It’s still winter in Indiana...

Low temp Jan 27 = -24C

Outline

- Weed management
  - HT varieties
  - HR weeds
- Insect management
  - Bt rootworm
  - Seed protectants
- Specialty traits & I-P
  - Transgenics
  - Specialty output traits
- Site-specific crop management
  - Opportunities
  - Challenges

Herbicide resistant weeds...

- Documented cases of weed resistance to herbicides becoming more common in the U.S. Midwest.
  - Resistance occurs naturally in some weed populations.
  - Resistance encouraged by overuse of single chemistry herbicides on multiple crops.
- Management involves use of multiple herbicide chemistries, appl’n timing, & tillage where appropriate.

Examples of HR weeds...

- Triazines
  - Lambsquarters (Chenopodium album)
  - Pigweed (Amaranthus spp.)
- ALS inhibitors
  - Ragweed (Ambrosia spp.)
  - Marestail (Conyza canadensis)
  - Waterhemp (Amaranthus tuberculatus)
- Glyphosate
  - Marestail
  - Waterhemp

Excellent Weed Web Site: www.weeds.iastate.edu/
Developments in Agronomy & Maize Management

U.S. transgenic maize acreage, 2002

- Minnesota: 29% (Bt), 11% (Herb.)
- Nebraska: 34% (Bt), 9% (Herb.)
- Iowa: 31% (Bt), 5% (Herb.)
- Illinois: 18% (Bt), 14% (Herb. tol.)
- Indiana: 7% (Bt), 22% (Herb. tol.)
- U.S.: 22% (Bt), 14% (Herb. tol.)

Source: http://jan.mannlib.cornell.edu/reports/nassr/field/pcp-bba/acrg0602.txt

Western corn rootworm

- One of Indiana's most worrisome maize pests.
- Larvae feed on maize roots, causing physiological injury and weakened root systems.
- Beetles feed on pollen and clip silks in the process, interfering with pollination.
- Demand for Bt rootworm hybrids will be great in Indiana in contrast to that for Bt ECB hybrids.

Seed protectants...

- Gaucho<sup>®</sup> seed insecticide treatment
  - Imidacloprid (www.gustafson.com)
  - Targets wireworm, seedcorn maggot, flea beetles, white grubs
- Cruiser<sup>®</sup> seed insecticide treatment
  - Thiamethoxam (www.syngenta.com)
  - Targets wireworm, flea beetles, aphids, leaf miners
- Such protectants will likely be standard seed treatments for Bt rootworm hybrids.

Other specialty markets...

- Historical markets
  - Popcorn, seed corn, waxy starch, white & yellow food grade corn
- Potential specialty traits
  - Alternative starches, industrial enzymes, pharmaceuticals, nutritional
- Potential niche corn types
  - Baby corn, Indian corn, blue corn, edible corn smut
- Vertically integrated markets
  - Seed >> Production >> Processing >> Product

Identity-Preservation (I-P)...

- One of the natural consequences of expanding into specialty markets is the requirement for I-P strategies that ensure the purity of the grain product from farm to end-user.
  - Transgenic crop production in general
  - Specialty output traits

I-P challenges: Farmers

- Purity of purchased seed
- Hygiene of planting & harvesting op's
- Pollen drift among adjacent maize fields
- Grain commingling during drying, storage, and transport of grain after harvest
- Extra costs associated with I-P strategies vs. premiums received for sale of grain
I-P challenges: Grain buyers

- Grain commingling during receiving, drying, storage, outloading, & transport.
- Increased need for multiple grain handling facilities to accommodate multiple I-P crop grain programs.
- Extra costs associated with I-P requirements, including employee training and premiums paid to grower for specialty trait itself.

Site-specific crop management

- The availability of GPS-enabled technologies offers the opportunity to identify and manage YIFs on a site-specific scale.
  - Mitigate negative YIFs to increase yield.
  - Enhance positive YIFs to increase yield.

Availability of technology

- GPS-enabled tools and technologies have been available to U.S. grain & oilseed farmers for about 12 years.
  - Initially, yield monitors & VR fertilizer
  - Realistically, technology adoption has occurred slowly among farmers.
  - Some contend that adoption is currently at a plateau.

Adoption of technology

- Yield monitors are the primary GPS-enabled equipment owned by farmers.
  - Used on about 30% of planted maize acres.
  - Though, half or less are estimated to be GPS-enabled and capable of yield mapping.
- Intensive soil sampling, VR lime and VR plowdown P & K are the primary dealer services used by farmers.
  - Some offer VR herbicide or fertilizer N

GPS-enabled technologies...

- DGPS receivers
- Grain yield monitors
- VR controllers for
  - Lime, fertilizers, pesticides, & seeding rates
- Aerial & satellite imagery
- Guidance systems
  - Parallel swathing
  - Automated navigation
- Instruments for measuring soil EC
  - Veris®, Geonics®
- Laser-assisted survey instruments for measuring topography
- Hardware & software for GIS crop scouting
- Software for GIS data analyses

GPS-enabled operations (I)

- Grain yield & moisture mapping
- Intensive soil nutrient sampling
- Land feature mapping
  - Topography (laser-guided)
  - Soil electrical conductivity
  - Tile drainage lines
  - Waterways & streams
  - Soil types (Order 1)
GPS-enabled operations (II)
- Crop scouting & monitoring
  - Plant population & uniformity
  - Weed ID, location & populations
  - Insect ID, location & populations
  - Nutrient deficiencies
  - Crop health & vigor

GPS-enabled operations (III)
- Guidance systems
  - Accuracy of fertilizer & pesticide appl'n's
- Aerial imagery
  - View from above is a first for some growers
  - Can assist in developing management zones
  - Crop “vigor” monitoring

SSCM Opportunities
- Improved and/or more consistent ...
  - Grain yield
  - Grain quality
  - Lower per unit cost of production
  - Improved input use efficiency
  - Fewer overall crop inputs

SSCM Opportunities (II)
- More detailed cropping records
  - Improved budget-making
  - Regulatory requirements
- Less environmental impact
  - Fewer overall pesticide or fertilizer inputs
  - “Wiser” placement or positioning of pesticide or fertilizer inputs

SSCM Challenges
- Costs of technologies relative to other costs & market price received
  - Production costs & gross returns are already close to breakeven today.
  - Some feel the additional costs of GPS-enabled technologies will not return a profit.
- Recent Ohio State Univ. farmer survey ...

Benefits vs. costs
- Adopting Farmers’ Perceptions

SSCM Challenges (II)
- Limitations of the equipment
  - The GPS "toys" are fun, but in reality are not quite good enough yet
  - Nor can most be characterized as being "off the shelf" ready to go
- Limitations of software
  - Most affordable programs are weak in ability to integrate data and analyze spatial interrelations
  - Neither can most software be characterized as being "off the shelf" ready to go

SSCM Challenges (III)
- Influence of "Mother Nature"
  - Most research confirms that, for maize and soybean, temporal yield variability is much greater than spatial variability
  - Spatial variability that is not consistent in its temporal pattern is very difficult to manage with SSCM strategies.

SSCM Challenges (IV)
- Limitations imposed by sparse data sets on computer interpolation
  - Data collected by field scouting, including soil nutrient sampling, often too sparse for affordable GIS programs to accurately estimate spatial relationships
  - Yet, more intensive data collection is often cost-prohibitive

SSCM Summary (I)
- Technology is available
  - Not always easy to learn
  - Not always affordable
  - Not always 'fancy enough'

SSCM Summary (II)
- SSCM opportunities
  - Increased/more consistent grain yield
  - Increased/more consistent grain quality
  - Less environmental impact
  - Better crop record keeping

SSCM Summary (III)
- SSCM challenges
  - Cost/benefit of technology
  - Limitations of equipment
  - Limitations of software
  - Influence of 'Mother Nature'
  - Limitations of sparse data sets
A Final Thought...

"Farming is a kind of continual miracle wrought by the hand of God."

-- Benjamin Franklin