



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Outlook Forum

Presented: February 17, 2006

SUPERIOR BREEDS FOR DROUGHT TOLERANCE

Wenwei Xu

Associate Professor of Corn Breeding & Genetics

Agricultural Research & Extension Center

Texas A&M University

Superior Breeds for Drought Tolerance

Wenwei Xu

Associate Professor

Texas A&M University System
Agricultural Research and Extension Center
Lubbock, TX 79403

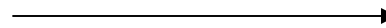
Water



- Precious natural resource
- A major limiting factor for crop production



Drought



Drought Stress



Moderate stress



Severe stress

- Reduced yield
- Increased aflatoxin

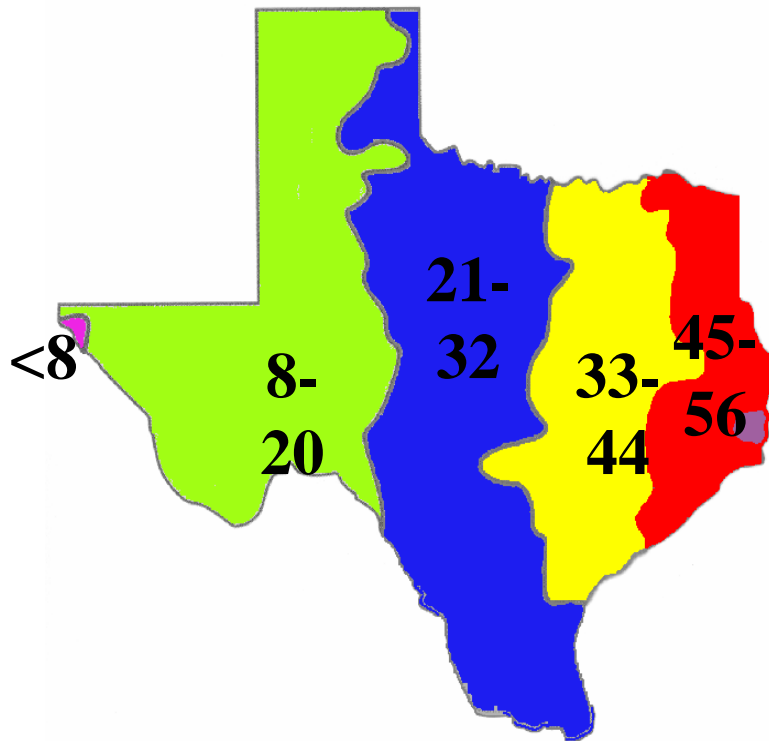
Managing Drought Stress

- **Change cropping system**
- **Utilize more efficient irrigation systems**



Managing Drought Stress

- Change cropping system
- Utilize more efficient irrigation systems



Average Rainfall in Inches

* Low rainfall

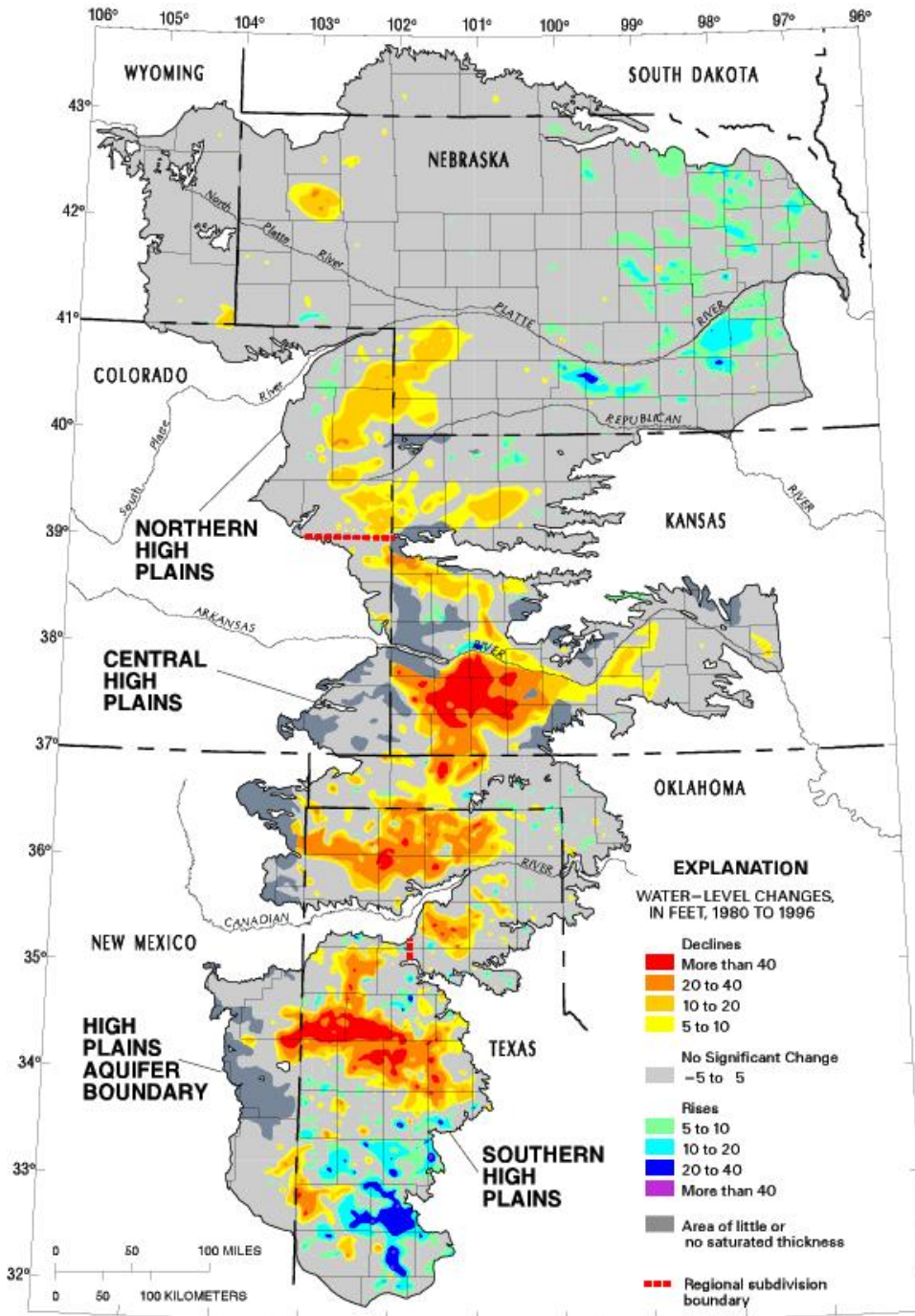
* Increasing pumping costs

* Declining water level of the Ogallala Aquifer.

Water-level changes in the High Plains (Ogallala) aquifer from 1980 to 1996:

- Ogallala aquifer covers 8 states: CO, KS, NE, NM, OK, SD, TX, WY.
- Water level has declined:
 - 0.25 feet/year in 1940-80.
 - 0.18 feet /year in 1980-96.
- * Irrigated acres by ground water (in millions):

1949	1959	1969	1978	1980	1990
2.1	6.1	9.0	12.9	13.7	95%



Managing Drought Stress

- **Change cropping system**
- **Utilize more efficient irrigation systems**
- **Change plants through genetic approaches**
 - ➔ **Early-season hybrids/varieties**
 - ➔ **Drought and heat tolerant hybrids**

Conventional breeding
Biotechnology



Well-irrigated



Drought stressed

Drought susceptible hybrid



Drought tolerant hybrids under drought condition

Breeding Approaches For Drought Tolerance and Progress At Texas A&M University

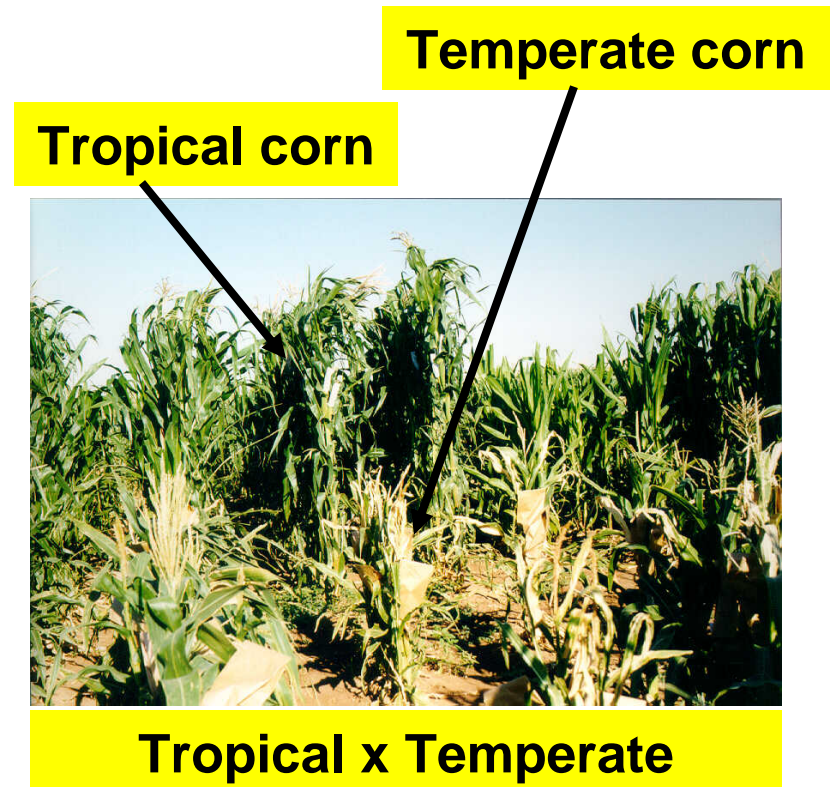
Use native drought tolerance genes in exotic corn germplasm, especially the tropical corn germplasm

Use Native Drought Tolerance Genes in Exotic Corn Germplasm

- One of the useful source of the USDA GEM (Germplasm Enhancement of Maize) Project

- Evaluate for drought and heat tolerance, insect resistance, grain mold resistance, yield and other agronomic traits.

➔ **Develop multiple stress tolerant corn.**



Drought Tolerance Evaluation

- Use drip irrigation system
- Take advantage of low rainfall
- 3 water treatments

Treatments	Acre-inch
Well-irrigation	16.0
Stress 1	12.3
Stress 2	7.0



Drip Irrigation system for drought tolerance study

Evaluation of Drought Tolerance

- Timing of drought stress
- Intensity of drought stress
- Duration of drought stress

Well-watered block

Drought block





Stay green rating

1 = 100% green, 2 = 75%, 3 = 50%, 4 = 25%, 5 = 0% green leaves



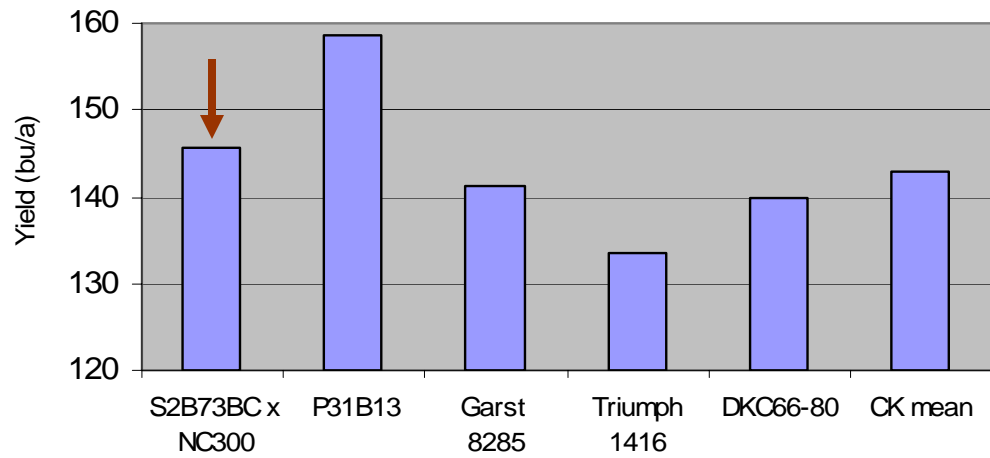




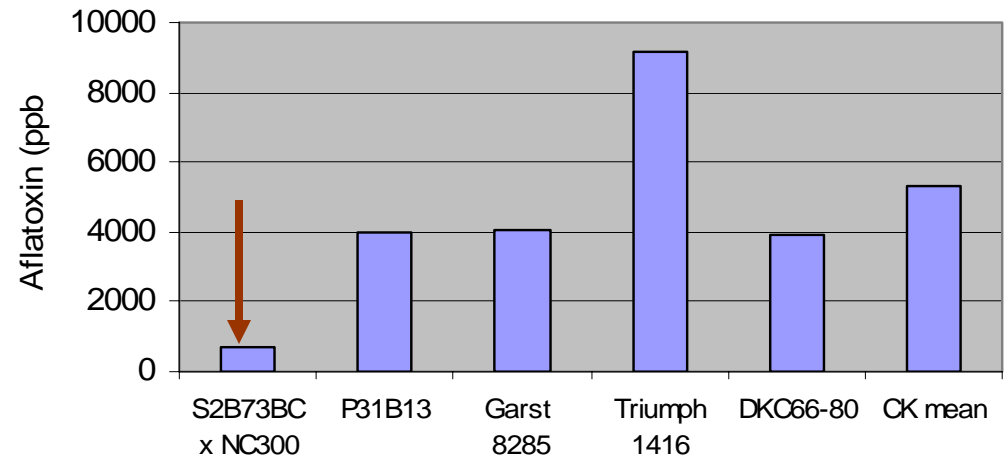
Stay green rating

1 = 100% green, 2 = 75%, 3 = 50%, 4 = 25%, 5 = 0% green leaves

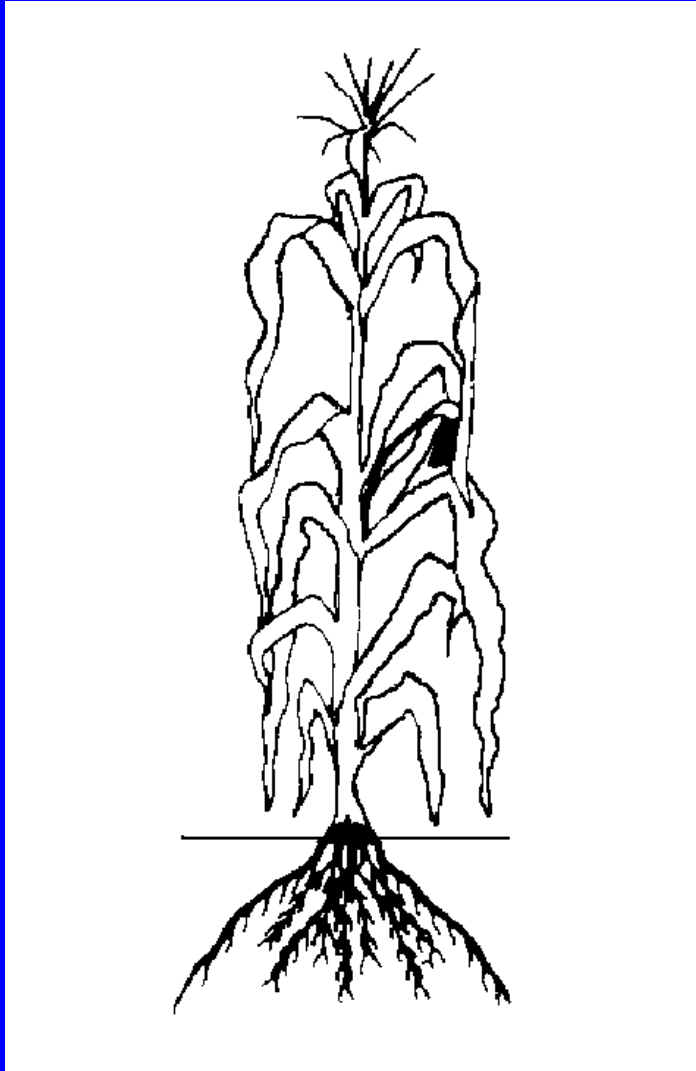
Average yield in six environments



Aflatoxin level under inoculated conditions



Thank you!



Hydraulic lift:

a process of water movement from relatively moist soil to dry soil layers using plant root systems as a conduit (Caldwell et al., 1998).

P3223

TAES176

P3225

Roots from
top pots →

Roots from
bottom pots →



