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FAR New Zealand Maize Conference
12-13 Feb 2003, Hamilton, New Zealand

Developments in Agronomy & Maize Management

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Links to this presentation can be found under "Presentations & Papers"

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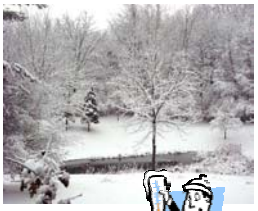
It's still winter in Indiana…



Low temp Jan 27 = -24C

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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

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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.

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Examples of HR weeds…

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

Image source: RLNielsen, Purdue Univ.

Excellent Weed Web Site:
www.weeds.iastate.edu/

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Insect management…

- Transgenic insecticidal traits
  - Transgenic Bt hybrids for control of European corn borer (*Ostrinia nubilalis*) have been available since mid-90's.
  - Herculex™ I Bt trait now available from Pioneer® that offers addn'l control for black cutworm (*Agrotis ipsilon*) and fall armyworm (*Spodoptera frugiperda*).
  - Both Monsanto® and Pioneer® hoping to commercialize Bt hybrids for control of corn rootworm (*Diabrotica* spp.).

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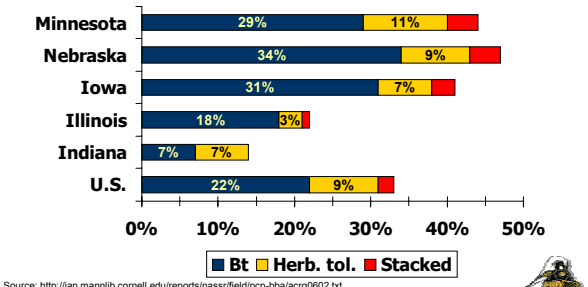
U.S. transgenic maize acreage, 2002



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

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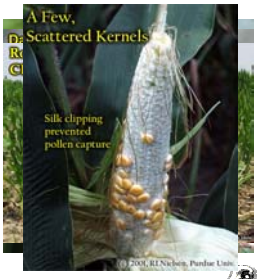
Western corn rootworm

- 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.



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Seed protectants…

- Gaucho® seed insecticide treatment
  - Imidacloprid (www.gustafson.com)
  - Targets wireworm, seedcorn maggot, flea beetles, white grubs
- Cruiser® 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.

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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

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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

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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

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I-P challenges: Grain buyers

- Grain commingling during receiving, drying, storage, outloading, & transport.
- Increased need for multiple grain handling facilities to accomodate 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.

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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.

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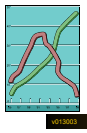
Availability of technology

- 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.



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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

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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

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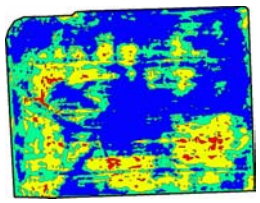
GPS-enabled operations (I)

- 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



Green vegetation index (NDVI) from IR aerial image (8 July)

GPS-enabled operations (III)

- Guidance systems
  - Accuracy of fertilizer & pesticide appl'ns
- 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

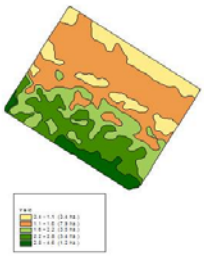


Image source: http://nzcpa.org.nz/research-ag_tools.html

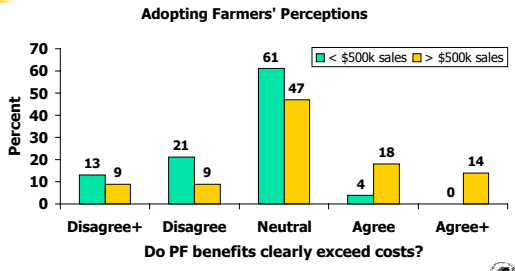
SSCM Opportunities (II)

- 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



Batte, M.T. 2001. Precision Farming and Profits – What Should I Expect? Proceedings of 2001 Regional Agronomy Meetings. Ohio State Univ.

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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

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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.

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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

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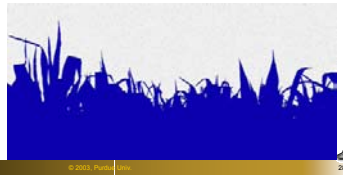
SSCM Summary (I)

- Technology is available
  - Not always easy to learn
  - Not always affordable
  - Not always 'fancy enough'



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SSCM Summary (II)

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

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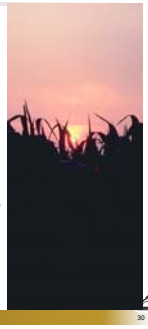
SSCM Summary (III)

- SSCM challenges
  - Cost/benefit of technology
  - Limitations of equipment
  - Limitations of software
  - Influence of 'Mother Nature'
  - Limitations of sparse data sets



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A Final Thought...

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

-- Benjamin Franklin