SP2.10: Utilization of Existing Wheat Genetic Stocks to Enhance Tolerance of Wheat Cultivars to Drought Stresses

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International Maize and Wheat Improvement Center

Co-operating Institutions

- Australia — Centre for Plant Functional Genomics, Canbarra
- China — Academy of Agricultural Sciences, Beijing
- Germany — Institute of Plant Genetics and Crop Plant Research (IPK), Gartersleben
- Japan — Kihara Institute for Biological Research; Tottori University
- Mexico — CIMMYT
- Pakistan — Institute of Biotechnology and Genetic Engineering, Peshawar
- Russia — Institute of Genetics and Cytology, Novosibirsk
- Syria — ICARDA
- UK — John Innes Centre
- USA — Kansas State University; USDA-ARS/University of Missouri; University California-Riverside; Cornell University

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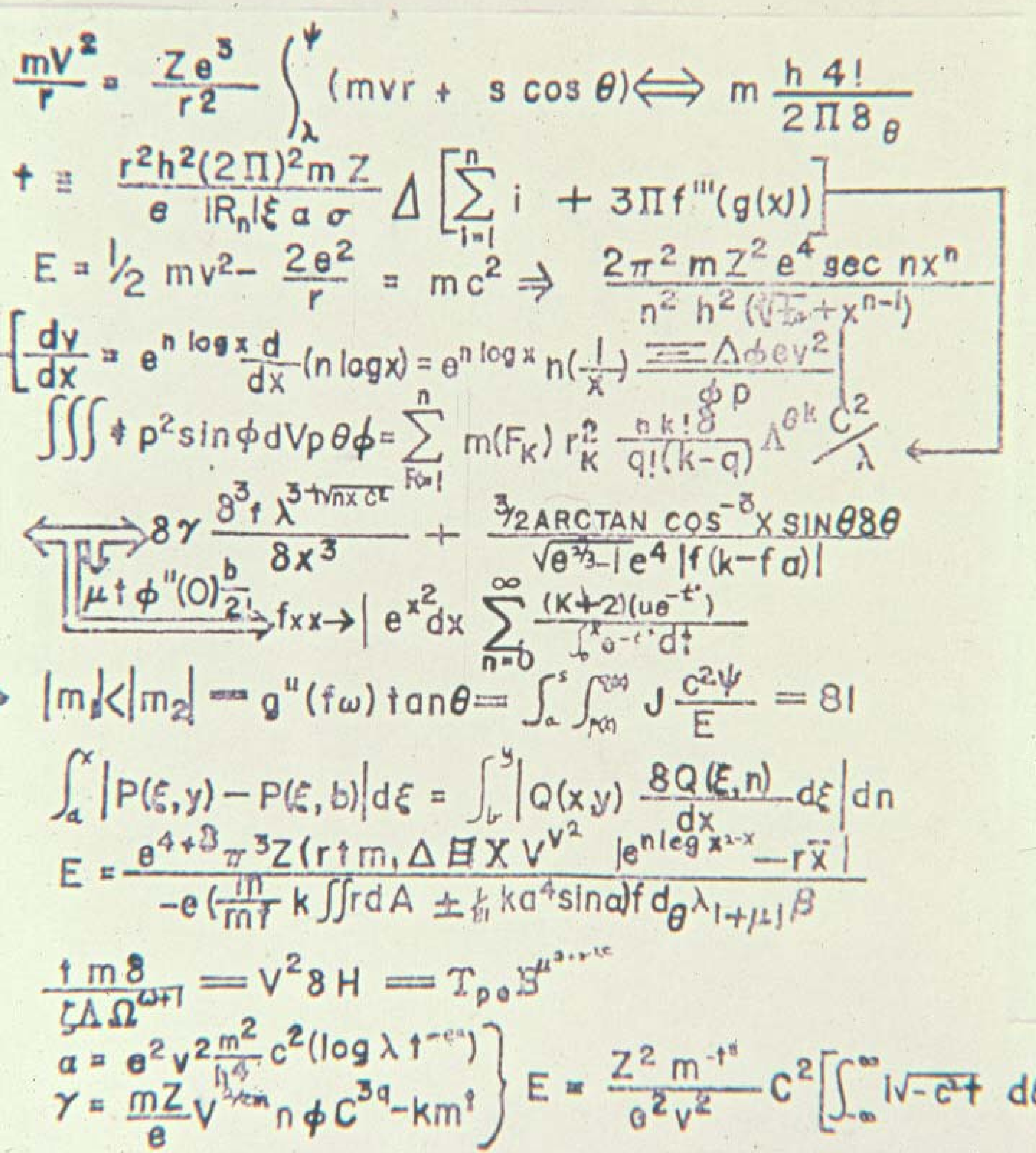
Project Objectives

- Conserve and catalogue existing relevant wheat genetic stocks
- Make these available for agronomic and molecular characterization
- Multiply, and upon request, distribute seed of these stocks
- Initiate phenotyping for traits relevant in drought prone environments

DROUGHT RESISTANCE =



Source: W.H. Pfeiffer

What is "Drought Tolerance"?

- *Per se*
- Avoidance
- Root health (nematodes, rots)
- Root vigor
- Tolerance to nutrient deficiencies
- Root biomass / architecture
- Photothermal response
- Salinity, etc.

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Significant new variation for drought tolerance from Synthetic Derivatives

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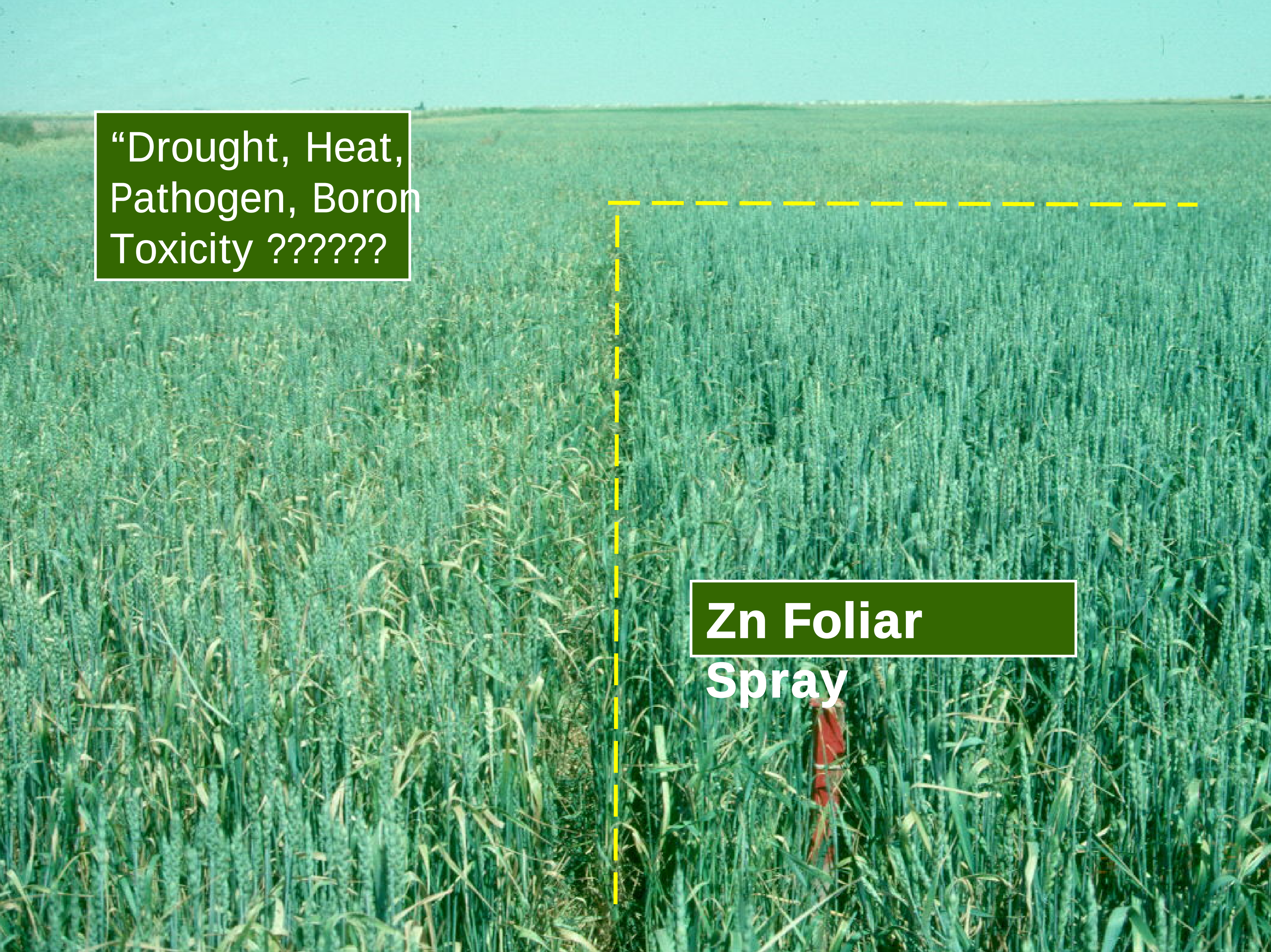
"Drought, Heat, Pathogen, Boron Toxicity ??????


“Drought, Heat, Pathogen, Boron Toxicity ??????
Zn Foliar Spray

Differences in Zn efficiency among cereal species

Source: Cakmk I

Yield & biomass of 7DL.7Ag translocation lines

		Yield (g/m^2)/	Biomass (g/m^2)
Angostura	*Check*	655	1610
	7DL.7Ag	700	1730
Bacanora 88	*check*	685	1650
	7DL.7Ag	710	1660
Borlaug 95	*check*	710	1730
	7DL.7Ag	830	1900
Star	*check*	695	1730
	7DL.7Ag	750	1800
Seri 82	*check*	680	1540
	7DL.7Ag	720	1740
Yecora-70	*check*	680	1320
	7DL.7Ag	720	1480
Average	*check*	675	1600
	7DL.7Ag	775	1760
Average increase		***14 %***	

Wheat Genetic Stock selection criteria

- Genetically stable
- Adapted background
- Available without restrictions
- Seed availability
- Possible phenotypic, genetic characterization
- Possible pre-existing phenotypic / genetic characterization data / publications
- Short-term guaranteed outputs (SP3, 3-5 years) + longer-term intermediary products (SP2, 7-10 years)

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Priority Traits

- Drought related Physiological Traits
- Tolerance to Zn deficient soils
- Tolerance to soil borne diseases
- Cereal Rusts
- Hessian Fly Resistance
- Salt tolerance
- Other traits based on interest of co-operator – seed freely available

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Genetic Stocks with good impact prospects

- Wheat rye translocation stocks
- Primary genepool derivatives
- Synthetics, and derivatives
- Saratovskaya 29 populations
- Mapping population parents

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Rye Introgressions

1BL_1RS

- **Yellow Rust, Yr9**
- **Leaf Rust, Lr26**
- **Stem Rust, Sr31**
- **Powdery Mildew, PM8**
- **Biomass**
- **Root architecture**

Other rye traits of interest

- **Zinc, Copper, Iron Efficiency**
- **Tolerance to extreme pH**
- **Hessian Fly Resistance**
- **Aphid Resistance**

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Project Implementation

- Initial Nomination of Available Stocks, ~3300
- Itemized Catalogue of Suitable Stocks
- Seed Multiplication in field and green house
- Intellectual Property Rights - MTA
- Field and Laboratory Screening in 2006