

# WGIN Stakeholders

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### Developing a Mutant Wheat Resource



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# Overview

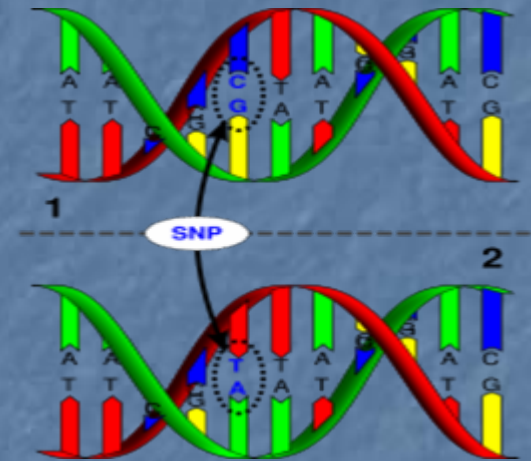
- What is a mutation?
- How the population was developed
- What was found
- Who is interested and why

# MUTATION!

- 'the changing of the structure of a gene, resulting in a variant form which may be transmitted to subsequent generations, caused by the alteration of single base units of DNA, or the deletion, insertion, or rearrangement of larger sections of genes or chromosomes'
  - Oxford English Dictionary

# Ethyl Methane Sulphonate (EMS) Treatment

- Induces transitions by alkylation of guanine bases
- Results in small / single base pair changes of GC to AT



# Starting Material

## Paragon Spring Wheat

- RAGT's NABIM Group 1 variety
- Lower yield than other spring varieties but higher protein content
- Relatively tall at 93cm approx 10% higher than other current spring varieties
- Generally good disease resistance, with good resistance to mildew, rusts and Septoria
  - \* Source HGCA



# Population Development

- 7000 seed treated with a 1% EMS solution for 3hrs
- Fifty per cent germination rate achieved
- Two seeds taken per plant at  $M_2$  harvest resulting in 7000 lines
- Single Seed Descent (SSD) to  $M_5$  generation.
- 6500  $M_5$  lines entered to field trial in 2006

# Paragon Mutant Development



Single Seed Descent under glass at the JIC

# Specimen Ear Archiving



club type



spelt type



sterility



awn suppressor



# EMS Paragon Field Trials

- $M_5$  seed drilled as 1m rows in field 2006
- Regular records made on development
- Specimen ear maintained for future reference
- $M_6$  seed available and  $M_3$  DNA. Check via database [www.wgin.org.uk](http://www.wgin.org.uk)



# Ear Emergence



clump dwarf

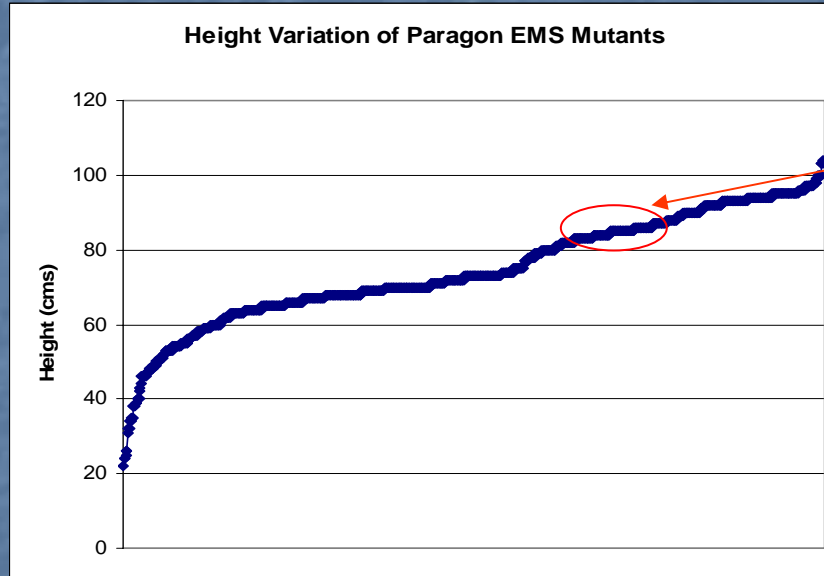


early ear emergence

Ear Emergence 85 –  
120 days (clump  
dwarf not included in  
trial)

Paragon 93 days  
following March 16th  
sowing

# Height Variation



Majority of lines 80 to 90cm



Paragon

- Heights 30 -104cm in field trial average – Paragon 84cm

Many more shorter and later than early and tall. Approx 1000 lines differing by 10% or more

# Testing Inheritance Patterns

Paragon Mutant x Cadenza



F<sub>1</sub> Produced

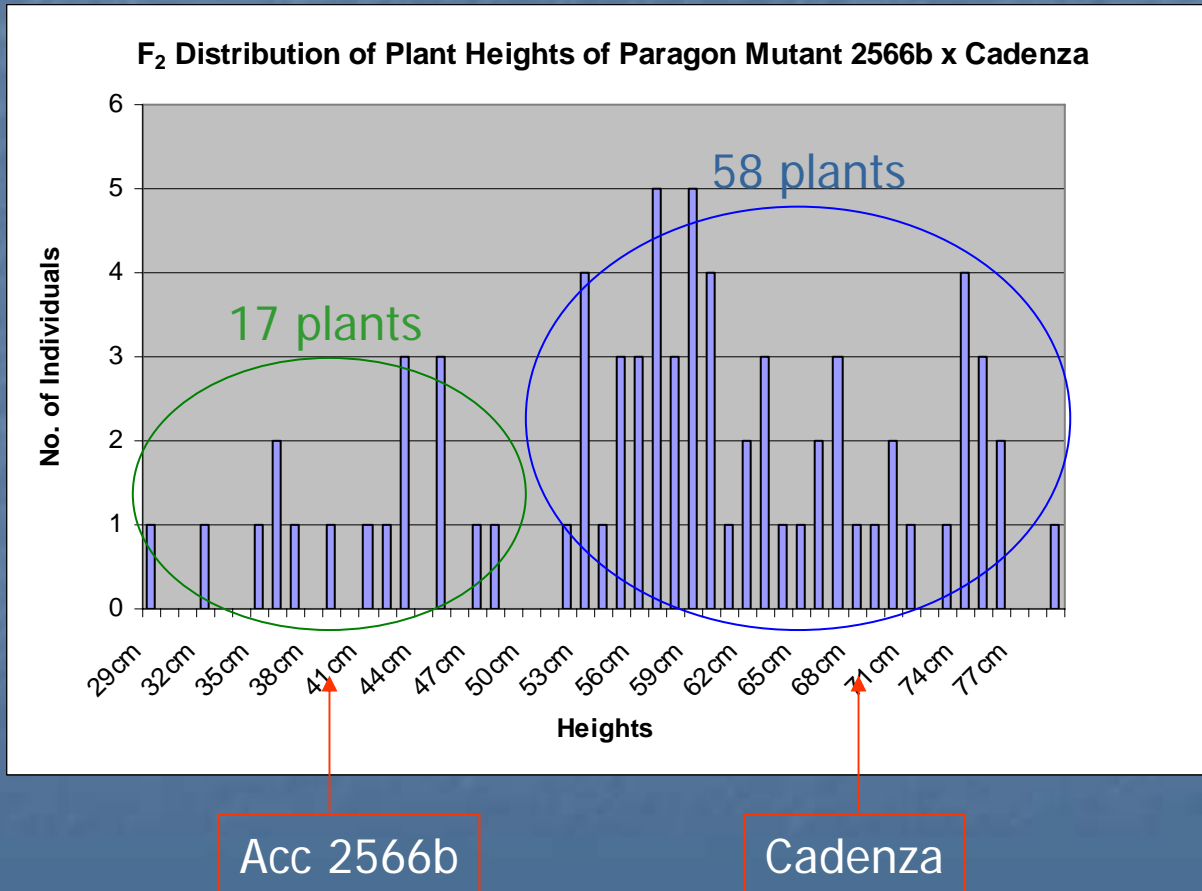


Self



Study of F<sub>2</sub> Phenotype Distribution

# Segregation of Dwarf Types



# Strategy for Tapping the Resource

- Crossing lines of interest to Paragon parent to 'clean' background
- Crossing to other adapted varieties and phenotypically selecting for mutation
- We are investigating the early proof of concept – BSA to genotypically rough map (DArT) - dealing with known or novel alleles?
- Being used in the current BBSRC / INRA Nitrogen Use Efficiency project

# Stay Green Candidates Nitrogen Use Efficiency?



- Tested under Low Nitrogen treatment 2007 BBSRC /INRA
- 60 candidate mutants replicated and more intensively investigated 2008 (-N and +N)
- Hydroponic testing planned on promising lines



# Early Senescence Variation



Early senescing  
Mutant ratio  
16/6500





# Leaf Colouration Variation



Anthocyanin expression

Necrotic  
lines



**zebra leaf expression  
to cold 11/6500**

# Grain Shape



Acc 732a

Paragon

grain  
shape  
6/6500?

# Stem and Leaf Variation



Waxless variation  
ratio – 11/6500

Waxless and awn suppressor  
Knockout –ratio 7/6500



Monoculm  
appearance  
ratio - 15/6500

# Paragon Gamma-ray Mutants

- Nicola Hart Phd - Larger deletions but smaller population size
- Initial tests with gamma-ray at Norfolk and Norwich Hospital to establish doses
- Irradiated at IAEA Austria 25-250 Grays. Higher dose showing more interest
- Developed to  $M_3$  generation – further development planned

# Publicity

- **Cereals Day January 2007 (Norwich)**
- **EWAC Conference May 2007  
(Istanbul)**
- **Cereals 07 June (JIC NIAB Alliance)**

# Early Public Exhibitions

- Research described as 'chemically induced genetic changes'
- Directed away from the use of the word 'mutation'

# One Year Later....



# External Projects

- At the JIC (BBSRC / INRA)
- CYMMIT (Turkey and Mexico),
- RAGT
- CPB Twyford
- Two areas of research at NIAB
- RRes (WGIN and CSI)
- INRA Clermont-Ferrand
- ADAS
- Interest in nitrogen use efficiency, root development, phytate pathways, stay green, monoculm, plant size, grain shape, waxiness (tilling) and general breeder interest



# Seed Maintenance



- Extensive specialist storage facilities at the JIC
- Low temp and humidity giving approx 20 year shelf life



# Requests?

- Substantial list of mutations recorded
- Visit [www.wgin.org.uk](http://www.wgin.org.uk) to view database
- Seeds requests to [simon.orford@bbsrc.ac.uk](mailto:simon.orford@bbsrc.ac.uk)

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