David Neale
Business Consultant and Crop Markets Specialist

Understanding the genetics and practical opportunities for Sustainable farming
Localised technology transfer
Our Agrii Footprint

WE HAVE...

5 TECHNOLOGY CENTRES

55,000 TRIAL PLOTS
across the UK representing all regions and crops

400 REPLICATED TRIALS NATIONALLY

28 DEMONSTRATION iFARMS
putting R&D into practice
## Supporting Primary Food Production

<table>
<thead>
<tr>
<th>Accounts</th>
<th>Agronomists</th>
<th>Staff</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,000</td>
<td>275</td>
<td>830</td>
<td>43</td>
</tr>
</tbody>
</table>

- **275** in 25,000 Agronomists: 29% of all practicing agronomists
- **22,000** farms: 40% of farms engaged in cereal production
- **1.4m ha** in 22,000 farms: 33% of primary combinable crop advice
- **16k ha** in 22,000 farms: 55% of primary fruit crop advice
- **57kt** in 1.4m ha: 17% of certified cereal seed market
- **94k ha** in 22,000 farms: 19% of certified OSR market
- **35kt** in 16k ha: 17% of farm-saved seed market*
- **457kt** in 25,000 Agronomists: 14.7% of fertiliser application market

* FSS – recent acquisitions take capacity to 22% market share
Sustainability - Means what to who?

“Produce more, impact less”

Target inputs

Improve productivity

Reducing impact

Greater value and public interest
UNFAO Quote
Cereal Consumption this year is an extra 200m/tonnes

This is 9% more than 3 years ago

over next 20 years + 1,400 m/tonnes

Another 70m/tonnes per annum?
Increased Demands Projected from a Wealthier, Growing Population – will it be the 9 billion?

GLOBAL GRAIN DEMAND (M MT)

- Rice: +102%
- Cotton: +28%
- Soybeans: +125%
- Wheat: +40%
- Corn: +76%

Source: IHS Global Insights, Agriculture Division
Average Wheat Yield of countries producing more than 300 000 tons

2008: 2.9 t/ha
2020: 3.6 t/ha = 22% yield increase = 1.6%/year
2015 Guinness World Record in Northumberland!

- 16.52 t/ha
- Variety Dickens
- Up to 22t/ha recorded in field
- Beats NZ record by over 1t/ha (with irrigation!)
- Cost of production £45 per tonne!
- Yield x lower prices works!
Genetics

+ Technology
+ DNA/Gene Marking
+ Investment
+ Breeder changes
+ Supermarkets
+ Brands
+ Segmentation
+ Knowledge
+ Yield requirement
Genetic maps of the wheat genome

Wheat chromosomes stained in a root tips cell, total of 42 chromosomes, 21 pairs

CHROMOSOME

MARKER SEQUENCE
A - T
G - C or A - T
T - A
C - G

GENETIC MAP

MARKER 1
A - T
A - T
C - G
C - G, or A - T
G - C
T - A
C - G
C - G
G - C
G - G
G - G

MARKER 2
A - T
A - T
C - G
C - G
A - T
A - T, or C - G
G - C
C - G

MARKER 3
A - T
A - T
C - G
C - G

MARKER 1
Allele 1 = phenotype 1
= tall (C-G)

MARKER 2
Allele 2 = phenotype 2
= short (A-T)

Gene 1
Allele 1 (A-T) = Avalon type
Allele 2 (A-T) = Feed type

Gene 2

Adenine
Guanine
Thymine
Cytosine
Molecular markers
Aegilops ventricosa = Bulbed Goatgrass – source of eyespot resistance
Eyespot Seedling Tests

RESISTANT     SUSCEPTIBLE
Wheat Orange Blossom Midge

A small pest but with a significant effect on grain yield and quality
Connecting agri-science with farming
Orange Wheat Blossom Midge

- Sporadic insect pest, but widespread
- Controlled with organo-phosphates!
- Can cause major yield losses & reduction in quality
- Very time consuming to phenotype
- Several resistant varieties now being grown commercially – eg Robigus, Viscount, Oakley, Glasgow, KWS Santiago
- Now routinely selected for using molecular markers – verified in field
Making Genetics work in practice
Wheat and Blackgrass!

- The challenge
- Genetic Potential 22t/ha viz actual 8-11t/ha
- Resistance
- Lack of chemistry R&D
- Variety
- Sow date
- Seed Rate
- Crop options
- Markets
- Future
The importance of an integrated approach

- 100 blackgrass ears /m² = 1t/ha lost

- Many different approaches to reducing Blackgrass identified

- Variety & cultivations effects the most interesting
Variety x seed rate data - Combined data over 6 years

Crop Competition Trials (2006-2012) - Yield and Blackgrass Ears in Untreated

High seed rate + right variety increased yields by 2.3t/ha and reduced BG ears by 44%

TAKE-HOME POINTS

Yield t/ha @ 15% m.c.

Yield

BG Ears/m2

Hereward 175

Hereward 350

Robigus 175

Robigus 350

Seeds/m2

Seeds/m2

Seeds/m2

Seeds/m2
Again Stow Longa has shown us the benefits of:

Competitive variety vs non Competitive
Winter Wheat Crop Competition Trial
Blackgrass Ears /m² in Untreated Varieties 2015

**TAKE-HOME POINTS**
- 63% reduction in Blackgrass ears/m²
Again Stow Longa has shown us the benefits of:

High seed rate (350) versus Low Seed rate (175)

199 BG heads/m²

373 BG heads/m²
Blackgrass always has the last laugh – now expressing ergot…!
Future Wheat?

- Milling
- Feed
- Industrial
- Functionality
- Supermarkets/Brands
- Audit Trails
- Environmental impact
- Segmentation
- Variety Traits – agronomical
- End user value
- More efficient plant model
Opportunities In Barley

- Malting
- Brewing Distilling segmentation
- Feed
- Industrial
- Beer
- Whisky
- Food
- Health
- Future
Pedigree: Beatrix x Marnie
Explorer crop – blackgrass ear counts: 120 m² (small and late to emerge through the crop)

Undrilled area in Explorer Field – blackgrass ear counts: 705 m²
Oilseed Rape
The crop under pressure!

- Neonics
- Cost of Production
- Genetic potential 11t/ha viz actual 3-5t/ha
- Biofuels
- Veg Oil
- HEAR
- HOLL
- Industrials
- Future
Oil Crops – Fatty Acid Profiles

OSR is a VERY Healthy profile

<table>
<thead>
<tr>
<th></th>
<th>Saturated Fat</th>
<th>Linoleic acid</th>
<th>Linolenic acid</th>
<th>Oleic Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>COCONUT</td>
<td>30</td>
<td>7</td>
<td>90</td>
<td>7</td>
</tr>
<tr>
<td>PALM</td>
<td>10</td>
<td>38</td>
<td>51</td>
<td>10</td>
</tr>
<tr>
<td>PEANUT</td>
<td>19</td>
<td>47</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td>SOYA</td>
<td>15</td>
<td>23</td>
<td>54</td>
<td>11</td>
</tr>
<tr>
<td>OLIVE</td>
<td>15</td>
<td>28</td>
<td>74</td>
<td>2</td>
</tr>
<tr>
<td>CORN</td>
<td>13</td>
<td>28</td>
<td>57</td>
<td>2</td>
</tr>
<tr>
<td>SUNFLOWER</td>
<td>12</td>
<td>15</td>
<td>71</td>
<td>2</td>
</tr>
<tr>
<td>OSR</td>
<td>7</td>
<td>11</td>
<td>61</td>
<td>2</td>
</tr>
</tbody>
</table>

Legend:
- Saturated Fat
- Linoleic acid
- Linolenic acid
- Oleic Acid
Vistive ® OSR – High Oleic, Low Linolenic

**HO,LL**
- Saturated Fat: 7%
- Linoleic acid: 10%
- Linolenic acid: 3%
- Oleic Acid: 80%

**STANDARD**
- Saturated Fat: 8%
- Linoleic acid: 20%
- Linolenic acid: 10%
- Oleic Acid: 62%
Vistive ® - The Healthy Sustainable Alternative

'Reuters - French retailer Casino to ban use of palm oil

'Medical News Today - ESA Launches Saturated Fat Campaign To Help

'Good fat' cuts heart risk by a fifth, study shows

Replacing saturated fats with healthier options can cut the risk of heart disease by a fifth, a US study says.

The Harvard Medical School reports adds weight to the growing evidence about polyunsaturated fats, found in some fish and vegetable oils.

The team analysed the findings from eight previous studies, covering more than 13,000 people.

'Real meat is a source of animal fat.
A sustainable, land-based source of Omega 3

Just one hectare of Omega-3, SDA- enriched soybeans is equivalent to ~25,000 x one hundred gram servings of salmon

* One Salmon Icon Represents 100 Servings of Fish
Overcoming Insufficient Fresh Water for Crop Usage: Drought Tolerance

The Challenge

- Agriculture is responsible for 70% of freshwater withdrawal (UNEP).

Drought Tolerance Product Concept

- Yield gain through water use efficiency
- Yield gain from water deficit tolerance

Benefits

- Increased, more stable yield
  - Mean trials yield increases 13.0-15.1% versus control hybrids under drought-stress
- Flexible Water Management
- Reduced Water Consumption, Cost Savings

* Unesco-IHE Inst of water education, 2004
Why does water matter?

+ Water used in homes and towns uses 10% of the Earths’ readily available freshwater (and is expected to increase by 150% by 2025)

+ Power generation & industry - uses 20% of water

+ Food grown by irrigation* – uses 70% of water

+ (* Only 45% of our food)

<table>
<thead>
<tr>
<th>Food or product</th>
<th>Water (in litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slice of bread</td>
<td>40</td>
</tr>
<tr>
<td>Potato</td>
<td>25</td>
</tr>
<tr>
<td>Cup of coffee</td>
<td>140</td>
</tr>
<tr>
<td>Egg</td>
<td>135</td>
</tr>
<tr>
<td>Kg of grain</td>
<td>1,500</td>
</tr>
<tr>
<td>Kg of chicken</td>
<td>6,000</td>
</tr>
<tr>
<td>Kg of beef</td>
<td>15,000</td>
</tr>
<tr>
<td>Cotton T-shirt</td>
<td>4,000</td>
</tr>
<tr>
<td>Pr. of leather shoes</td>
<td>8,000</td>
</tr>
</tbody>
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Source: Lenntech “Use of water in Food and Agriculture”, University of Delft, The Netherlands
Extracted from: “The coming famine” by Julian Cribb
And GM?

Another subject another day
But read the latest edition of
The Grocer!
Biotechnology – is nothing new!
Monsanto ‘Gene Chipper’
‘Chipped’ corn seed
Public biotech research

GM Camelina field Trial: Public information

The Institute of Agricultural Biotechnology - INBIO - is a private non-profit organization that aims to promote the development of biotechnology research in the Republic of Paraguay.

MANEJO INTEGRADO DE PLAGAS Y USO DE REFUGIOS EN ALGODON BHR
PROGRAMA DE AGRICULTURA SOSTENIBLE Y USO RESPONSABLE DE LA BIOTECNOLOGIA
But its all starts with our Sustainable Factory Floor!
My Question is **Sustainability** for who?

Or is it a case of ensuring we survive in Farming in the short term and connect better with R&D and genetics knowledge.

In a period of harsh UK/EU and World economic climate we need to adopt new and revisit old **sustainable** farm practices to allow long term survival to feed the world!
Thank you for listening!
And suggest you don’t have......
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At an iFarm event
Agrii supports the work of FCN

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