



Evolution -

'Gradual Change'

... We Can Believe In

Drought Tolerance Breeding

oy--

Pretty Much The Same !



Galapagos

Drought Cycles + Isolation

Shaped What Darwin saw

Beak of the Finch

© shunya.net

Breeding for
Drought Tolerance

in the **Southeast**

Tommy Carter, USDA @NCSU

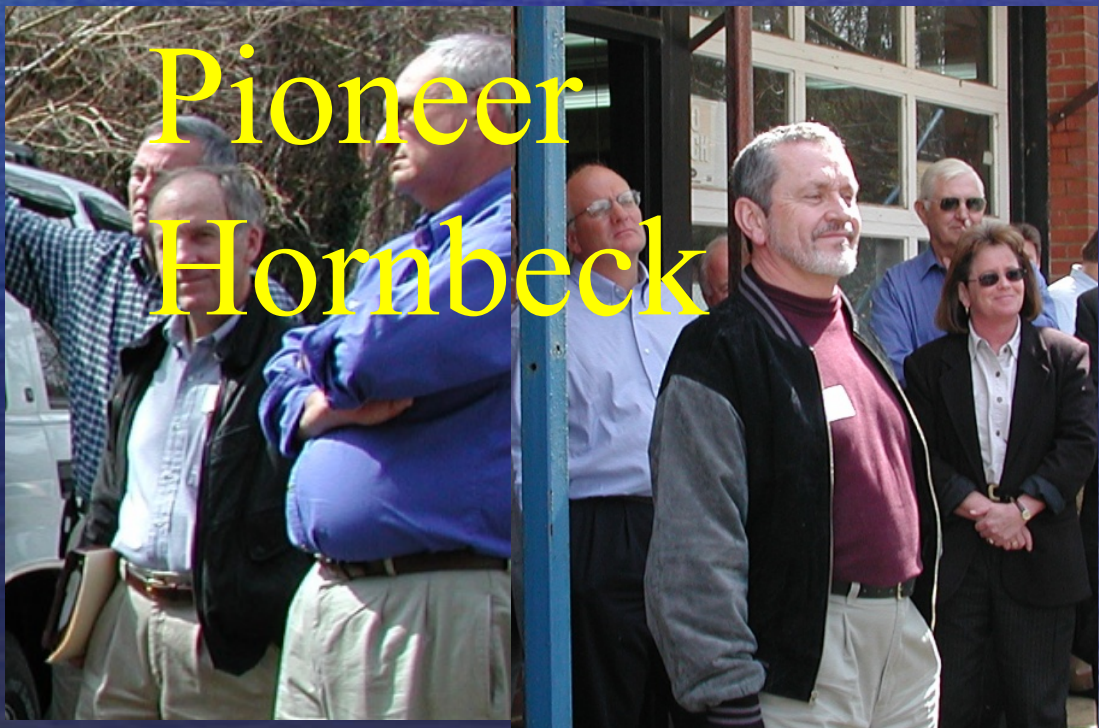
‘Gradual Change’ We Can Believe In

First a Thanks!

USB and State commodity groups

Syngenta
Monsanto

Pioneer
Hornbeck



Team Drought



Team Drought

9 Scientists

Orf

Purcell

Specht

Chen

Boerma

Rufty

Carter

Sinclair

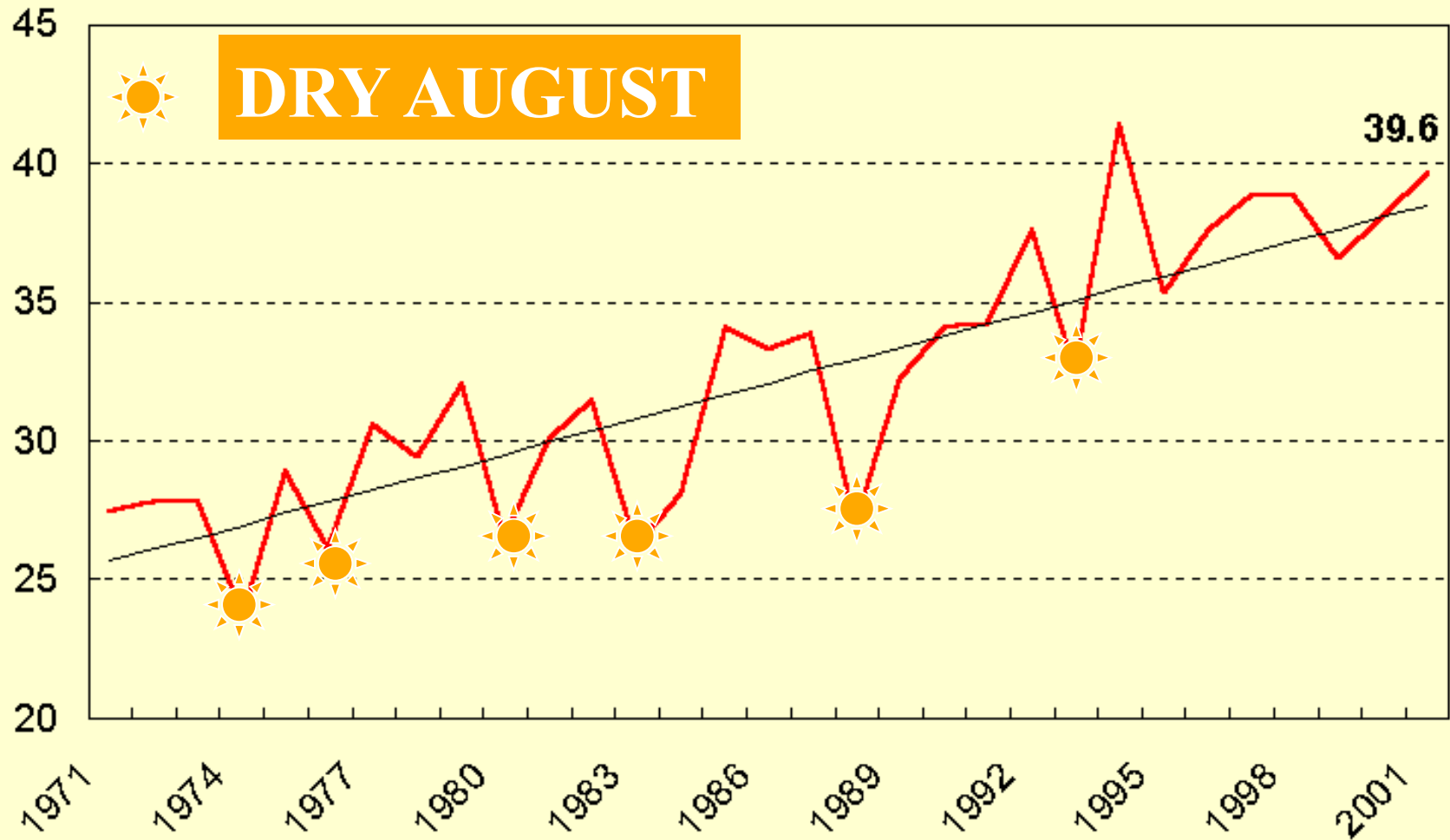
Fritschi

HOW IMPORTANT IS DROUGHT ??



U.S. Soybean Yield

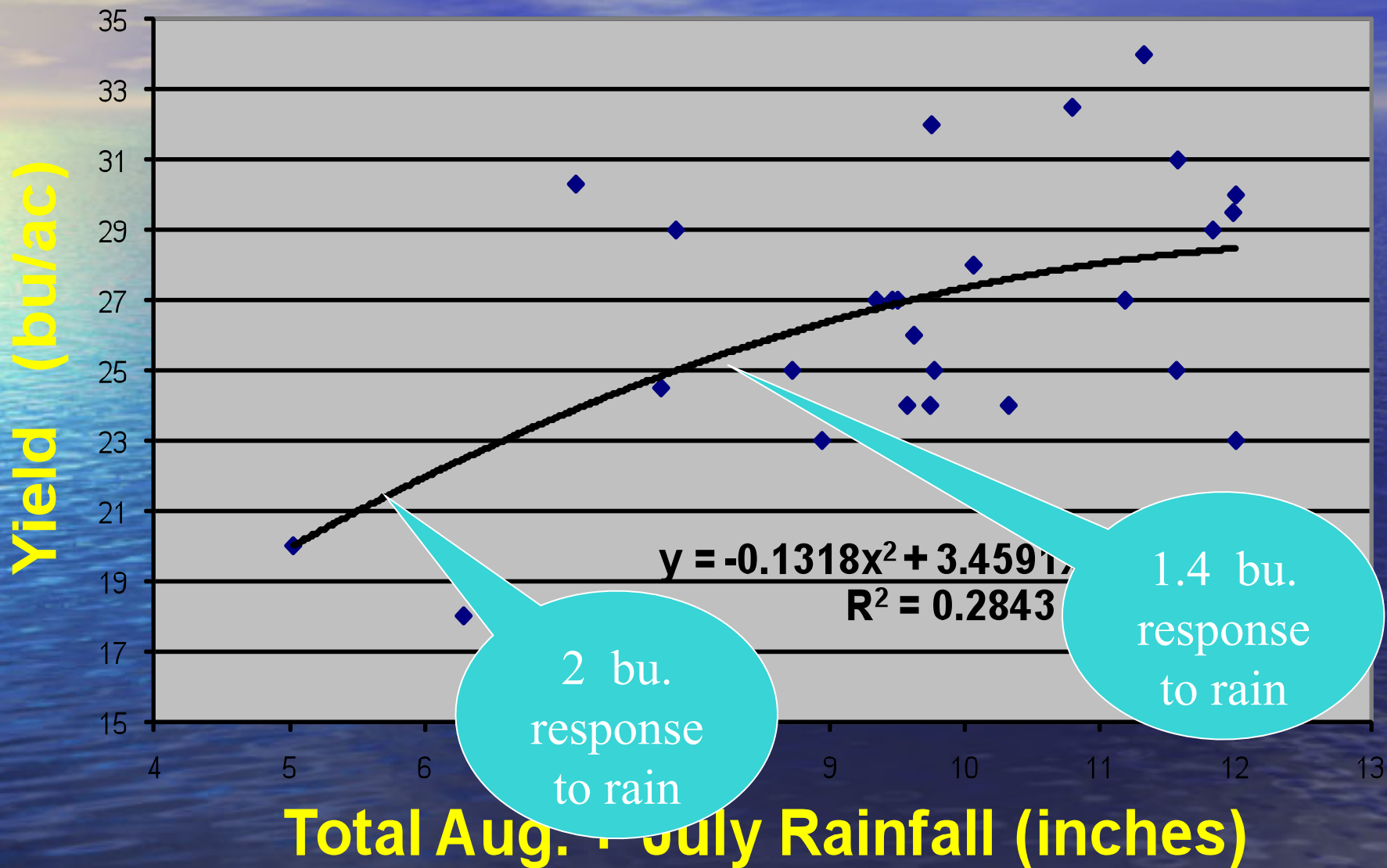
Bushels/Acre



USDA-NASS
01-11-02

Rainfall and Yield in North Carolina

1980-2005



CENTRAL DOGMA in

DROUGHT TOLERANCE

Start with Observed

Field Differences

& BUILD UP

SANDHILLS Research Station











Slow Wilting Trait

Fast
wilting

Slow
wilting

All Varieties are FAST Wilting
-- Some worse than others

HMMM! Where to find variation?



**Searching the Globe
for tolerance**

**About 2500 Strains
screened in NC**

Thank you Randy Nelson !!!





Germplasm Discoveries (slow wilters)



PI 416937 - Japan

PI 471938 - Nepal

H2 L16 - Egypt (Celest x Crawford)

NTCPR94-5157 (from USDA Tracy, Davis, Ransom)

93705-50 from AR (Jackson x K4895)

5 other PIs which have modest levels of slow wilting

Germplasm Discoveries (slow wilters)



NONE documented as deep rooting

However, one is 'funny rooting' (PI 416937)

Slow Wilt QTLs identified in 3 sources thus far

All are multigenic – all have something unique.

Multiple Physiological Mechanisms - water conversation, aquaporins, hydraulic conductivity?

Complicated picture emerging -

Germplasm Discoveries

QED:

Field Programs &

Yield under Stress Remain Essential

Goal is to :

Develop great material from each slow wilter

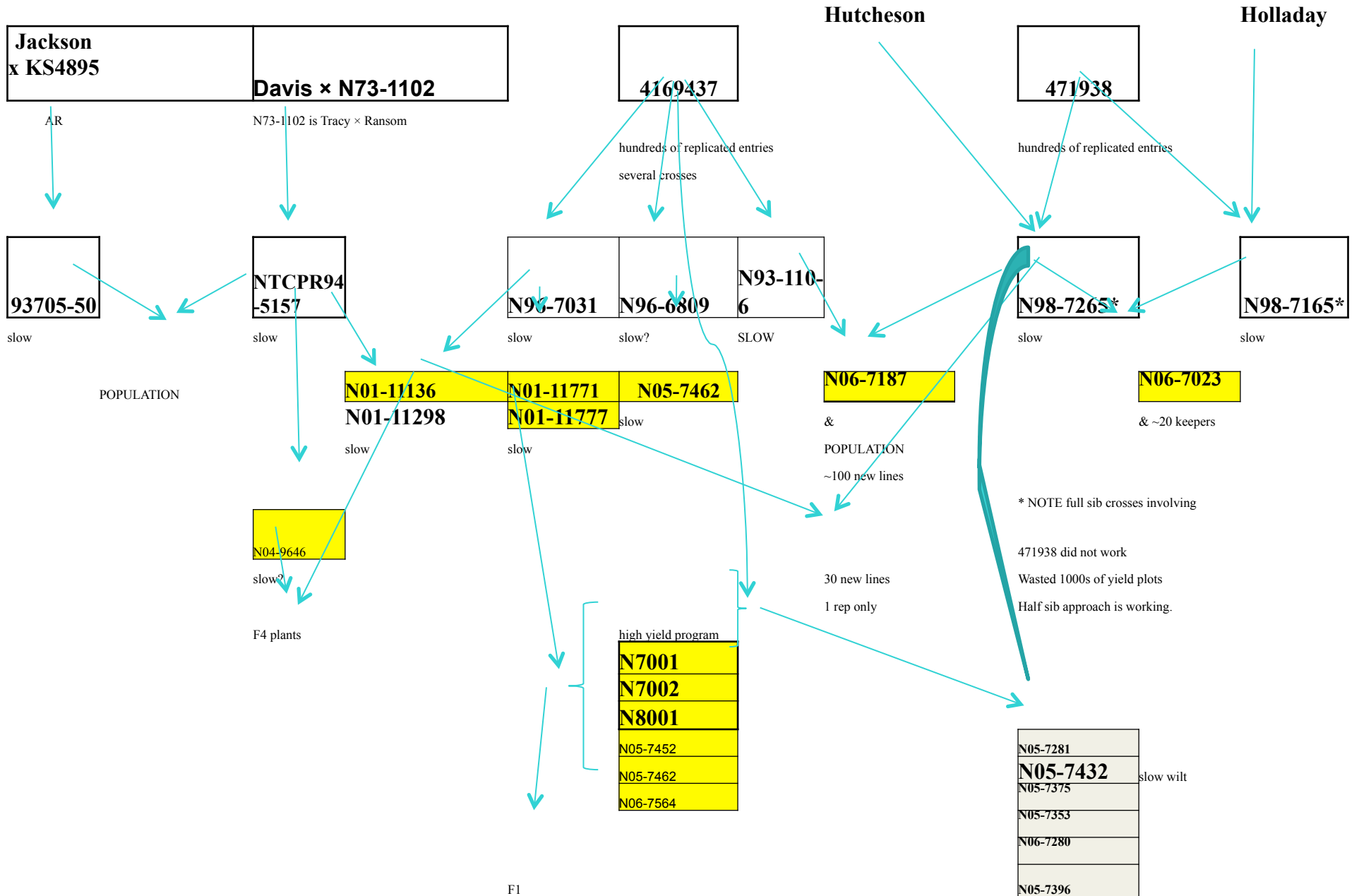
Identify QTL

Pyramid Various Alleles; Find Best Agronomics



TC Crosses for southern breeding

Boxes indicate tested in Uniform Test in recent years



F1

Gradual change you can believe in



**30 acres of plot work (5000 plots)
annually at Sandhills since the late 90's**

More than 100 lines submitted to regional testing

Surprise!- High Yielding Varieties came out **W/O Slow Wilt**

'Slow wilt' transferred to adapted - not high yielding

New Slow Wilts ARE high yielding - MG VI thru VIII.

HIGH YIELD VARIETIES

FROM SLOW WILT 416937

N7001

50% PI



N7002

25%

Uniform Check

N8001

25%

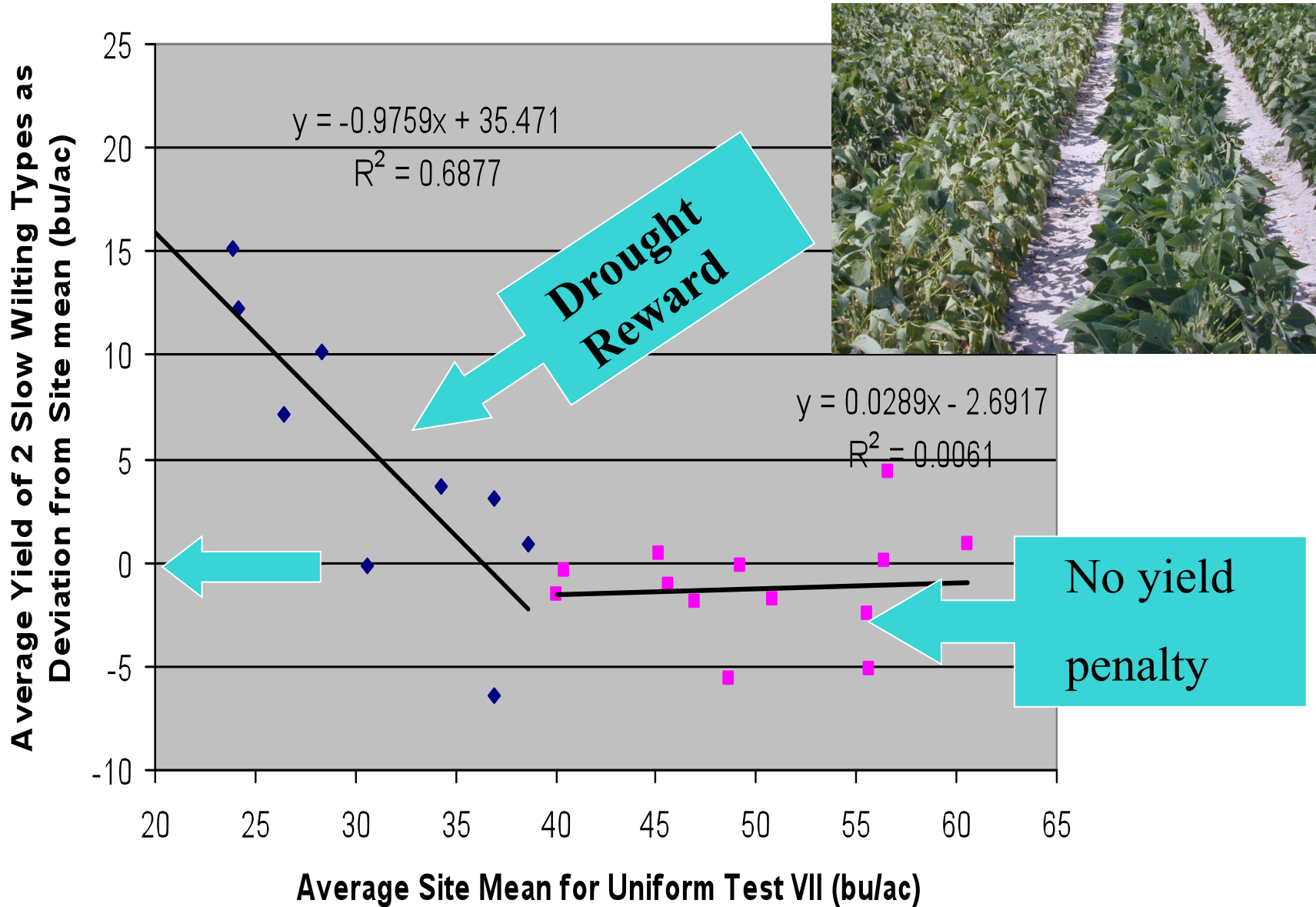
Uniform Check

WOODRUFF

25 %

Best yielder- Boerma

1st Slow Wilters in USDA REGIONAL TRIALS



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New ERA Slow Wilter in Regional Trials



| Group 8 | | HI YIELD | LOWER YIELD |
|------------------------|------------------|---------------------|------------------------|
| TYPE | | 55+ | LT 55 |
| | | BU/ | AC |
| NEW | N05-7432 | 59.0 | 44.8 |
| BEST CHECK | N8001 | 58.9 | 40.6 |
| | ADVANTAGE | 0.1 | <u>4.2</u> |
| | | | |
| # LOCS = 25 | | 5 | 20 |

37.5% PI

12.5% 416937

25% 471938

**SLOW WILT --
471938**

**HI YIELD
--416937**

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you can believe in**

New Era Slow Wilter in Regional Trials



| Group 7 | | YIELD |
|----------------------------|-------------------|--------------------|
| TYPE | | BU/AC |
| | | |
| NEW | N05-7281 | <u>44.8</u> |
| BEST CHECK | N7002 | 47.0 |
| <u>HISTORIC CHK</u> | Haskell RR | 43.2 |
| | | |
| # LOCS =32 | | |

50% PI

25% 416937

25% 471938

**Gradual change
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New Era Slow Wilter in Regional Trials



| Group 6 | | YIELD |
|-------------------|-----------------|--------------------|
| TYPE | | BU/AC |
| | | |
| NEW | N05-7023 | <u>42.1</u> |
| BEST CHECK | DILLON | 44.1 |
| | | |
| # LOCS =15 | | |

50% 471938

Future Directions

Continue Yield Testing

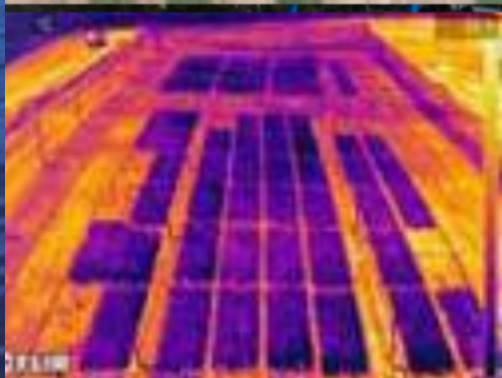
Augment field breeding with MAS & new QTLs

**Collaborate with Team Drought, Farmers & Industry -
Understand Mechanism and Genomics of Drought**

New Toys for Rapid Phenotyping

High Resolution Plant Phenomics Centre

CSIRO



Purcell in Arkansas



CSIRO



Apogee IR sensors
What: canopy temperature

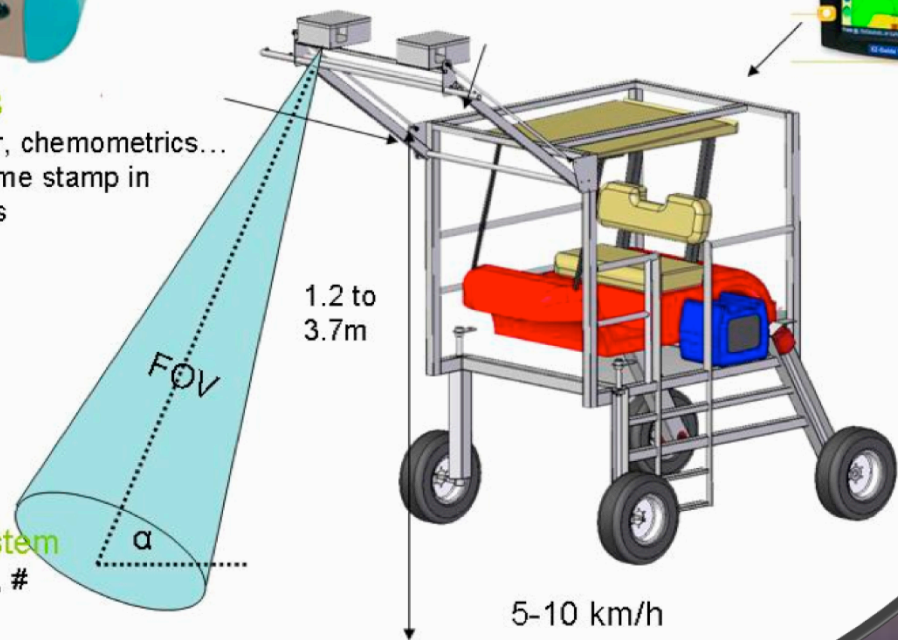
Trimble GNSS
Where: (2-cm accuracy)

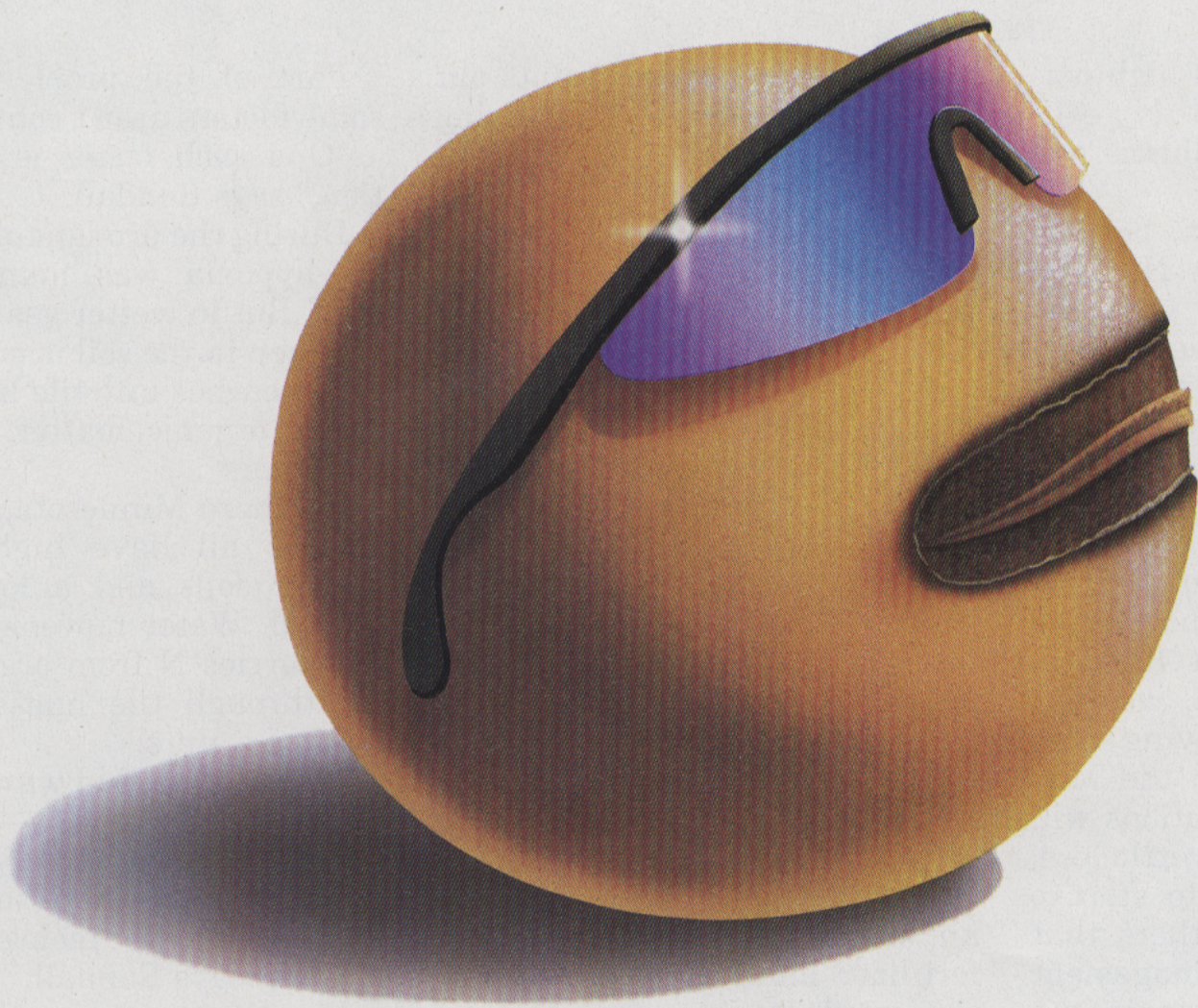


ASD FieldSpec3
What: ground cover, chemometrics...
When: Automatic time stamp in spectral file headers



stereo-system
What: ground cover, chemometrics...
When: Automatic time stamp in spectral file headers





Cool Bean.

ific weed control programs and prices vary. See your dealer. Read and follow the label. © 1998 DuPont