

WGIN and NUE

Nitrogen mobilisation in wheat

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WGIN Stakeholder Meeting

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Why be concerned about N-efficiency?

Financial costs

Conventional farmers
Fertilizer producers
Organic growers
Millers
Bakers

Nitrogen
fertilizer

efficiency

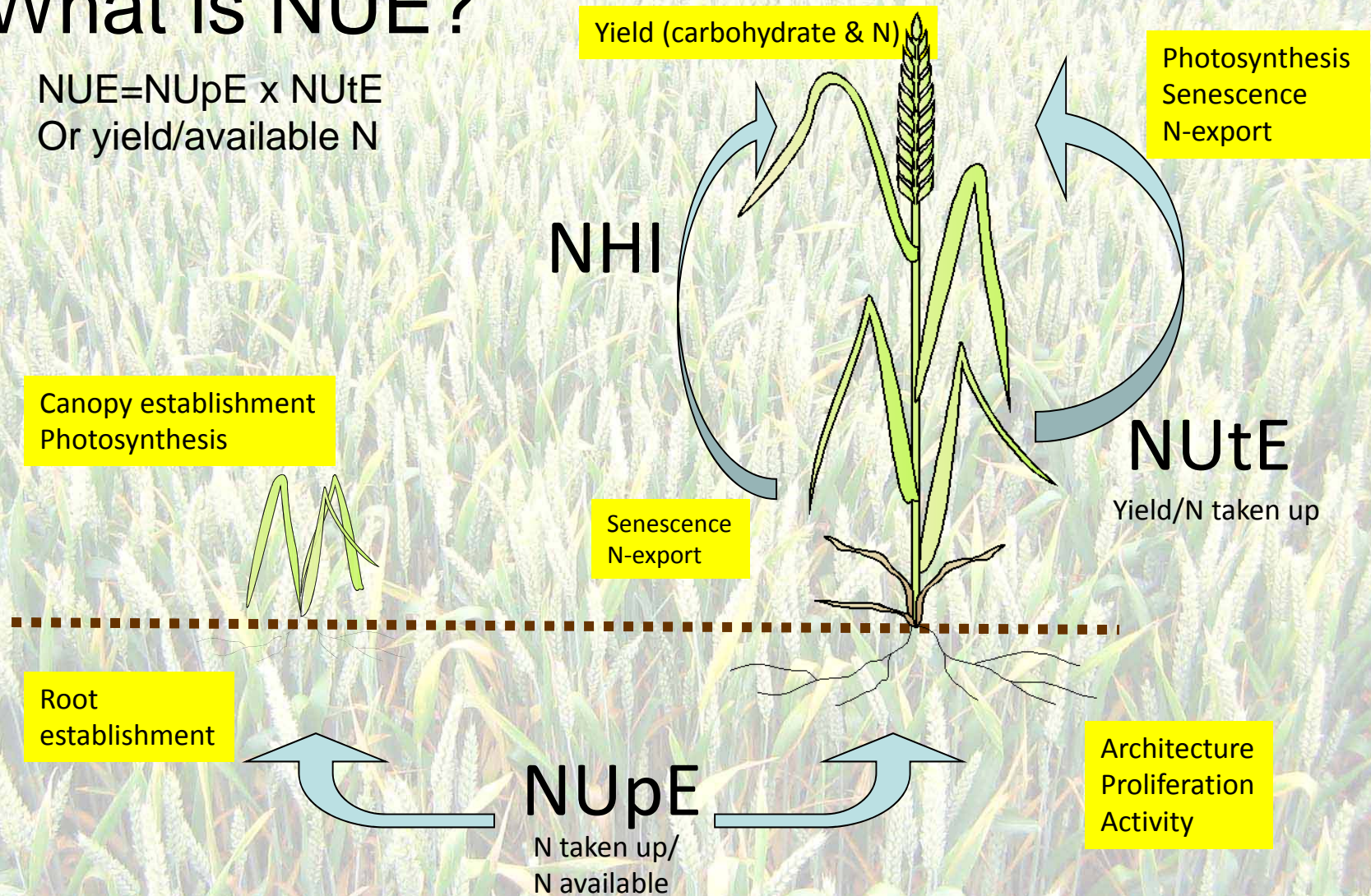
YIELD
&
QUALITY

Environmental costs

Government/legislation/NVZs
Public concerns
Carbon footprint

What is NUE?

$NUE = NU_{pE} \times NU_{tE}$
Or yield/available N



WGIN NUE objectives

1. **Quantify variation and dissect** components of yield and NUE parameters
2. Examine variation in NUE in more '**exotic**' germplasm
3. Use **mapping populations** to identify robust key QTLs for NUE
4. Examine variation in nitrogen **uptake** ability.
5. Determine whether **functionality** can be maintained at reduced grain protein
6. Examine **physiology/biochemical** processes contributing to NUE and assess expression of **key genes (non WGIN funded)**



BBC filming, 3rd August, 2009

Approaches

1. Wide germplasm screening + core set:
Diversity Trial
2. Use of mapping populations:
Avalon x Cadenza
3. **Yield, NUE**
4. Acquisition and root characteristics
5. Canopy functioning after anthesis



Spring 2009

WGIN Diversity Trial summary (2004-2013)

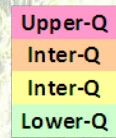
- **Choice of varieties** (varied with core set identical) c. 25 y^{-1}
- **N usually 0, 100, 200 and 350 kg/ha**
- Randomised block design, 3 replicates, 18 x 3 m plot size with destructive sampling area
- Variety performance ranked on several parameters
- Basic dataset on 2004-07 trials submitted for publication



2007

Variety Performance at 200 kg-N/ha (2004-08)

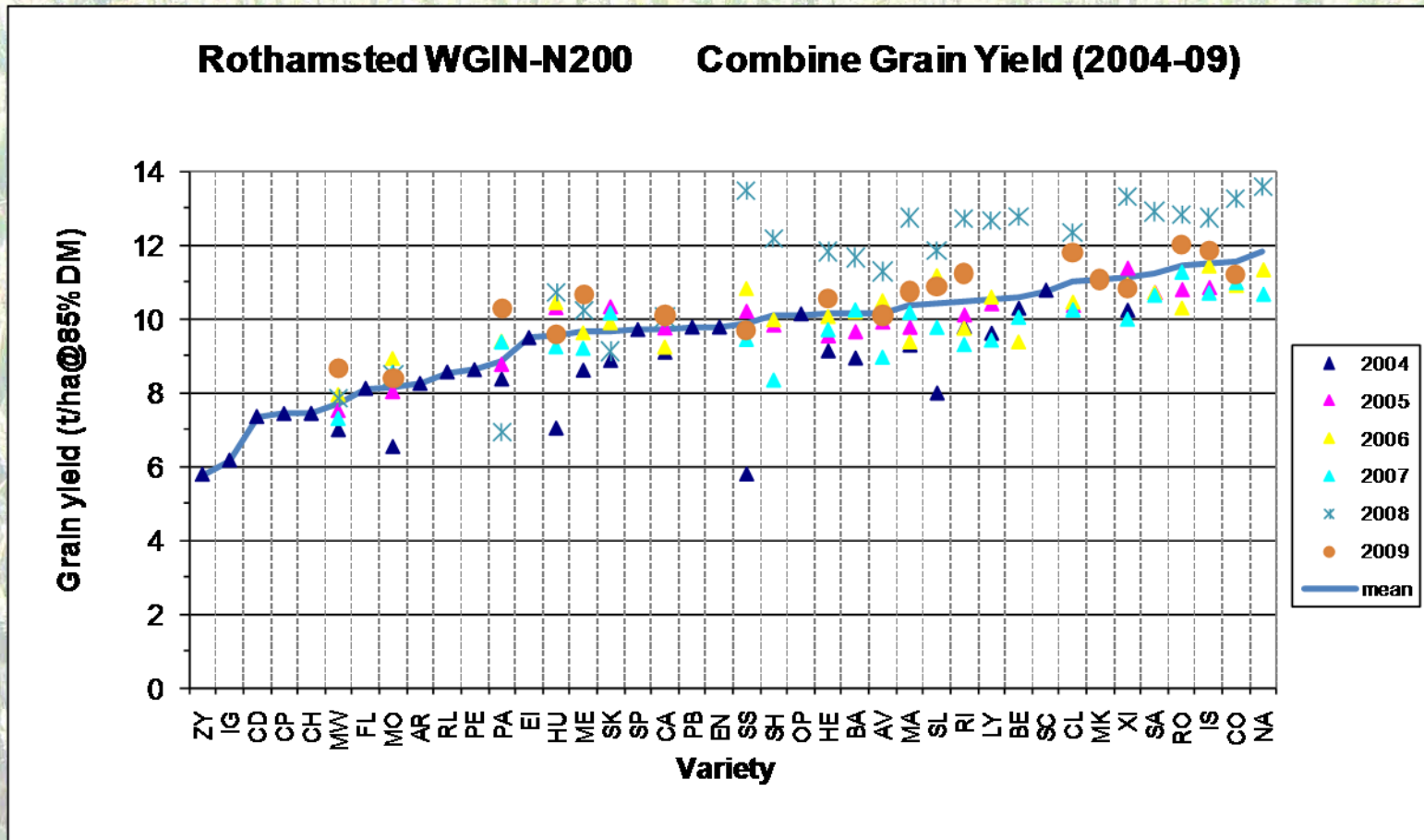
| Variety | Code | Nabim | Years | Yield | %N | Uptake | Utilisation |
|------------------|------|-------|-------|-------|----|--------|-------------|
| Avalon | AV | 1 | 5 | | | | |
| Flanders | FL | 1 | 1 | | | | |
| Hereward | HE | 1 | 5 | | | | |
| Hurley | HU | 1 | 5 | | | | |
| Malacca | MA | 1 | 5 | | | | |
| Mercia | ME | 1 | 4 | | | | |
| Maris Widgeon | MW | 1 | 5 | | | | |
| Shamrock | SH | 1 | 4 | | | | |
| Solstice | SL | 1 | 5 | | | | |
| Spark | SP | 1 | 1 | | | | |
| Xi 19 | XI | 1 | 5 | | | | |
| Cadenza | CA | 2 | 5 | | | | |
| Cordiale | CO | 2 | 3 | | | | |
| Einstein | EI | 2 | 1 | | | | |
| Lynx | LY | 2 | 5 | | | | |
| Rialto | RL | 2 | 1 | | | | |
| Scorpion | SC | 2 | 1 | | | | |
| Soissons | SS | 2 | 5 | | | | |
| Beaver | BE | 3 | 4 | | | | |
| Claire | CL | 3 | 4 | | | | |
| Riband | RI | 3 | 5 | | | | |
| Robigus | RO | 3 | 4 | | | | |
| Istabraq | IS | 4 | 4 | | | | |
| Napier | NA | 4 | 3 | | | | |
| Savannah | SA | 4 | 4 | | | | |
| Paragon (spring) | PA | 1 | 5 | | | | |
| Chablis (spring) | CH | 2 | 1 | | | | |
| Arche | AR | F | 1 | | | | |
| Batis | BA | G | 5 | | | | |
| Caphorn | CP | F | 1 | | | | |
| Cappelle Desprez | CD | F | 1 | | | | |
| Enorm | EN | G | 1 | | | | |
| Isengrain | IG | F | 1 | | | | |
| Monopol | MO | G | 5 | | | | |
| Opus | OP | G | 1 | | | | |
| PBis | PB | G | 1 | | | | |
| Petrus | PE | G | 1 | | | | |
| Sokrates | SK | G | 5 | | | | |
| Zyta | ZY | P | 1 | | | | |



Summary of variety performance (quartile rankings) based on 2004-07 WGIN datasets



Year and varietal variation in yield at 200 kg N/ha input



WGIN & NUE - what next?

- Additional germplasm
- Breakdown of yield components and partitioning of N
- Analysis of post anthesis canopy dynamics and function
- Assessment of uptake variability
- Examination of yield and quality (grain protein) interactions



WGIN mapping population (2007-2011)

- Avalon x Cadenza parent
- 204 doubled haploid lines
- Map data
- Triplicate, randomised plots, 2 x 10 m
- **100 and 200 kg N/ha**



2007

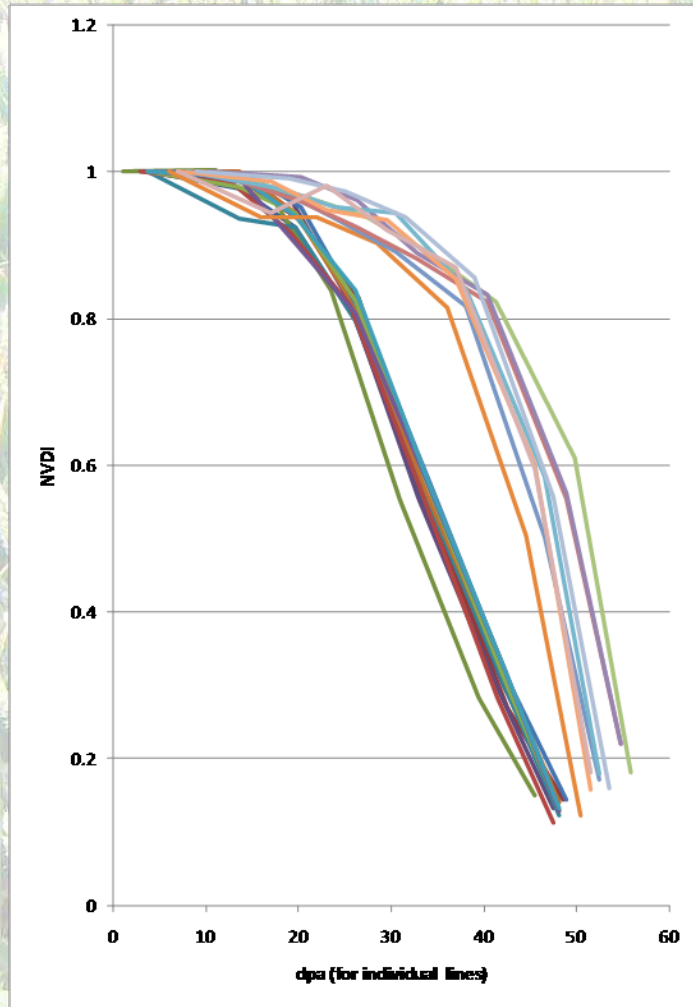
Avalon x Cadenza

Traits

- Flowering time and height
- Yield (grain and straw) and TGW
- Nitrogen (grain and straw)
- NUtE, N uptake (final)
- Leaf N and SPAD (anthesis and 21 dpa)
- Leaf size
- Canopy longevity, reflectance, rate of senescence
- Early N uptake
- Gene expression



Canopy senescence assessed by NVDI



2009 data set

- $NVDI = \frac{740nm - 680nm}{(740nm + 680nm)}$
- Variation across population
- Major difference is in timing of initiation of rapid increase in senescence
- Can add these parameters to map



Stakeholders 2009

Thanks

- Peter Barraclough
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