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**

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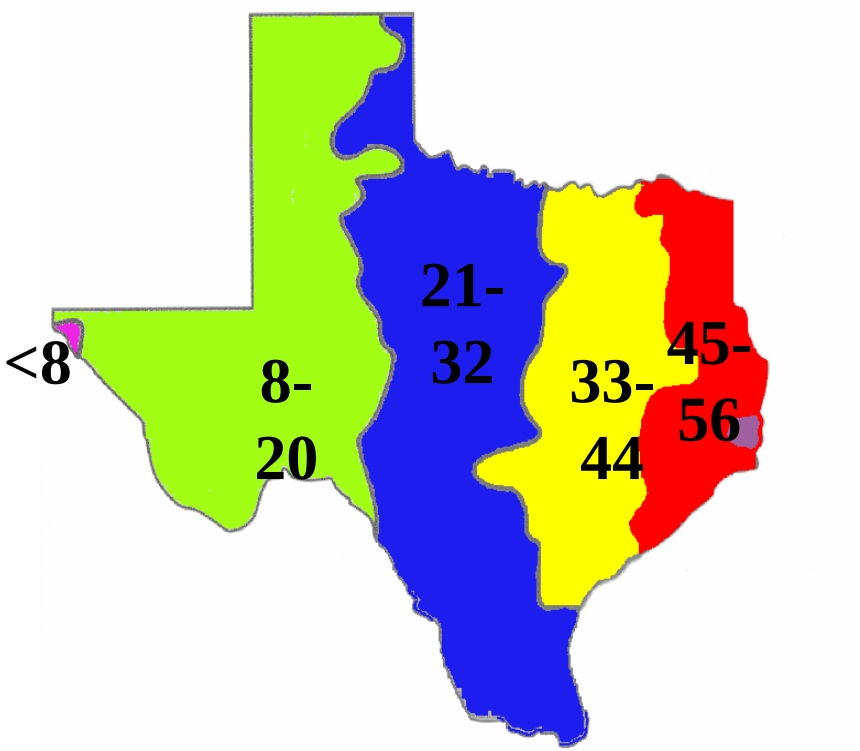
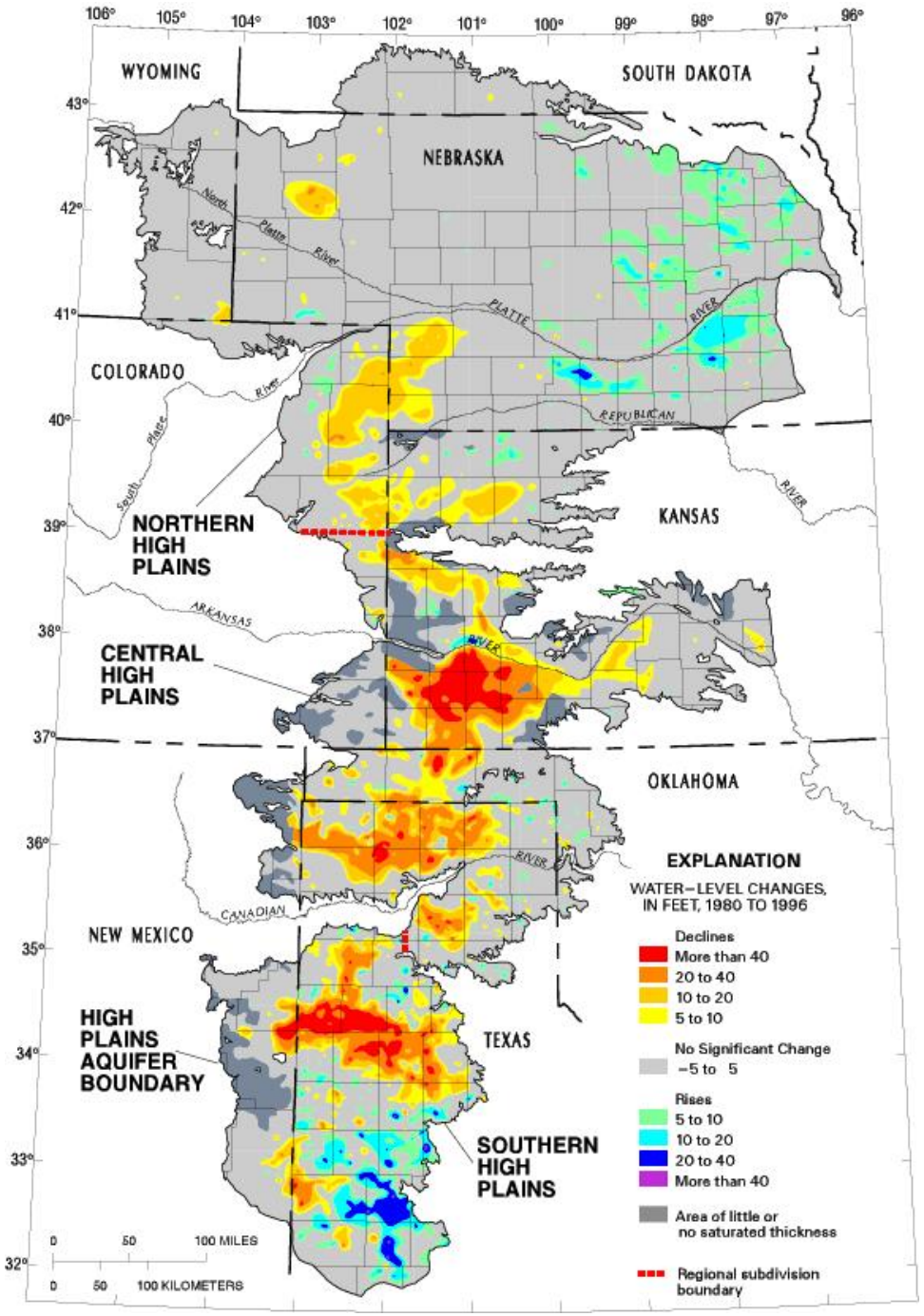


Average Rainfall in Inches

*** 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.**

Tropical x Temperate

Drought Tolerance Evaluation

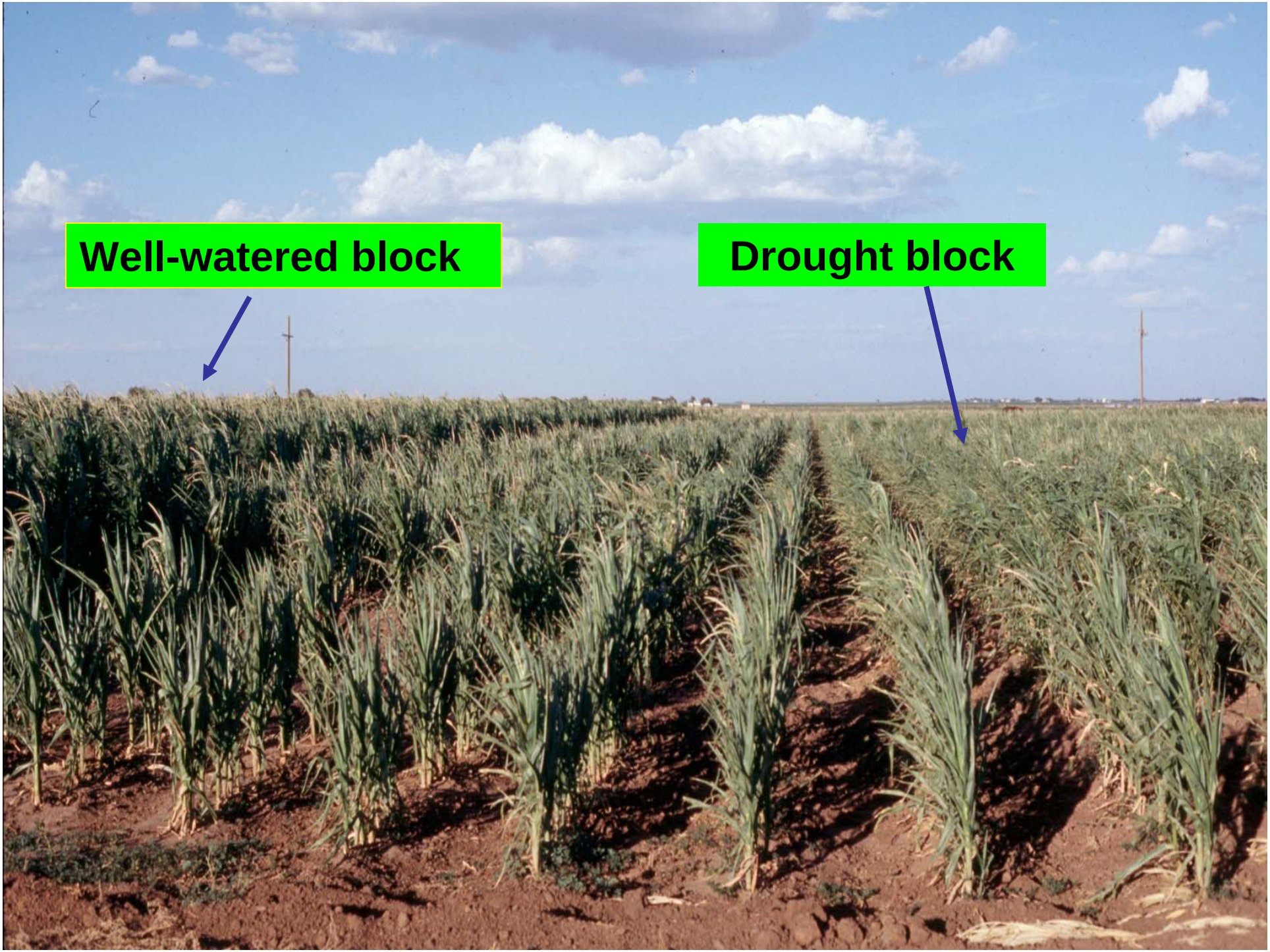
- Use drip irrigation system
- Take advantage of low rainfall
- 3 water treatments

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

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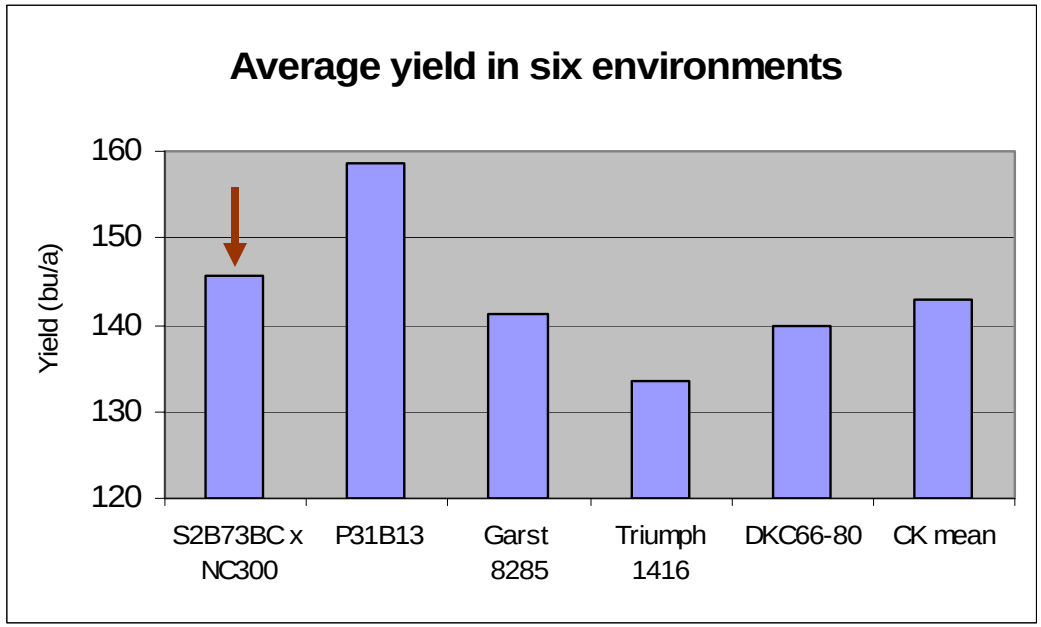
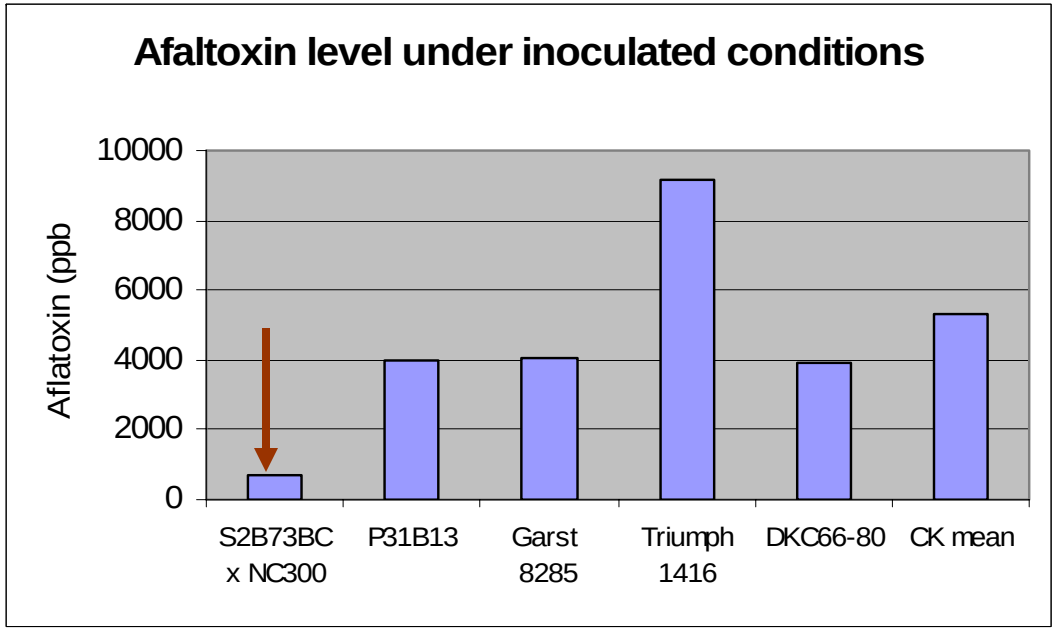
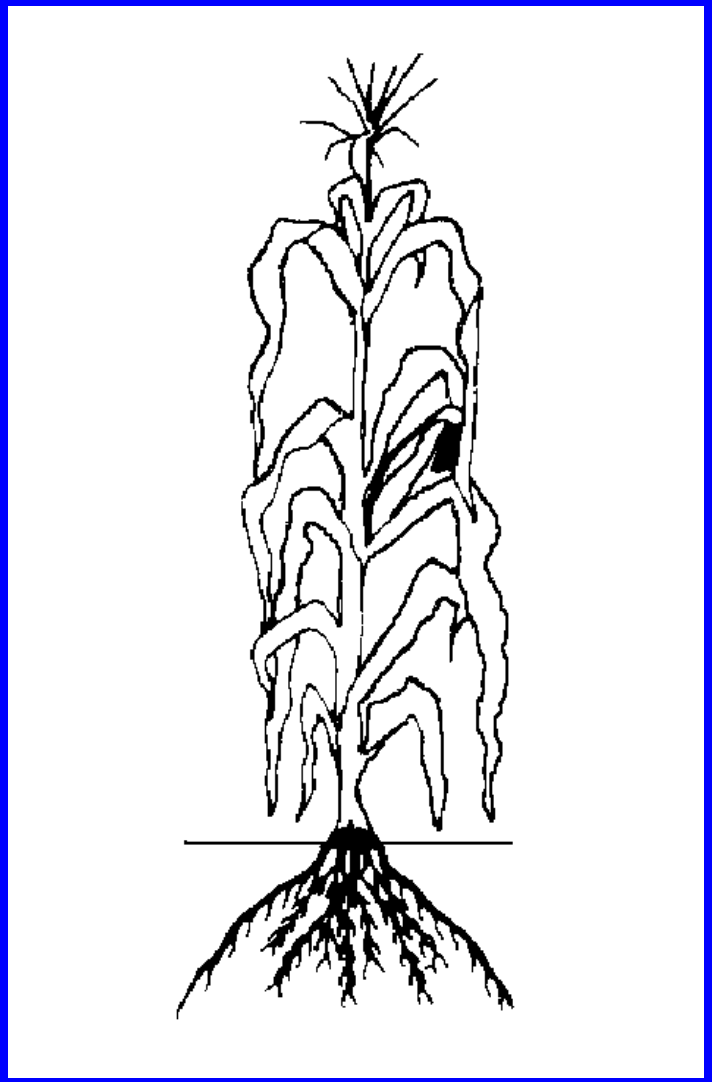

Average yield in six environments
Yield (bu/a)
160
150
140
130
120
S2B73BC x NC300
P31B13
Garst 8285
Triumph 1416
DKC66-80
CK mean


Afaltoxin level under inoculated conditions
Aflatoxin (ppb
10000
8000
6000
4000
2000
0
S2B73BC x NC300
P31B13
Garst 8285
Triumph 1416
DKC66-80
CK mean

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).

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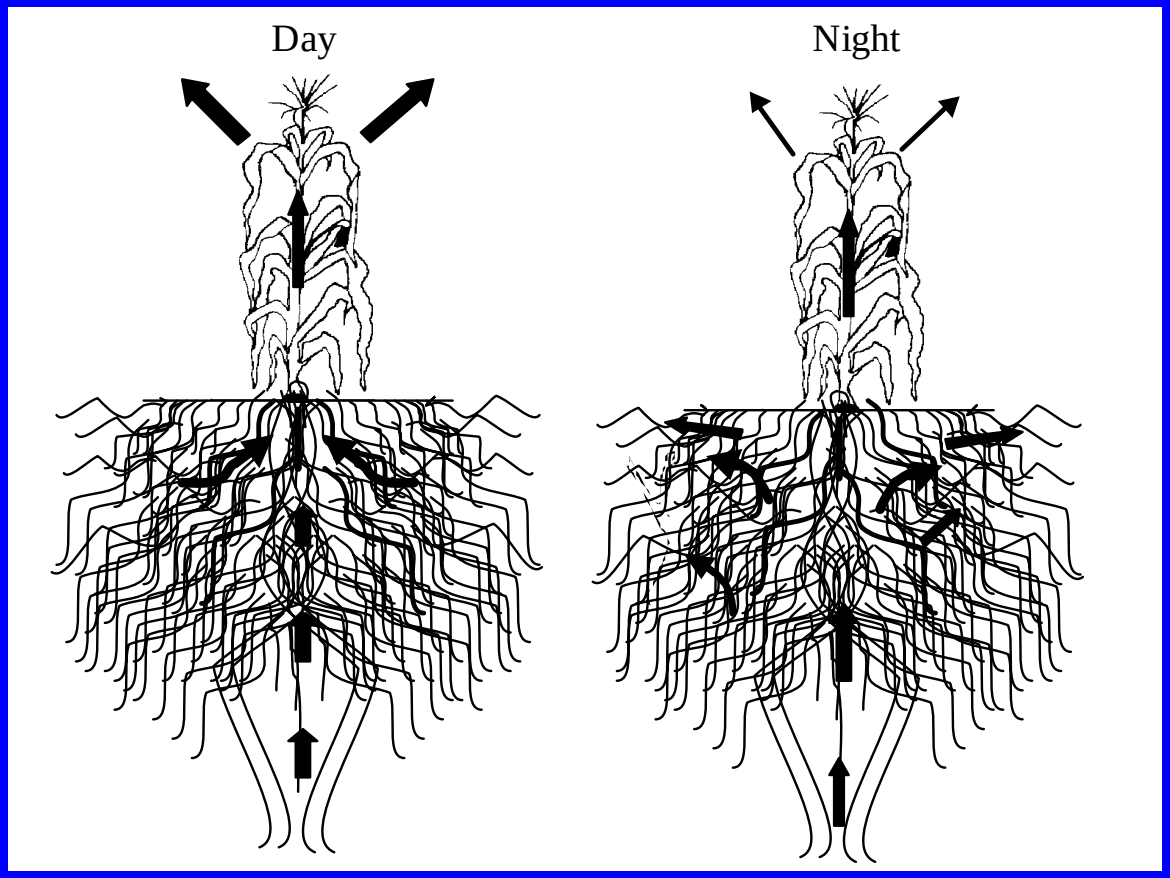
Roots from top pots →

Roots from bottom pots →


Day
Night