

# International Adaptation Trial 2006

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# The Goal



- Better varieties to Australian growers, faster
- Evaluate Australian and CIMMYT germplasm in Australia and global wheat production regions
  - understand Australian germplasm on a global scale
  - link Australian production environments to global wheat production regions
- Probe and reference genotype sets
  - isolines, related lines
  - broadly adapted reference lines

# Presentation Overview

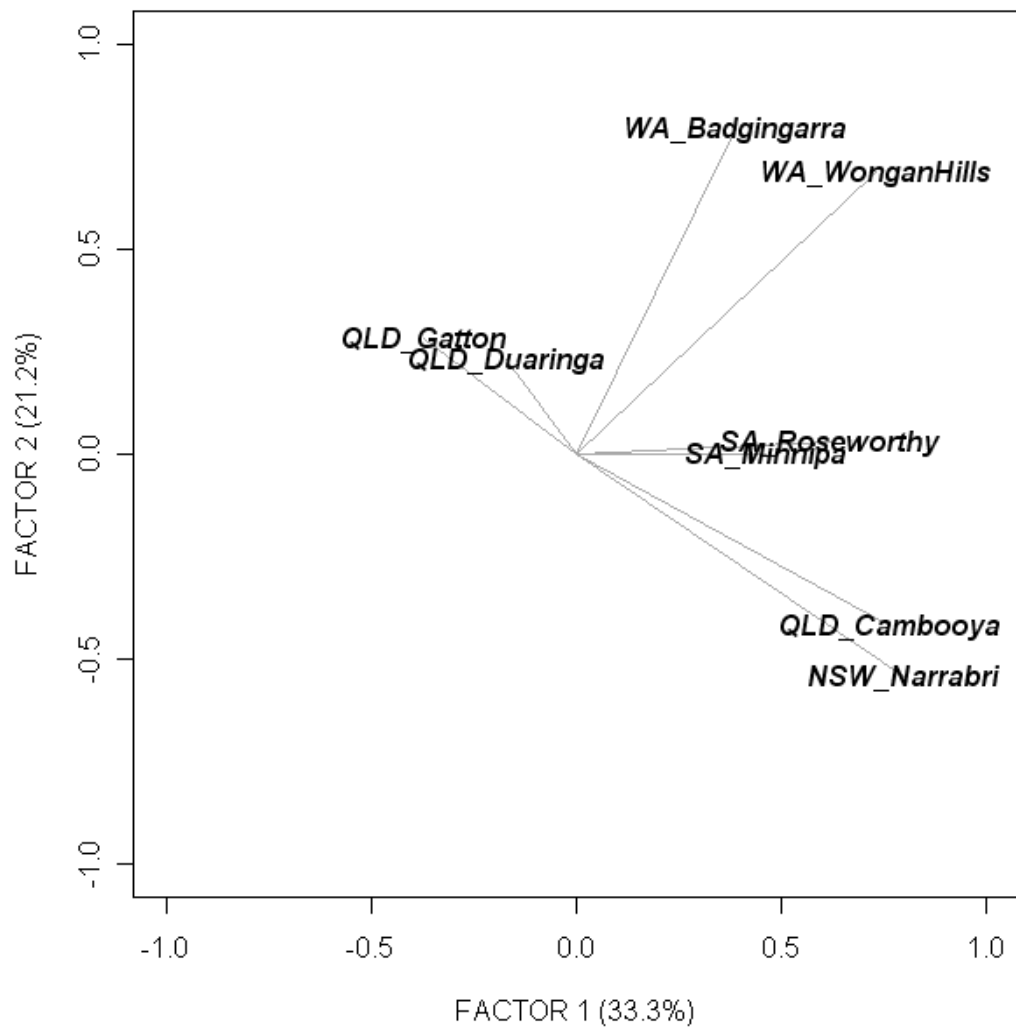


- Results from the 2006 season
- Research overview
  - global adaptation of Australian and CIMMYT germplasm
  - ‘window-on-wheat’: a real-life example!
  - molecular data
  - protein analysis
- Planning for 2007
  - CIMMYT
  - sites
  - entries
  - research

# 2006 locations



# 2006 Trials



<b>Trial</b>	<b>Yield (t/ha)</b>	<b><math>h_G^2</math></b>
QLD_Gatton	4.90	0.864
QLD_Duaringa	3.37	0.907
WA_Badgingarra	1.16	0.706
WA_Wongan Hills	0.95	0.629
SA_Roseworthy	2.33	0.868
SA_Minnipa	0.40	0.777
QLD_Cambooya	4.37	0.939
NSW_Narrabri	3.22	0.949



# 2006 overall top performers



- based on BLUPs from across site analysis which models between trial variance heterogeneity and correlation

- |     |                     |     |                        |
|-----|---------------------|-----|------------------------|
| 1.  | PUGSLEY             | 11. | <b>EGA BONNIE ROCK</b> |
| 2.  | <b>WYALKATCHEM</b>  | 12. | <b>BABBLER</b>         |
| 3.  | ANNUELLO            | 13. | <b>GBA COMBAT</b>      |
| ★   | 4. <b>WENTWORTH</b> | 14. | NESSER DWARF           |
| ★   | 5. <b>YOUNG</b>     | 15. | KAUZ DWARF             |
| 6.  | YITPI               | 16. | ATTILA*2/PBW65         |
| 7.  | WESTONIA            | 17. | TRIDENT                |
| 8.  | SILVERSTAR          | 18. | SUPER SERI #1          |
| 9.  | KRICHAUFF           | 19. | WEEBILL1               |
| 10. | ATTILA              | 20. | FRAME                  |

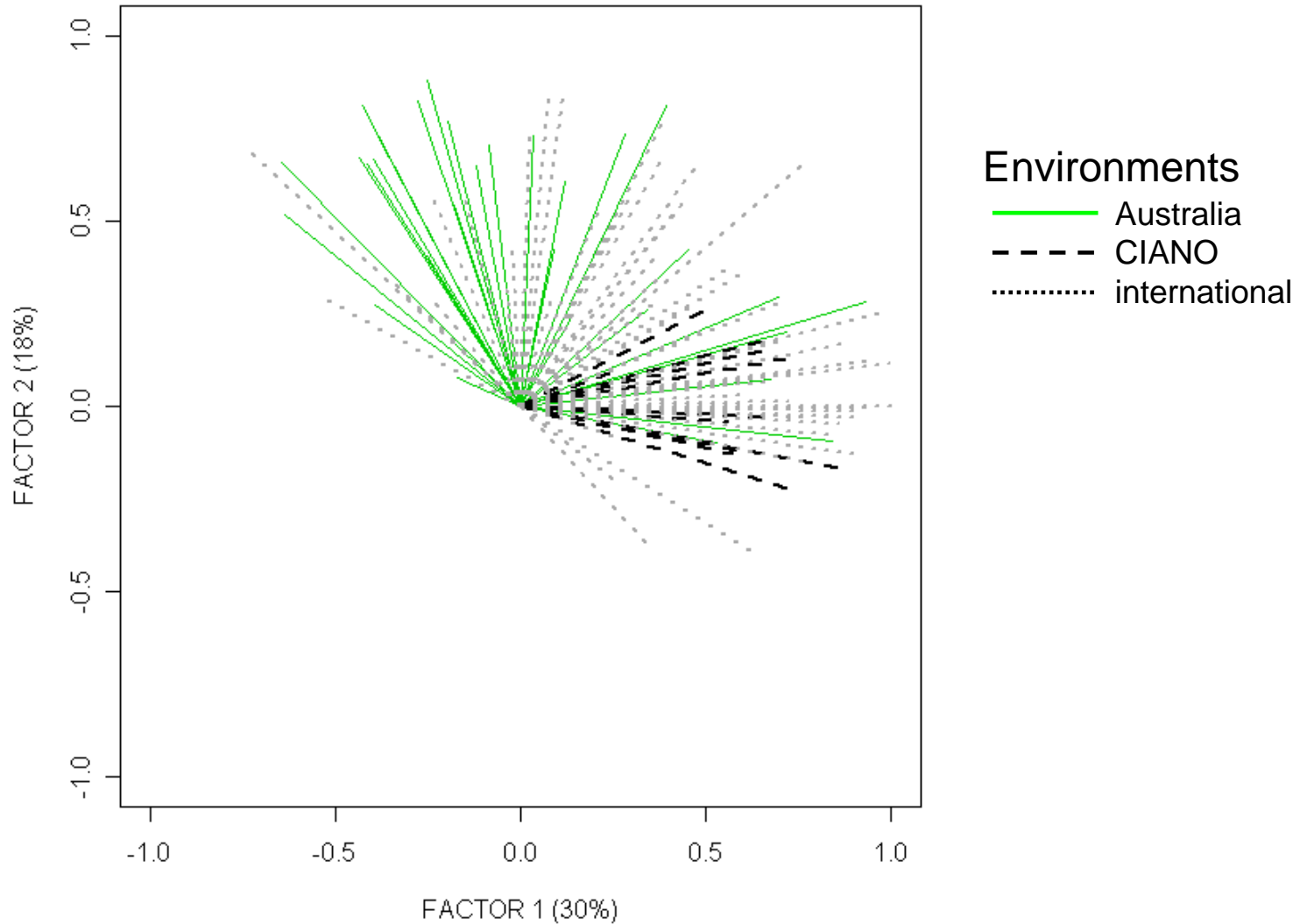
Yield Range: 2.6 – 3.7 t/ha

## **Mathew et al 2007 Global adaptation patterns of Australian and CIMMYT spring bread wheat**

- **investigate the G×E patterns for grain yield in the IAT**
- **pedigree relationship matrix used to partition the additive and non-additive genetic line effects**  
**Oakey et al (2006) TAG**
- **maturity used to explain the observed adaptive patterns**



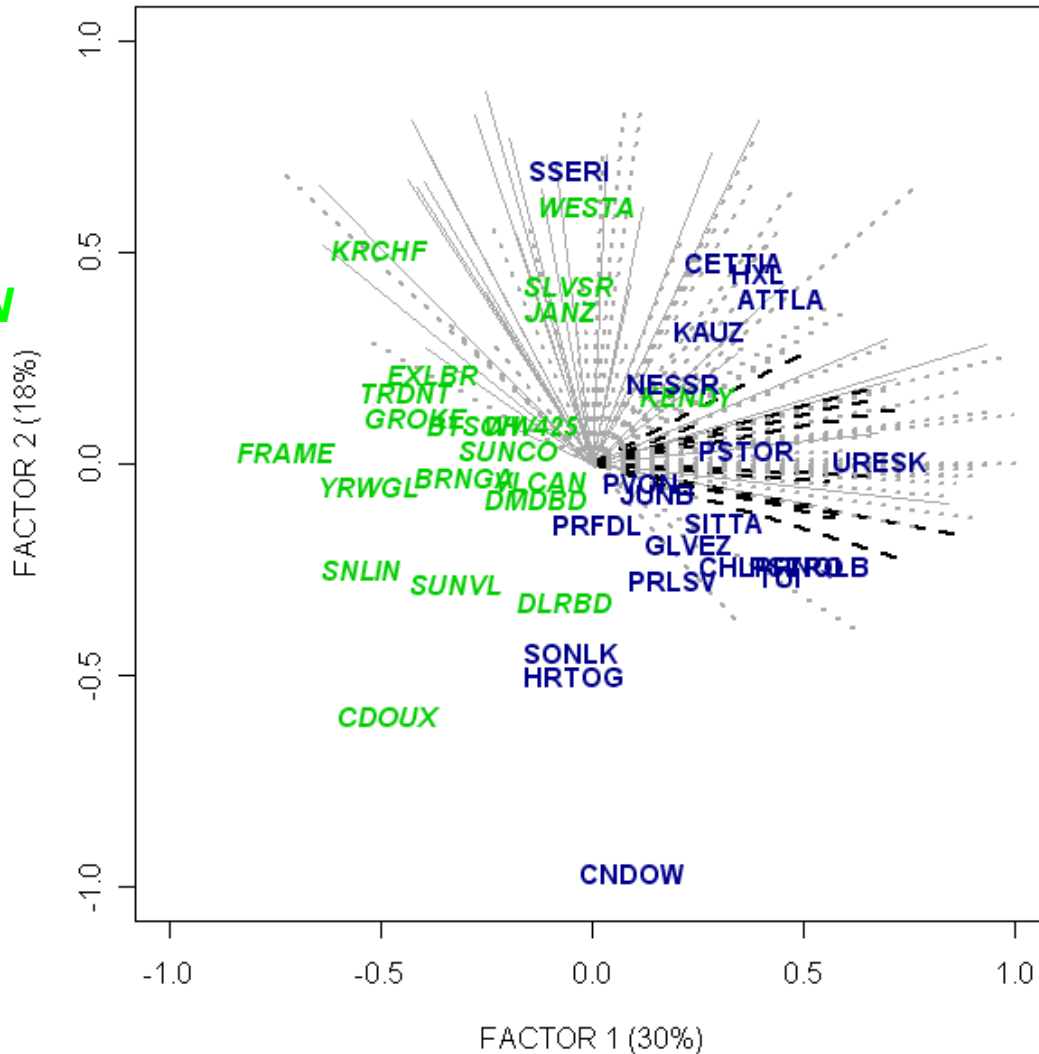
# Global G x E



# Global G x E



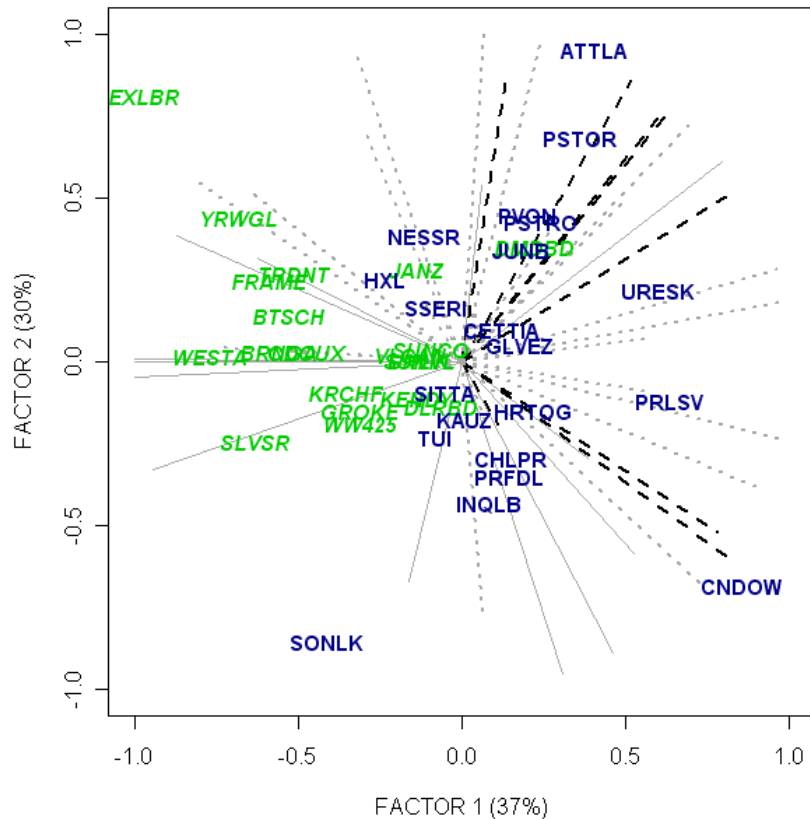
**Germplasm**  
**CIMMYT**  
**AUSTRALIAN**



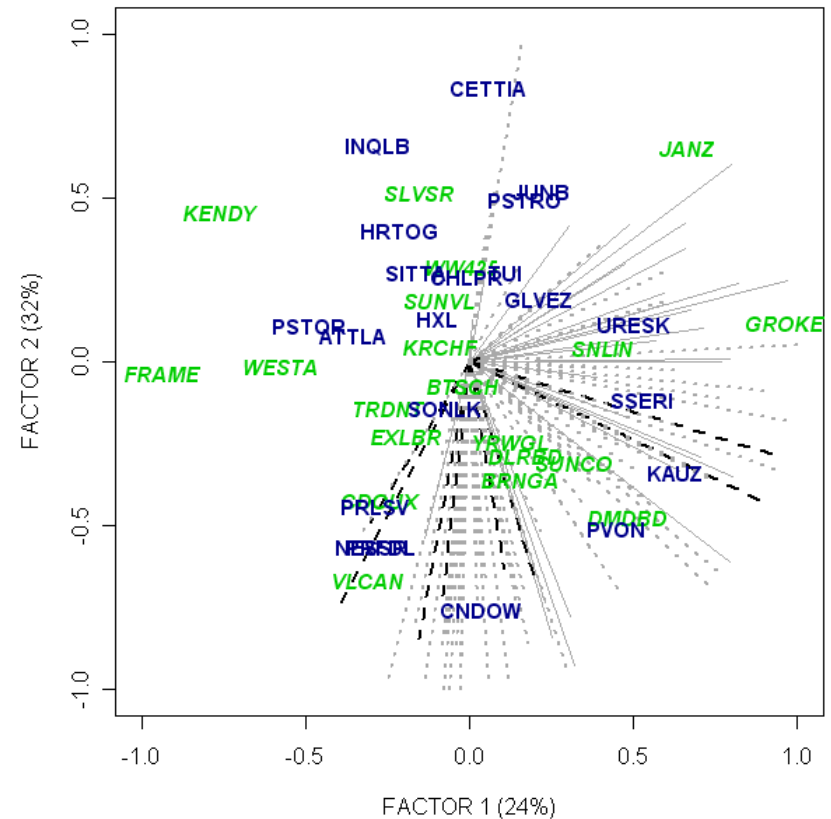
# Additive and non-additive by environment



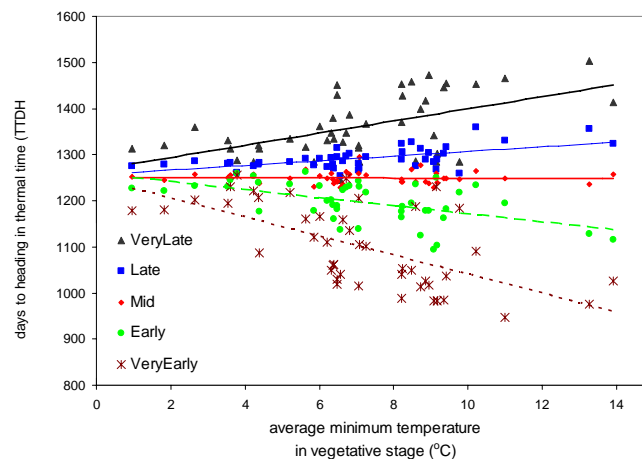
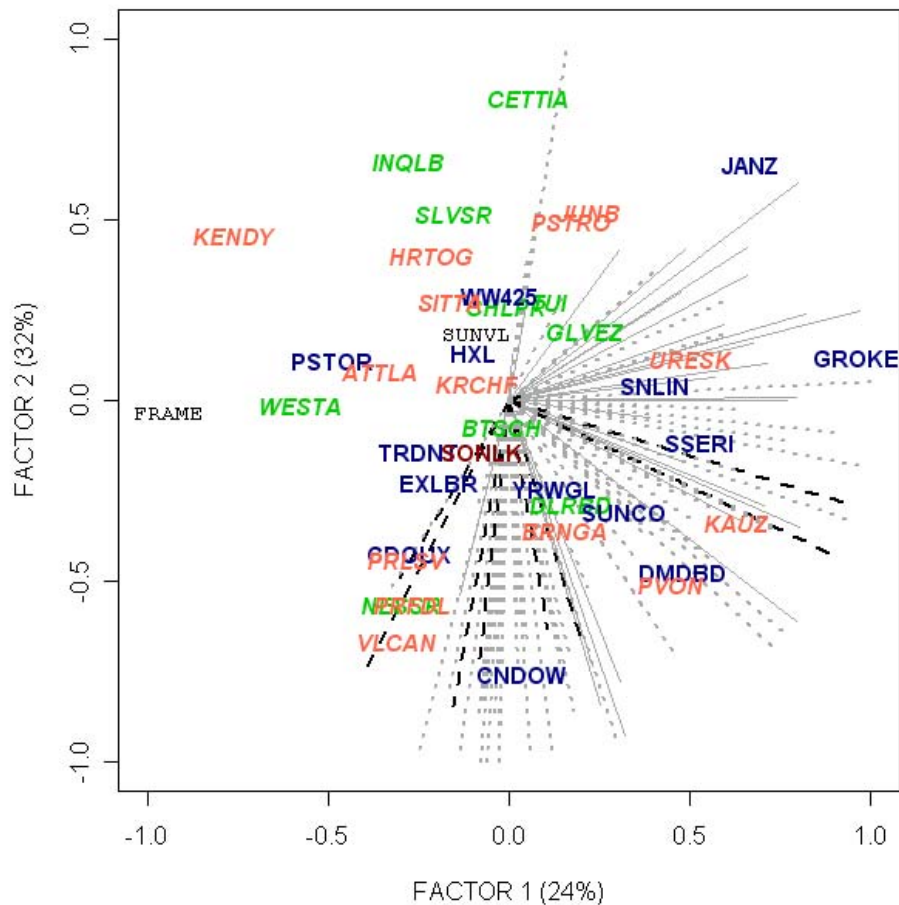
## additive by environment



## non-additive by environment



# Maturity Class



**VERY LATE**  
**LATE**  
**MID**  
**EARLY**  
**VERY EARLY**

# Key Points



- multiplicative mixed models be used in the analysis of multi-environment trials
- inclusion of pedigree information quantifies additive and non-additive effects
- Australian and CIMMYT germplasm are well adapted to their respective target environments and these environments are diverse
- maturity explains some of the adaptation differences between Australian and CIMMYT germplasm
- CIANO is a good source for northern Australian sites; southern sites may be better investigating later maturing lines suitable to the mega-env 9



# A real-life example!

## Selecting lines for high rainfall, irrigated trials



Identified three types of environments to select from

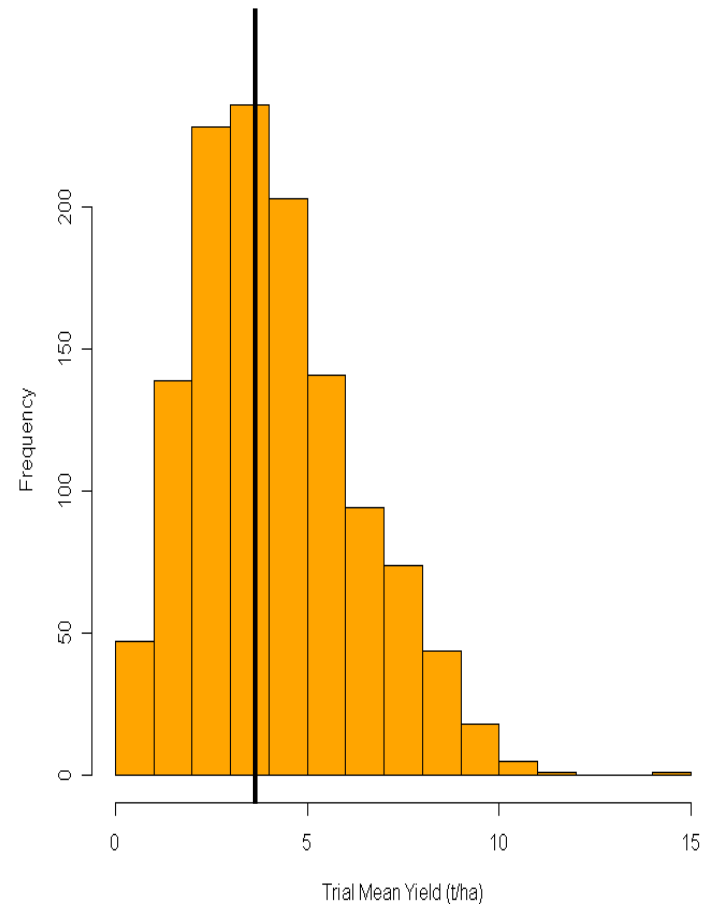
1. irrigated and high yield international trials, >4 t/ha
2. international locations which correlate with south-eastern Australia e.g. Wagga Wagga, Horsham, Robinvale, Moombooldool, Junee
3. international environments which correlate with irrigated IAT trials e.g. Tamworth.

# International Nursery Data



## Data used from IWIS (ICIS?)

- 1994 to 2004
- ESWYT, HRWYT, SAWYT
- traits: yield, days to heading, height
- 1231 trials
- 1253 genotypes
- 335 locations





# The process of a real-life example!

## Selecting lines for high rainfall, irrigated trials



### **1231 trials; 1253 genotypes**

1. irrigated and high yield international environments
  - > 4 t/ha and irrigated = yes
  - 341 trials with 1231 genotypes
2. international environments which correlate with south-eastern Australia
  - Wagga Wagga and Robinvale used
  - 199 trials with 1253 genotypes
3. international environments which correlate with irrigated IAT trials e.g. Tamworth
  - 241 trials with 1252 genotypes

# Lessons from a real life example...



- Takes 2-3 'Ky-days'
- decreased the number of trials to investigate significantly
- did not decrease the number of genotypes
- only single trial summaries provided
  
- so.... future developments
  - perform a GxE analysis on the selected trials and provide an across site BLUP to better identify the top performing lines, and hopefully decrease the quantity!!!

# Other research activities



- Molecular work
  - DArTs have been run across 94 lines, not including durums
  - data received 2 weeks ago
  - Scott Chapman to outline future work
- GxE quality
  - seed supplied to Colin Cavanagh (CSIRO, Canberra) from 5 trials in 2005
    - Robinvale, Morowa, North Yuna, Wagga Wagga, Duaringa
    - Narrabri and Tamworth analysed in Brisbane
  - analysis in progress...

# Planning for 2007



- CIMMYT
  - Tom Payne providing entry list, some new lines from Ravi Singh and Yann Mannes
  - 6 sets sent to southern latitude locations
- Australia
  - IAT grown with 5 Germplasm Evaluation Trials
  - seed to be distributed by Agrisearch using DAFWA seed source
  - entries – see handout
- research
  - probe paper: crown rot and boron tolerance
  - DArT
  - protein

# Acknowledgements



- Grains Research and Development Corporation
- International and Australian collaborators who grew the trial (and returned data!)
- Helena Oakey for assistance with pedigree analysis
- Andrew Milgate for requesting the window-on-wheat
- Chris Moore/Robin Wilson, DAFWA for seed source for 2007