2005 Solution Days

Yield
What determines yield potential?

Potential biomass growth (lb dry matter/acre/d) = light intercepted per day x RUE

RUE = (A - Rm) / Rg

A = Photosynthetic activity
Rm = Maintenance respiration rate
Rg = Growth respiration rate

Factors influencing yield:
- CO₂
- Temperature
- Genotype
- Plant density
- Water supply
- Light availability
- Genetic potential
- Nutrient availability
- Pathogens

Corn yield potential in the Corn Belt

Simulated average yield potential, Mead, NE, 1992-2004

Effect of hybrid and plant population (CMDC plot, plant km April 23)

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Extension Solution Days
Crop Management to Reach the Genetic Yield Potential of Hybrid Corn

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Protocol
- Identify Recovery Rate of Corn Under Stress
  - Shade During Grain Fill
    - 6 Days
    - 12 Days
    - 18 Days
- Planting Dates vs Solar Radiation
  - 4 Hybrids – 1365, 1375, 1380, 1450 HU/Mid Silk
  - 3 Planting Dates – April 27, May 5, May 12

Solar Radiation Review
- Stress.....Lack of Photosynthesis
- Cloudy Days
  - decrease photosynthesis (manufacture of food)
  - taking sugars away from the stalk to promote grain fill
- Heat Units vs Solar Radiation
- Diseases
- Planting Dates

Stress At Pollination
What Happened In 2004?

Where Are We Today?

Grand Island, NE

Average Water Use, Platan Day
From Aug. 26 - Oct. 2

Heat Units

June    July    August

2002
2003
2004
5 yr ave

Understand What To Do

• Hybrid A – 112 Days – 1375 GDU’s - Mid Silk
  – Planting Date – April 17-24

• Hybrid B – 112 Days – 1340 GDU’s – Mid Silk
  – Planting Date – April 24-30

The Take Away

• Understand the difference between days to maturity and heat units to mid silk and then to black layer

• Using heat units to mid silk; adjust planting dates to hit the highest average amount of solar radiation during grain fill

• Take what nature gives you and then turn it into your advantage

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Crop Management to Reach the Genetic Yield Potential of Hybrid Corn

- Genetic yield potential is the yield of a well adapted hybrid when soil and crop management eliminate all stresses due to abiotic (water, nutrients) and biotic (weeds, insects, disease) factors
- When pests are controlled, it depends mostly on:
  - solar radiation and temperature
  - optimization of hybrid maturity and plant density
  - Adequate and timely N supply
- Profit maximization typically occurs at 85-90% of genetic yield potential
- Requires sites with reasonable soil quality (no hard pan or barrier to root penetration, good soil structure, lack of toxicities—salinity, alkalinity, acidity)

Hybrid Maturity x Density x N Fertilizer Management Demonstration Plots

- Short (92d) vs later maturity (112d) hybrids
- 28k vs 36k seed drop
- Two N management treatments
  - One dose: 200 lb N/acre before planting
  - Gradual supply (50 lb N/acre in 4 splits): before planting, 5/23, 6/13, and 7/4
- General field management
  - Planted on April 27
  - One section no-till, another tilled and disked
  - Ammonium nitrate N source
  - Optimal irrigation and pest control

Simulated Range in Grain Yield and Yield Determinants at York, NE (based on historical climate data from 1998-2004)
Take home messages

- Achieving genetic yield potential depends on maximizing light interception in time (especially length of grain filling period) and space (early canopy closure; stay green during grainfilling).
- Substantial year-to-year variation in yield potential due to climate (temperature, solar radiation).
  - 2004 was the “perfect” growing season.
- Optimizing planting date, plant density, hybrid maturity, and N management are key factors.
- Use of Hybrid-Maize simulation model and test strips provide efficient means to identify optimal combinations for a given field site.

Other considerations in selecting hybrid maturity and plant density

- Dangerous to have all fields planted to same maturity hybrid, or all fields reaching silking at the same time, due to devastating yield loss from freak events.
  - Straight line wind storms, hail, hot & dry winds at pollination, short-term flooding events, etc.
- While later maturing hybrids may give highest yield:
  - Dry-down requirements to harvestable maturity.
  - Risk of frost and yield stability of later maturing hybrids?
- Marginal cost-benefit of higher plant density needs to be considered and consistency of the response.
  - Diminishing return at densities above 35-37k.
  - Greatest response in high-yielding, more favorable years.