 1. John Snape mentioned proto proposal from Flintham/Holdsworth - what is status?
1. Septoria. Very Important (aiming for complete immunity). Feasible. Substantial UK research in LINK (though not all breeders are members) - and because of this it may not be such high priority for WGIN.
1. Second wheat. Very Important. Very difficult. No significant UK research. It may merit a scoping study to ensure there are no opportunities being missed, especially take-all control strategies.

2. Orange Blossom Midge. Important in some areas. Feasible (Sm1 and anti-settling/feeding/reproduction genes). Sm1 gene already deployed & significant work in existing LINK (though not all breeders are members) - so may not be a priority.

3. Lodging. Important. Feasibility? Breeders can already deal with?? Lower importance.
3. BYDV. Important in most areas. Feasible. Little existing UK work. Should be key target. May require initial scoping study?

4. Other insect pests (Gout, Frit, Bulb fly). Moderate importance. Feasible. Little existing UK work. Likely target especially if some anti-feeding strategies for OBM and BYDV were generic.

5. Nitrogen Utilization. Very low priority for breeders but very high for DEFRA (sustainability). Breeders would find it hard to be involved or utilize outputs unless economic model changed (N tariff and/or sustainable management subsidy).

Breeders also made a strong plea for maintenance of skills base especially Pathology (Insect, Fungi, Virus) for isolates and varietal testing.

Breeders also flagged Biofuels but DEFRA made an interesting comment that this was not seen by UK Govt. as effective as wind power for sustainable energy. It would be good to see the calculations on which this is based. Also noted that ADAS led (Roger Sylvester-Bradley) LINK with Syngenta on animal feed/bioethanol is about to go ahead.

A concern was raised that, with regard to second wheat syndrome, it is already difficult to find expert knowledge of this field, and that care should be taken to maintain the remaining knowledge base. If it is not, there is a chance that research will never be feasible again.

It is also felt that scoping studies are also more appropriate with regard to insect pests also, rather than allocation of core WGIN funds or LINK projects.

There is again some disagreement about how Nitrogen use is prioritised in WGIN as a whole. There is still opposition to the idea from breeders, but those in the public sector feel that this may become of importance in the future due to policy changes and therefore merits study. It is possible to breed for both yield and nitrogen efficiency, and more decisions should probably wait until the scoping study is complete. There will be a great deal more research undertaken before nitrogen efficiency will enter commercial breeding programmes, and by that point a change in grower demand due to legislation may make it worthwhile to breeders.

It is felt that a dialogue between breeders and policy makers needs to be established so breeders may be made aware of possible policy changes in advance.